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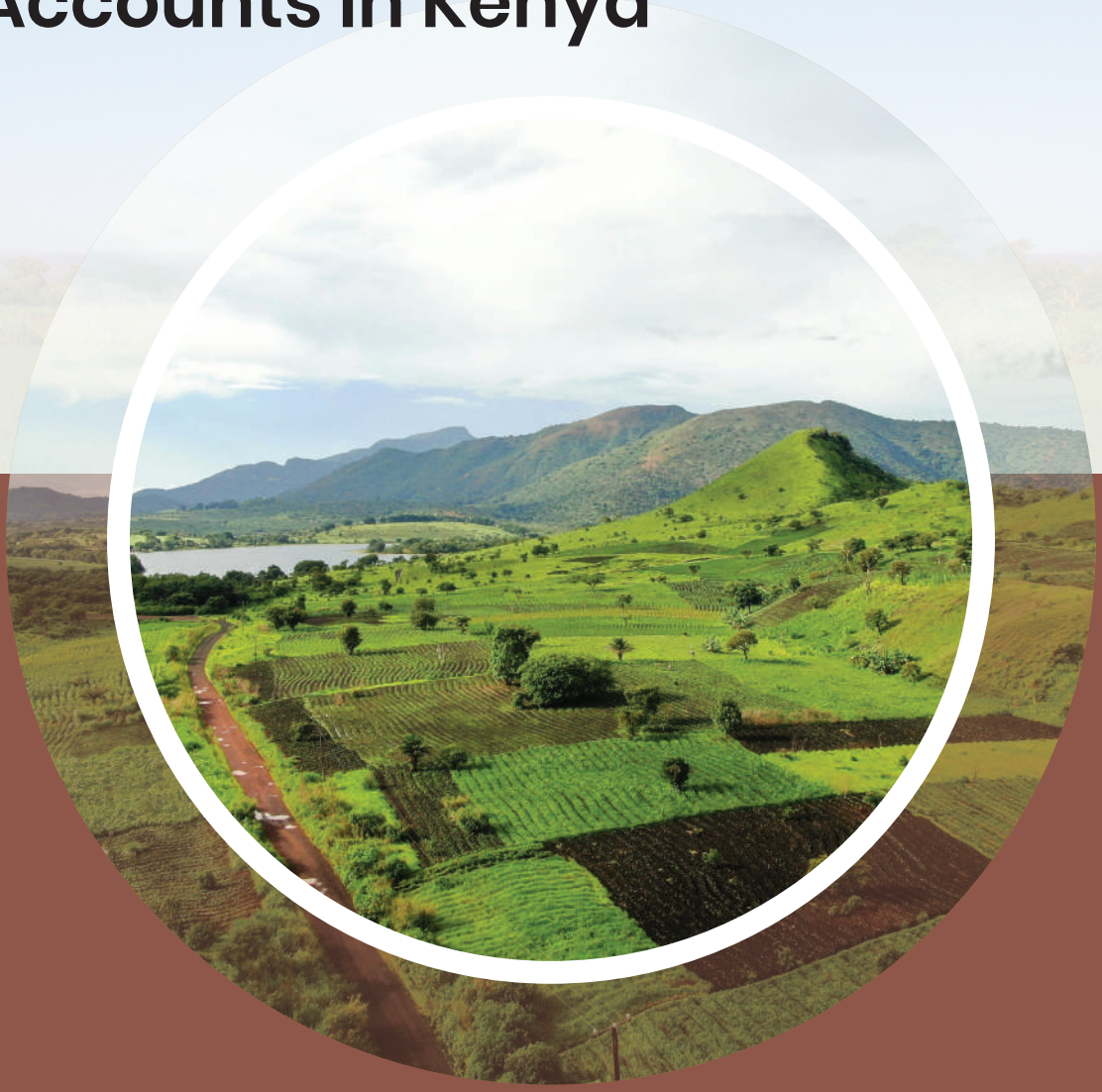
Strengthening Governance of Natural Capital and Climate Policy in Kenya:

The Development of Land Accounts in Kenya



Scaling Kenya's Land for Growth and Resilience

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Table of Contents

List of Figures iv
List of Tables v
Acronyms vi
Glossary vii
Foreword viii
Acknowledgments x
Executive Summary xii

CHAPTER 1. INTRODUCTION 1

1.1 Background 1
1.2 Coverage and Geography 1
1.3 Kenya's Natural Capital Accounts 2

CHAPTER 2. METHODOLOGY 4

2.1 Background 5
2.2 Physical Asset Accounts 5
2.3 Land Use Change Matrix 7
2.4 Land cover maps 7
2.5 Land Use Shares under National Land Use Policy 7
2.6 Data Quality 7
2.7 Account Format 7

CHAPTER 3: LAND COVER ACCOUNTS FOR KENYA 8

3.1 Introduction 9
3.2 Kenya Land Cover Extent 9
3.3 Land Cover Trends 10
3.4 Recent Land Cover Changes 2015–2024 14
3.5 Land Cover Changes at County Levels 16

CHAPTER 4: LAND USE ACCOUNTS 18

4.1 Agriculture Land Use 19

4.2 Livestock and Pastoralism 21

4.3 Wildlife Conservation 23

4.3.1 Categories of Wildlife Conservation Areas in Kenya 23

4.4 Land Ownership 26

CHAPTER 5: CHALLENGES IN DEVELOPING NATURAL CAPITAL ACCOUNTS 28

5.1 Challenges 29

5.2 Proposals to Improve Data Quality 29

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS 30

6.1 Policy and Institutional Implications 31

6.2 Development of an Institutional Framework 31

6.3. Sustainability Measures 31

Annexes 32

List of Figures

Figure 1: Kenya County map 2

Figure 2: Proportions of land cover in 2024 9

Figure 3: Land cover maps for 1990 and 2018 depicting increasing croplands 11

Figure 4: Trends of change for selected land covers 12

Figure 5: An illustration of trends (2015–2024) in land cover based on recent drivers of change 14

Figure 6: An illustration of land cover changes among counties 17

Figure 7: An illustration of the trends of production for different agricultural crops 20

Figure 8: Livestock population trends 1990–2021 22

Figure 9: An illustration of the establishment of state-designated protected areas 24

Figure 10: Maps of Kenya's protected areas under wildlife and forest conservation 24

List of Tables

Table 1: Subcategorization of the IPCC land use classes under the SLEEK program 6

Table 2: Land cover extent in the period 1990–2024 9

Table 3: A matrix of land cover changes showing the land cover transitions between 1990 and 2018 12

Table 4: Change in land cover between 1990 and 2024 and the implied drivers of change 13

Table 5: Growth in area and production for major crops 19

Table 6: Livestock number and trends in the period 1990–2022 22

Table 7: Wildlife conservation areas of Kenya 23

Table 8: Land tenure systems and their estimated areas 26

Acronyms

AFR100	African Forest Landscape Restoration Initiative
BTR	Biennial Transparency Report (UNFCCC)
DRSRS	Directorate of Resource Surveys and Remote Sensing (Kenya)
EO	Earth Observation
FAO	Food and Agriculture Organization (of the United Nations)
GHSL	Global Human Settlement Layer
GFOI	Global Forest Observations Initiative
GHG	Greenhouse gases
GHSL	Global Human Settlement Layer
GPS	Global Program on Sustainability (World Bank)
IMPRESS	Improving measurement for payments to reduce emissions and strengthen sinks
IPCC	Intergovernmental Panel on Climate Change
KENMOD	Kenya Macroeconomic Model
KNBS	Kenya National Bureau of Statistics
LCLU	Land Cover and Land Use
LCLUCM	Land Cover/Land Use Change Matrix
MoLPP	Ministry of Lands and Physical Planning (Kenya)
NCA	Natural Capital Accounting
NLC	National Land Commission (Kenya)
NP-AEEA	National Plan for Advancing Environmental-Economic Accounting
PES	Payment for Ecosystem Services
QGIS	Quantum Geographic Information System
REDD+	Reducing Emissions from Deforestation and Forest Degradation (and related goals)
R-Studio	Statistical computing and graphics software (based on R)
SEEA	System of Environmental-Economic Accounting
SLEEK	System for Land-based Emissions Estimation in Kenya
SNA	System of National Accounts
SUT	Supply and Use Table
TWG	Technical Working Group
UNFCCC	United Nations Framework Convention on Climate Change
UNSD	United Nations Statistics Division
WB	World Bank

Glossary

Additions/Reductions - The increase or decrease in the area or value of a land cover or land use class between two time periods, used in SEEA asset accounts to track changes over time.

Design-Based Estimation - A statistical method that uses probability sampling techniques and inferences to estimate land cover areas and their accuracy, providing confidence intervals and reducing classification bias in remote sensing data.

Ecosystem Accounting - A component of the SEEA that measures the extent, condition, and services provided by ecosystems, and links them to economic and social benefits.

Gross Change/Net Change - Gross change refers to the total area of land that shifted between classes (both gains and losses), while net change represents the overall increase or decrease after gains and losses are offset.

Land Cover - The physical and biological features of the land (e.g., forests, croplands, grasslands, settlements, water bodies).

Land Cover/Land Use (LCLU) Account - A SEEA account that tracks land cover types over time and, where possible, links them to land use categories (e.g., agriculture, settlement), enabling the analysis of landscape transitions and their implications.

Land Cover/Land Use Change Matrix (LCLUCM) - A tabular representation showing the specific transitions from one land cover or land use class to another between two time periods, used to understand land cover or land use conversion dynamics.

Land Ownership Account - A type of SEEA account that disaggregates land by ownership type (e.g., public, private, communal), providing insight into tenure patterns and policy implications.

Land Use - The functional use of land, including for economic or administrative purposes (e.g., residential, commercial, agricultural), often determined by survey or land use plan.

Pixel Counting - A method of area estimation in raster datasets where the number of classified pixels for each land cover and use class is multiplied by the pixel area to derive total class areas.

Raster Data - Gridded spatial data where each cell (pixel) has a value representing a land cover type or other variable; commonly used in satellite-based mapping.

Remote Sensing - The use of satellite or airborne sensors to collect information about the Earth's surface without physical contact, widely used in land cover and land use monitoring.

SLEEK - System for Land-based Emissions Estimation in Kenya. A national program that was designed to estimate emissions using medium-resolution imagery (Landsat) from land cover change maps (1990–2018).

Spatial Disaggregation - The process of breaking down data to smaller geographic units (e.g., counties or sub-counties) to support localized analysis and decision-making.

Land Cover Statistical Register - A structured, validated database of land cover information suitable for use in official statistics and national accounts.

Technical Working Group (TWG) - A multi-agency body responsible for the coordination, development, and validation of natural capital accounts, such as those for land, water, or ecosystems.

Foreword



The Kenya National Bureau of Statistics (KNBS) is pleased to present the report on The Development of Land Accounts in Kenya, developed in strategic multi-agency collaboration with the National Land Commission, the Directorate of Resource Surveys and Remote Sensing, the Ministry of Lands, Public Works, Housing and Urban Development, the State Department for Agriculture and Livestock Development, the Kenya Space Agency, and our esteemed development partners. This landmark report marks a critical milestone in Kenya's ongoing journey to integrate natural capital and environmental sustainability into national economic planning, spatial governance, and policy formulation.

Land is the foundational asset of Kenya's socio-economic development—serving as the primary factor of production, a vital cultural heritage, and the essential substrate supporting agriculture, livestock production, forestry, urban settlement, and critical ecosystem services. Despite its central importance, the dynamic transformations in land cover and land use driven by population growth, rapid urbanization, agricultural expansion, and climate pressures have historically lacked a systematic, standardized mechanism for national tracking and valuation.

Prepared in accordance with the United Nations System of Environmental-Economic Accounting (SEEA) Central Framework, this report establishes a standardized spatial and statistical baseline for tracking national and county-level land cover extent, land use shifts, and landscape transitions spanning from 1990 to 2024. Grounded in the roadmap set out by the National Plan for Advancing Environmental-Economic Accounting (NP-AEEA) 2025–2028, the Land Accounts build upon our pioneering work across priority natural capital sectors—including energy, water, ecosystems, and forests.

The integration of advanced Earth observation inputs—such as those championed by the Kenya Space Agency, Directorate of Resource Surveys and Remote Sensing —alongside comprehensive agricultural and livestock data from the State Department for Agriculture and Livestock Development, ensures that these accounts reflect the true pulse of our terrestrial landscape. The findings detailed herein offer actionable insights directly aligned with Kenya's national development agenda, including Vision 2030, the Bottom-

Up Economic Transformation Agenda (BETA), and our international climate commitments under the Paris Agreement and Sustainable Development Goals (SDGs). By linking physical land dynamics directly to macroeconomic modeling tools such as the Kenya Macroeconomic Model (KENMOD), these accounts empower decisionmakers to evaluate spatial trade-offs, strengthen land governance, and target green fiscal measures and climate resilience investments effectively.

As we institutionalize natural capital accounting across government agencies, KNBS remains committed to producing these accounts on a regular reporting cycle. Future iterations will progressively expand toward monetary valuation and enhanced land ownership and tenure accounts. It is our sincere hope that this publication serves as an invaluable resource for policymakers, spatial planners, researchers, and stakeholders as we collectively foster sustainable land stewardship and inclusive green growth for present and future generations.



Dr. Daniel Mwirigi M'Amanja

Chairperson, Board of Directors
Kenya National Bureau of Statistics

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We appreciate the Technical Working Group, representing various institutions, for their enthusiastic data analysis, discussions, peer review and finalization of the Land Natural Resource Account. Much appreciation goes to the Technical Working Group on the Land Natural Resource Account which comprised of the following TWG members;

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- Hellen Wanyoike_ Kenya National Bureau of Statistics
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- Maureen Akinyi_ Kenya National Bureau of Statistics
- Maina Nyakang'o_ Kenya National Bureau of Statistics
- Abdihakim Mohamud_ Kenya National Bureau of Statistics
- Dr. Mwangi Kinyanjui_ Karatina University
- Benard Opaa_ National Lands Commission
- Bonventure Musyoka_ National Lands Commission
- Charles Situma_ Directorate of Resource Surveys and Remote Sensing
- Robert Kimtai_ Directorate of Resource Surveys and Remote Sensing
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Macdonald George Obudho, PhD, EBS, MBS

Director General

Kenya National Bureau of Statistics

Executive Summary



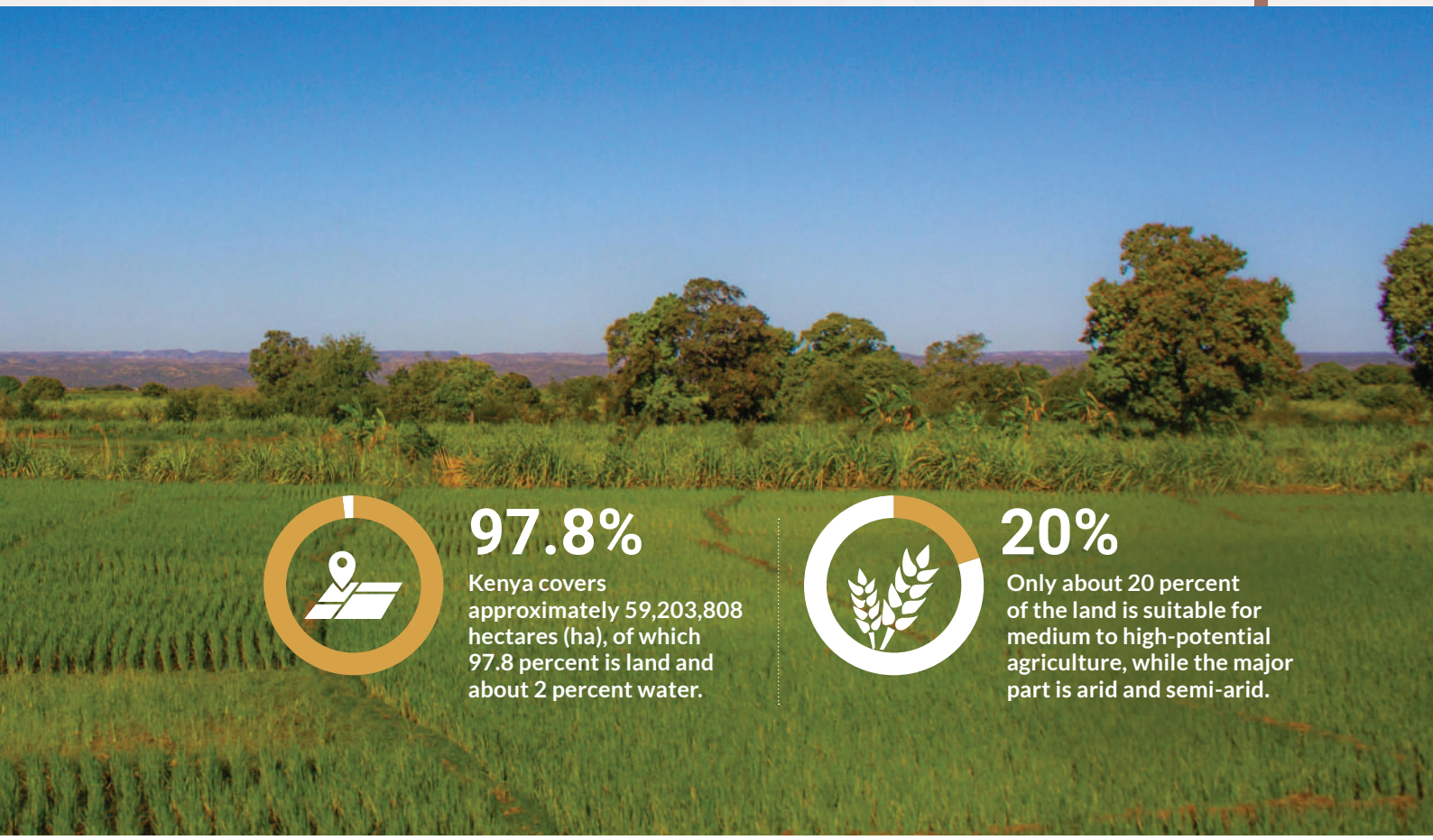
Land in Kenya is a critical resource that supports livelihoods, socioeconomic development, and environmentally sustainable development. The Constitution of Kenya defines land broadly to include the earth's surface and subsurface, water bodies, marine areas, natural resources, and airspace. Land in Kenya is classified into public, community, and private land, and its governance is guided by constitutional principles such as equitable access, secure land rights, sustainable management, environmental conservation, transparency, gender equality, and community-based dispute resolution.

Kenya covers approximately 59,203,808 hectares (ha), of which 97.8 percent is land and about 2 percent water. Only about 20 percent of the land is suitable for medium to high-potential agriculture, while the major part is arid and semi-arid. Key land uses include agriculture, forestry, pastoralism, fishing, settlements, infrastructure, industry, wildlife conservation, and recreation. Land cover is categorized into several types such as forests, croplands, grasslands, wetlands, water bodies, and settlements. However, population growth, urbanization, agricultural expansion, and infrastructure development are driving rapid land use and land cover changes.

Despite land being central to Kenya's development and livelihoods, its economic and environmental contributions have not been systematically measured, resulting in policy and governance gaps. This report presents Kenya's first Land Accounts, developed through an inter-agency process following the UN System of Environmental-Economic Accounting (SEEA) Central Framework. The accounts rely on national land use planning datasets (SLEEK, IMPRESS, and AIM4Forests) to describe land use and land cover change over time, providing information for analysis. These land cover maps and associated statistics are quality-controlled at source and are provided with their specific uncertainty levels. Using land use change matrices, shifts between land cover types have been analyzed for the period 1990 to 2024. The findings show major transformations, including declines in forests and wooded grasslands, and increases in cropland, urban settlements, wetlands, and open water.

The report demonstrates practical methods for compiling land accounts using existing earth observation datasets, highlighting their potential for cost-effective monitoring of land use and land cover changes.

These accounts support Kenya's National Plan for Advancing Environmental-Economic Accounting (NP-AEEA) and provide data for evidence-based policy, spatial planning, climate action, and sustainable development. They can help track land transformation trends, assess trade-offs, and guide investments, including opportunities for green jobs and climate-resilient development.



Key recommendations include:

i.Institutionalizing a **Land Accounts Technical Working Group (TWG)** to maintain and increase capacity to produce and use accounts.

ii.**Strengthening data and methods** to improve the quality and timeliness of accounts systems such as advancing SLEEK or enhancing the data collected through sample-based area estimation methodologies such as those used by AIM4Forests.

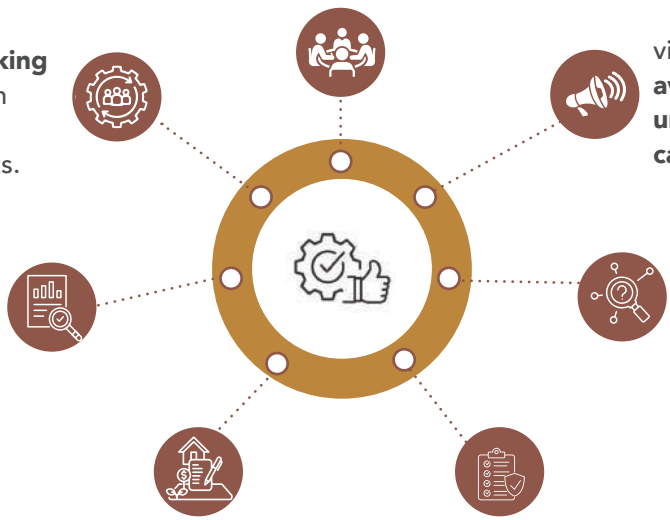
iii. Developing **monetary, land use, and land ownership accounts** to increase the policy relevance of accounts.

iv. Encouraging the use of land accounts in analysis to support policy and management, including for **green job creation, climate resilience initiatives, nature-based tourism, land banking and agriculture.**

v.Expanding the use of accounts in **macro-economic modeling and analysis** to better understand the links between land and the economy.

vi. Improving the **awareness and understanding of natural capital accounting**, and

vii. **Enhancing coordination** among the institutions that produce the land accounts to facilitate data sharing and account production.



01

Introduction



1.1. Background

Land is a critical asset in Kenya's development. It is currently the main factor of production and the foundation upon which all other facets of development are anchored. The contribution of land to economic development has not been fully established. Further, land use reflects the most important planning decisions, drives patterns of settlement and production, and directly impacts household livelihoods and ecosystem integrity.

According to Sessional Paper Number 3 of 2009 on the National Land Policy for Kenya, land is not just a commodity that can be traded in the market. It represents a multitude of values which should be protected by both policy and law due to the fact that:

(a) Land is an economic resource that should be managed productively;

(b) Land is a significant resource to which members of society should have equitable access for their livelihood;

(c) Land is a finite resource that should be utilized sustainably; and

(d) Land is a cultural heritage which should be conserved for future generations.

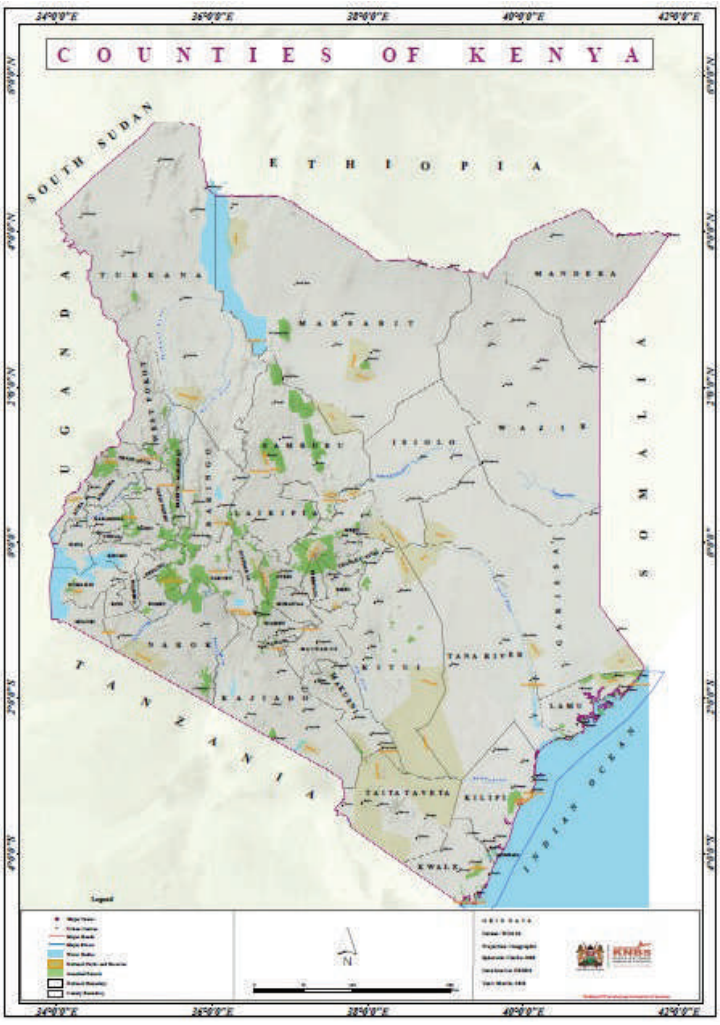
Land accounts are critical in socioeconomic planning, decision-making, and policy formulation as they provide evidence of the contribution of land to the economy (e.g., gross domestic product; GDP) and people's well-being. They add value in sustainable development planning by providing indicators and trend analysis to track performance targets for sustainability, land allocation, service delivery, and productivity. In addition, land accounts help clarify and compare the economic value generated by land across competing uses and show how land use changes affect land values. When land accounts are integrated with other sectoral data, they provide critical and deeper insights about potential effects on other linked resources such as water, energy, forest, ecosystems, and food production. Broadly, land accounts which are part of Natural Capital Accounting (NCA) contribute to accountable governance by increasing the quality, credibility, and consistency of the statistics and analyses that support national and county policies, development plans, and targets. Land accounts are also a tool for monitoring and analyzing assets and changes in land use, land cover, ownership, and land value and provide consistent data and evidence to inform both policies and potential investments, on issues such as the impacts of urbanization, the sustainability of agriculture, and the extent of and threats to habitats for biodiversity conservation and climate.

1.2 Coverage and Geography

Kenya lies in East Africa, across the equator, at latitude 4°N to 4°S and longitude 34°E to 41°E. The country is bordered by South Sudan and Ethiopia in the north, Somalia to the east, the Indian Ocean to the south-east, Tanzania to the south, and Uganda to the west (Figure 1). Kenya has a total area of 592,039 km2, including 13,400 km2 of inland water.

Kenya's geography is diverse and varied. The terrain gradually changes from the low-lying coastal plains to the Kenyan highlands reaching a peak of 5,199 meters above sea level at Mt Kenya. The Great Rift Valley located in the central and western part of the country dissects the Kenyan highlands into east and west. Further west, the altitude decreases towards Lake Victoria while northwards, there are vast drylands which are gradually being colonized to support livelihoods for pastoralist communities and game ranchers. Kenya has six drainage patterns based on topography and tectonic activities, and the majority of inland water bodies are found in the Rift Valley. The country is divided into 47 counties for administrative purposes (Figure 1).

Figure 1: Kenya County map



Source: Administrative boundaries provided by the Survey of Kenya

1.3 Kenya's Natural Capital Accounts

Kenya has developed and adopted a National Plan for Advancing Environmental-Economic Accounts (NP-AEEA). The plan describes the conditions which make it critical to account for natural capital in a way that it is congruent with sustainable economic development and national planning. The plan, the first draft of which was conceived during a collaborative effort between the Kenya National Bureau of Statistics (KNBS) and the United Nations Statistics Division (UNSD) to develop environmental-economic accounts for Kenya in September 2023,[1] identified Water, Energy, Land, Forest, and Ecosystem Accounts as a priority.

Land Accounts are a core component of the System of Environmental-Economic Accounting (SEEA) Central Framework,[2] providing the struc-

[1] https://seea.un.org/events/kenya-national-dissemination-workshop (last accessed 12 June 2025).

[2] The System of Environmental-Economic Accounting is the internationally recognized statistical standard published by the United Nations. The guidelines to create the Land Accounts are presented in the Central Framework document, and further elaborated in a dedicated technical note. These documents can be found here: https://seea.un.org/content/seea-central-framework and https://seea.un.org/content/land-accounts (last accessed 12 May 2025).

ture for organizing and tracking data on land cover, land use, land ownership, and land values in a way that is compatible with the System of National Accounts (SNA).[3] The Land Accounts help countries monitor how land is allocated, transformed, and managed over time, enabling a better understanding of the relationship between land dynamics and economic or environmental outcomes. The Land Accounts serve as a "fundamental bridge between environmental conditions and human activities".[4] They are essential for countries like Kenya, where land is not only a vital economic asset but also central to ecosystem services, climate resilience, and rural livelihoods.

By providing a consistent and structured framework for measuring and classifying land cover and use, Land Accounts enhance the reliability of data used in policy formulation, budget allocation, and investment planning—ensuring that decisions are based on comparable, credible, and spatially explicit information. In Kenya, Land Accounts are particularly important in the national efforts to integrate environmental considerations into macroeconomic models and public finance strategies. Land Accounts can contribute the data required for macroeconomic modeling and policy by supporting the development and adoption of the Kenya Macroeconomic and Fiscal Model (KENMOD), ensuring that decisions on public investment, restoration, and budget allocations[5] on robust, standardized environmental data.[6]

Also, as part of the broader natural capital accounting effort, Land Accounts complement other accounts—such as forest, water, or ecosystem services—by anchoring them to the physical structure and dynamics of the landscape. The Land Accounts provide the spatial backbone for the Ecosystem Accounts to determine the extent, condition, and services of ecosystems.

This report aims to strengthen the foundation for SEEA Land Accounting in Kenya by supporting stakeholder capacity, presenting initial physical asset accounts for land cover and land use, and exploring pathways to develop monetary and ownership accounts. It also sets out a roadmap for integrating these accounts into the national statistical system.

This technical report provides an overview of the development of Land Accounts in Kenya. It begins with an introduction to the context, objectives, and significance of SEEA-aligned land accounting within the broader framework of Kenya's development plan. It then outlines the data sources and methodology used. The report proceeds to explain how national and county-level land cover/land use (LCLU) Accounts were compiled and analyzed, followed by a presentation of key empirical results in tables and graphics, including maps. Statistics of land cover and land use are presented in change matrices to detail the opening and closing stocks of various land uses to indicate the net increases and decrease in land use, based on what land cover types were converted from (in the case of increases) or to (in the case of decreases). The report also discusses current gaps in monetary and ownership accounts, before offering recommendations to improve technical methods, institutional coordination, and policy relevance.

---

[3] SEEA accounts are designed to be consistent with the System of National Accounts (SNA), allowing environmental data—like land cover and ecosystem services—to be integrated with economic indicators such as GDP and national wealth. While this alignment is essential for policy relevance, this document focuses on the technical development of Land Accounts and does not delve into the structure or principles of the SNA.

[4] SEEA Technical Note on Land Accounting, 2017.

https://seea.un.org/sites/seea.un.org/files/seea_technical_note_-_land_jan_2017_draft.pdf (last accessed 12 June 2025).

[5] Republic of Kenya, The National Treasury and Economic Planning Medium Term 2025 Budget Policy Statement, "Consolidating gains under bottom-up economic transformation: Agenda for inclusive green growth", February 2025, https://www.treasury.go.ke/wp-content/uploads/2025/02/2025-Budget-Policy-Statement...pdf (last accessed 12 June 2025).

02
Methodology



2.1 Background

The development of the NCA Kenya Land Accounts adhered to the System of Environmental-Economic Accounting (SEEA) established by the United Nations Statistical Division in 2012.[7] The SEEA provides a set of internationally recognized standard concepts, definitions, classifications, accounting rules, and tables for creating comparable statistics on the environment and its relationship with the economy. By organizing statistical data in the same framework as the System of National Accounts, the SEEA allows for the derivation of consistent descriptive statistics and coherent environmental-economic indicators. This framework helps monitor interactions between the economy and the environment, ultimately supporting better decision-making.

The development of land accounts has concentrated primarily on Physical Asset Accounts, which include land cover and land use. This accounting approach measures changes in land use and land cover by quantifying these at various points in time.

2.2 Physical Asset Accounts

Kenya developed the land cover classification program for reporting greenhouse gases in the land sector[8] and these are derived domestically using Intergovernmental Panel on Climate Change (IPCC) land cover classifications. The IPCC provides guidance for countries reporting changes in land use and land cover in a harmonized way that allows comparability across countries. This classification of land has been used to monitor land areas over time and in the development of national reports to the UNFCCC such as the National Forest Reference Level for REDD+ Implementation[9] and the First Biennial Transparency Report.[10]

The physical asset accounts were primarily developed using data sourced from the SLEEK[11] dataset (1990–2018) and sample-based area estimation data from the IMPRESS project[12] (Improving Measurement for Payments to Reduce Emissions and Strengthen Sinks), and AIM4Forests[13] (2017–2024). These are datasets that have been developed for greenhouse gas inventories and have clear technical guidelines for their development and use. They have undergone quality control at the institutional and national level. The use of these data sets supports sustainability of the National Land Accounts because already approved data sets will be adopted for use in developing the land accounts. The data sets were harmonized to develop a complete time series data set for the period 1990–2024. The legend in Kenya's land cover mapping program uses the IPCC classes and is adapted to fit the local context, including disaggregating some classes. The classes include forestland (dense forest, moderately dense forest, open forest), grasslands (wooded grassland, open grassland), cropland (annual cropland, perennial cropland), wetlands (vegetated wetland, open water), urban settlements, and other lands, as described below.

i. **Forestland:** This category includes all land areas with woody vegetation whose height is more than 5m with a canopy closure of more than 15 percent and an area more than 0.5ha.

ii. **Cropland:** This category includes arable and tillage land, and agroforestry systems where vegetation falls below the thresh-

[7] https://seea.un.org/sites/seea.un.org/files/seea_cf_final_en.pdf

[8] Technical Manual for Land Cover Change Mapping in Kenya

[9] https://redd.unfccc.int/media/kenya_national_frl_report-_august_2020.pdf

[10] https://unfccc.int/documents/645091

[11] https://apps.ipcc.ch/outreach/documents/476/1575549883.pdf

[12] https://www.ukpact.co.uk/kenya-fao-project-landing-page

[13] https://www.fao.org/in-action/aim4forests/activities/kenya/en

olds used for the forest land category.

iii. **Grassland:** This category includes grasslands, rangelands, and bushlands and pasture land that is not considered as cropland and fall below the thresholds used to define forests.

iv. **Wetlands:** This category includes open waters and land that is covered or saturated by water for all or part of the year and that does not come under forestland, cropland, or grassland.

v. **Settlements:** This category includes all developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories.

vi. **Other land:** This category includes bare soil, rock, ice, and all unmanaged land areas that do not fall into any of the other five categories.

Based on these 6 IPCC classes, Kenya subcategorized the mapping classes under the SLEEK program into 10 classes, as shown in Table 1. The AIM4Forests program has further subcategorized some of these classes to include classes like public and private forest plantations, agroforestry, tea, coffee, sugarcane and other perennials.

Table 1: Subcategorization of the IPCC land use classes under the SLEEK program

National Land cover class	IPCC equivalent Class
Dense Forest (above 65%)	Forestland
Moderate Forest (40 % to 65%),	
Open Forest (15% to 40%)	
Annual Crops	Cropland
Perennial Crops	
Open Grasses	Grassland
Wooded Grass	
Water Body	Wetland
Vegetated Wetland	
Others (settlements, bare soil, rocks, and infrastructure e.g., roads)	Other lands

Source: Technical Manual for Land Cover Change Mapping in Kenya

Noting that the SLEEK data is provided for settlements and other lands as a combined land use class, a separation of the two classes was done by obtaining the urban settlement data from the Global Human Settlement Layer (GHSL).[14] Since the Built Surface (BUILT-S) component of this dataset depicts the density of built surfaces in five-year time intervals, the 1990 dataset was identified for the base year and 2020-layer data compared with the AIM4Forests data for the same year to allow recalculation of numbers in the time series. It is noted that the AIM4 Forests dataset had urban settlement area for the period 2017–2024 and only the data for the historical years (1990–2016) was recalculated for the GHSL-based urban settlements area statistics.

[14] https://human-settlement.emergency.copernicus.eu/

Further, administrative jurisdictional boundaries also constituted an integral component of Land Accounts data sources. These are available from Survey of Kenya,[15] the official government agency responsible for all matters relating to land surveying, administrative boundaries, and mapping in Kenya. Such layers included the county boundaries which were used to disaggregate the national land use maps into counties.

2.3 Land Use Change Matrix

The Land Use Change Matrix was compiled to enable a multifaceted analysis of land use changes in Kenya. These physical land cover/use change matrices detail the opening and closing stocks of land areas for various land uses. They also indicate the net increases and decrease in land use, based on what land cover types were converted from (in the case of increases) or to (in the case of decreases). The total net change for each land cover/use can be calculated by summing up the values of all land uses by type at the beginning of the reference period. The closing stock is determined by adding the opening stock to the total net change in land area for each land use or land cover type.

2.4 Land cover maps

The land cover maps for Kenya used in this NCA present the land cover/use types for the country using the time series data described above. The maps show the trends of major land cover categories such as forests, wetlands, settlements, and grasslands, among others, over the given period of 10-year epochs.

2.5 Land Use Shares under National Land Use Policy

Kenya's Sessional Paper No. 1 of 2017 on the National Land Use Policy[16] outlined nine land use classes: agriculture, pastoralism and livestock development, industrial, mining and energy, tourism, transport and infrastructure, natural resources and environment, human settlement/housing, and urban land uses. Livestock data was obtained from the GHG inventory used to develop Kenya's First Biennial transparency report,[17] while agricultural crop data was obtained from the Natural Resource Atlas.[18]

An estimation of the tenure systems was done based on data available for public areas (mainly under management of the KWS and KFS), community land, and private land. It is noted that these are only estimates because land tenure data could not be obtained.

2.6 Data Quality

Data used for this report was validated at source (mapping institutions) and data custodians. Annex 1a and 1b illustrate uncertainty assessment for images that have been used. The data has been used in reporting to the UNFCCC and has therefore received credibility and quality assurance protocols. In addition, the data has been used to develop other official government strategies,[19] policy documents and action plans. Geospatial tools and techniques were used to harmonize data sets into a common projection system using guidelines provided in the Kenya Technical Manual for land cover change mapping developed under the SLEEK program.

2.7 Account Format

The land accounting follow those specified within SEEA guidelines. Due to unavailability of some data, the accounts have been customized into formats that provide results based on the datasets that were available.

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[15] Ministry of Land, Housing & Urban Development. https://lands.go.ke/department-of-survey/

[16] https://repository.kippra.or.ke/items/f9ecca8c-d5d7-4932-8792-5d7fd2358cb9#:~:text=*Sessional%20Paper%20No.%201%20of%202017%20on,and%20cultural%20conservation**%20As%20the%20policy's%20philosophy

[17] /https://unfccc.int/sites/default/files/resource/Biennial%20Transparency%20Report%20-%20Final%202.pdf

[18] https://landcommission.go.ke/download/kenya-country-natural-resource-atlas/

[19] https://www.un-redd.org/sites/default/files/2022-05/NATIONAL%20REDD%2B%20STRATEGY%202022.pdf

03

Land Cover Accounts For Kenya



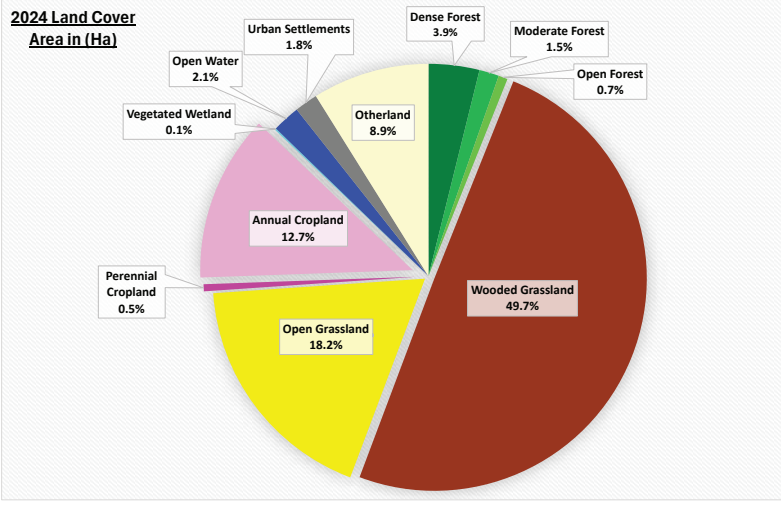
3.1 Introduction

This section presents the results of Land Cover accounts, including areas of specific land categories, change matrices, and graphical displays of the changes. The results are presented in specific thematic areas in a manner that informs policy guidelines for sustainable land use.

3.2 Kenya Land Cover Extent

Kenya's land cover in 2024 comprised four major land cover/use classes (Figure 2). Grasslands, which are found in Kenya's arid and semi-arid lands, are the most dominant with an area of 40,163,687 ha (67.8 percent); croplands comprise 7,827,633 ha (13.2 percent); forestlands comprise 3,591,486 ha (6.1 percent), while wetlands comprise 1,315,049 ha (2.2 percent). The urban settlements comprise a total of 1,042,337 (1.8 percent). Figure 2 also shows the extent of each disaggregated land cover. The wooded grassland class contributes the largest land area at 29,403,052 ha, followed by the open grasslands (10,760,635 ha). The annual croplands follow with an area of 7,510,033 ha, while dense forests comprise 2,289,231 ha.

Figure 2: Proportions of land cover in 2024



Source: Directorate of Resources Surveys and Remote Sensing (DRSRS)

Land Cover	Area in 2024 (Ha)
Dense Forest	2,289,231
Moderate Forest	890,128
Open Forest	412,127
Wooded Grassland	29,403,052
Open Grassland	10,760,635
Perennial Cropland	317,600
Annual Cropland	7,510,033
Vegetated wetland	65,280
Open Water	1,249,769
Urban Settlements	1,042,337
Other land	5,263,616
Total	**59,203,808**

Table 2: Land cover extent in the period 1990–2024

Land Cover	Area of different land cover types (1000ha) for the period 1990–2024							
	1990	1995	2000	2005	2010	2015	2020	2024
Dense Forest	2,393.94	2,368.77	2,221.38	2,157.93	2,463.67	2,243.37	2,256.00	2,289.23
Moderate Forest	963.64	1,012.95	1,170.06	856.82	889.33	830.27	813.93	890.13
Open Forest	576.70	646.63	619.59	455.23	525.47	504.61	425.90	412.13
Sum Forests	3,934.28	4,028.35	4,011.03	3,469.98	3,878.47	3,578.25	3,495.82	3,591.49
Wooded Grassland	34,277.73	34,298.51	32,729.93	33,802.54	31,742.30	31,246.22	30,223.55	29,403.05
Open Grassland	9,861.80	9,870.15	10,297.53	8,901.85	9,331.84	10,831.53	10,429.04	10,760.64
Sum Grasslands	44,139.54	44,168.66	43,027.47	42,704.39	41,074.14	42,077.75	40,652.59	40,163.69
Perennial Cropland	319.93	285.78	286.15	277.02	261.82	345.28	310.05	317.60

Table 2: Land cover extent in the period 1990–2024

Land Cover	Area of different land cover types (1000ha) for the period 1990–2024							
	1990	1995	2000	2005	2010	2015	2020	2024
Annual Cropland	3,141.75	3,391.30	3,947.95	4,682.51	5,800.96	6,145.64	7,071.68	7,510.03
Sum Croplands	3,461.67	3,677.08	4,234.11	4,959.54	6,062.78	6,490.92	7,381.73	7,827.63
Vegetated Wetland	30.82	37.79	24.68	31.40	45.96	45.49	58.89	65.28
Open Water	1,206.65	1,208.35	1,218.11	1,204.63	1,215.34	1,223.96	1,244.10	1,249.77
Sum Wetlands	1,237.47	1,246.14	1,242.79	1,236.03	1,261.30	1,269.45	1,302.99	1,315.05
Urban Settlements	113.81	157.63	218.31	302.36	418.76	579.98	803.25	1,042.34
Other land	6,317.04	5,925.96	6,470.11	6,531.50	6,508.34	5,207.47	5,567.43	5,263.62
TOTAL	**59,203.81**	**59,203.81**	**59,203.81**	**59,203.79**	**59,203.79**	**59,203.81**	**59,203.81**	**59,203.81**

Source: Directorate of Resource Surveys and Remote Sensing (DRSRS)

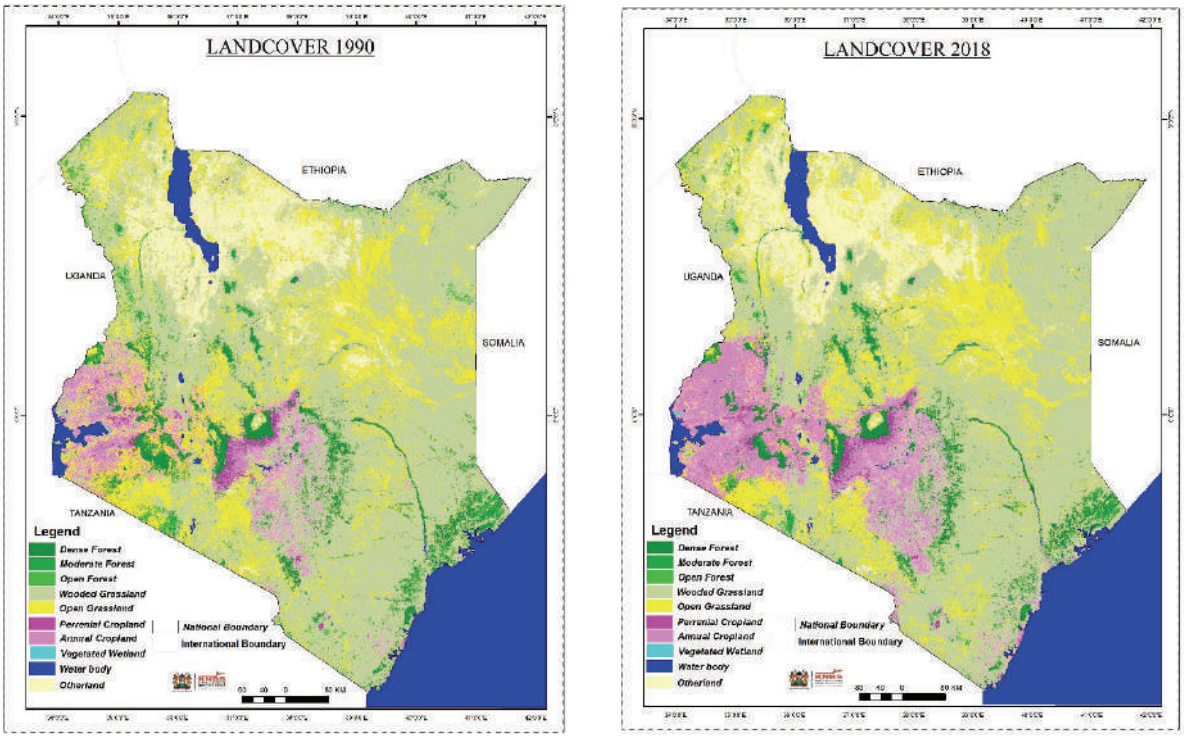


3.3 Land Cover Trends

The statistics of land cover change for the period 1990–2024 are shown in Table 2 and illustrated in Figure 3 by way of a comparison for the years 1990 and 2018. The table shows that grasslands have undergone a significant reduction of 3,975,850 ha in the period 1990 to 2024. In the same period, forests reduced by 342,793 ha from an area of 3,934,279 ha in 1990. Croplands and settlements increased by 4,368,286 ha and 928,525 ha respectively. The trends of these changes are illustrated in Figure 4 for grasslands, forestlands, croplands, and settlements, all of which showed significant changes.

Table 2 presents the matrix of change showing transitions of the land cover for the period 1990–2018. This table provides clarity on dynamics of land cover changes, including patterns of conversions, and may help understand the drivers of these changes. The matrix shows that grasslands were largely converted into croplands while forests were largely converted into grasslands and croplands. Similarly, croplands were converted into forestlands and this may illustrate the effect of agroforestry systems where trees are grown in farmlands.

Figure 3: Land cover maps for 1990 and 2018 depicting increasing croplands

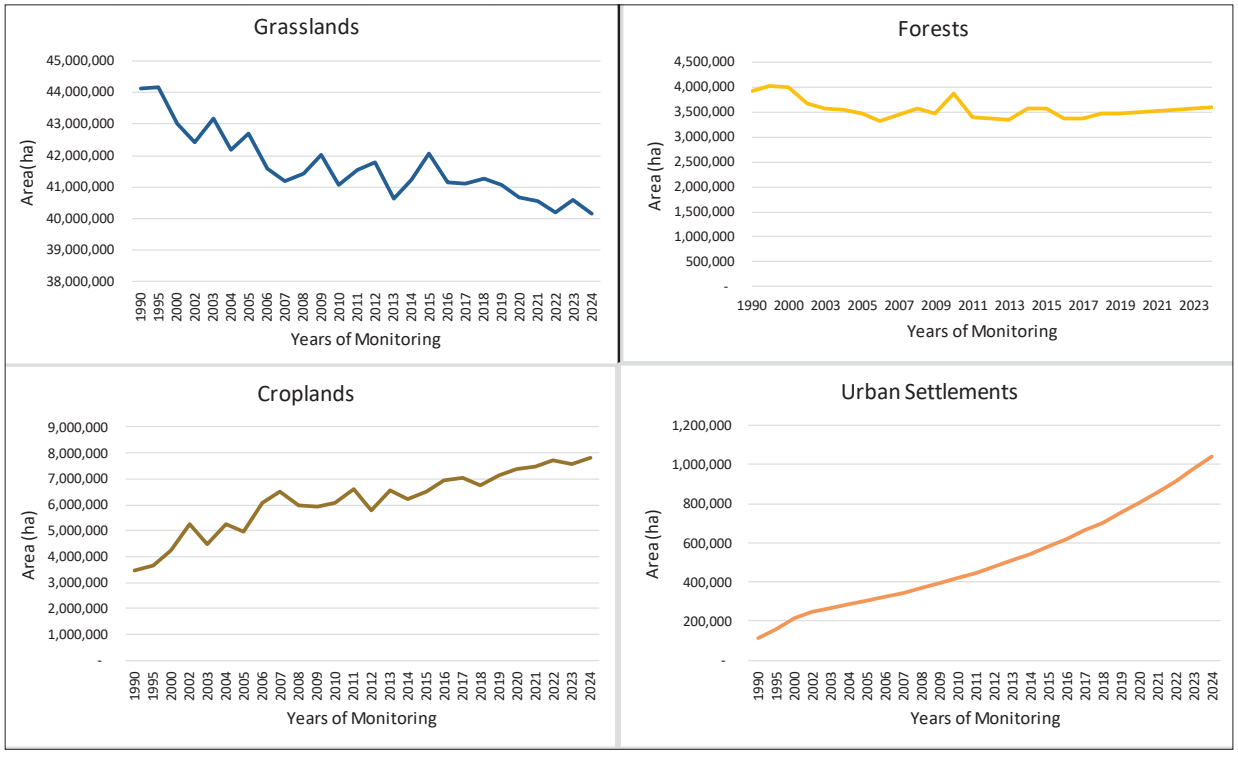


Source: Directorate of Resource Surveys and Remote Sensing (DRSRS)

The changes in the various land cover types are presented in Table 3. The table shows possible reasons to these changes that are largely due to human interventions and point towards expansion of agricultural areas, clearance of woody vegetation, and a rapid urbanization trend. The greatest increase is in urban settlements rising by 816 percent while annual croplands increased by 139.04 percent. Open forests had the greatest decrease of 28.54 percent.



Figure 4: Trends of change for selected land covers



Source: Directorate of Resource Surveys and Remote Sensing (DRSRS)

Table 3: A matrix of land cover changes showing the land cover transitions between 1990 and 2018

Area (1000ha) of land cover 1990	Land Cover Types	Area (1000ha) of land cover 2018							
		Opening Stock, 1990	Forest	Grassland	Cropland	Wetlands	Settlement & Other Land	Closing Stock, 2018	Net Change
	Forest	3,934.28	1,979.75	1,349.44	385.02	13.48	12.92	3,546.16	-388.12
	Grassland	44,139.54	1,361.75	37,142.98	3,571.60	61.17	2,143.91	41,518.27	-2,621.27
	Cropland	3,461.67	93.24	577.11	2,753.53	3.27	15.86	8,459.80	4,998.13
	Wetlands	1,237.47	7.53	27.62	16.15	1,175.73	6.22	1,082.53	-154.94
	Settlement & Other Land	6,430.85	20.26	2,154.96	13.88	13.88	4,302.53	4,597.05	-1,833.80
	Total	**59,203.81**	**3,462.54**	**41,252.11**	**6,740.17**	**1,267.53**	**6,481.44**	**59,203.81**	**0.00**

Source: Directorate of Resource Surveys and Remote Sensing (DRSRS)

Table 4: Change in land cover between 1990 and 2024 and the implied drivers of change

Land Cover	Area (ha)			% Change	Change type	Implied drivers of change
	1990	2024	change 1990–2024			
Dense Forest	2,393,940	2,289,231	104,709	-4.37	Decrease	Dense forests decreased due to historical drivers such as excisions
Moderate Forest	963,636	890,128	73,508	-7.63	Decrease	Moderately dense forests increased as dense forests got degraded
Open Forest	576,703	412,127	164,576	-28.54	Decrease	Open forests decreased significantly because they are fragile and easily converted into non-forests
Sum Forests	**3,934,279**	**3,591,486**	**342,793**	**-8.71**	**Decrease**	**The forest area has generally decreased**
Wooded Grassland	34,277,734	29,403,052	4,874,681	-14.22	Decrease	Woodlands have reduced and, as with open forests, they are identified as sources of charcoal
Open Grassland	9,861,804	10,760,635	-898,831	9.11	Increase	Open grasslands increased as wooded grasslands lost their woody cover
Sum Grasslands	**44,139,538**	**40,163,688**	**3,975,850**	**-9.01**	**Decrease**	**Grasslands have generally reduced**
Perennial Cropland	319,925	317,600	2,326	-0.73	Decrease	Perennial croplands have decreased due to expansion of urban areas
Annual Cropland	3,141,746	7,510,033	-4,368,286	139.04	Increase	Annual croplands have increased significantly as farming expanded into marginal areas to meet the increasing food demands of the population
Sum Croplands	**3,461,672**	**7,827,632**	**-4,365,961**	**126.12**	**Increase**	**Croplands have significantly increased**
Vegetated Wetland	30,823	65,280	-34,457	111.79	Increase	Growth of marshlands in former waterbodies may have resulted this increase
Open Water	1,206,648	1,249,769	-43,121	3.57	Increase	An increase in water bodies may be associated both natural and human factors
Sum Wetlands	**1,237,471**	**1,315,049**	**-77,578**	**6.27**	**Increase**	**Wetlands have generally increased**
Urban Settlements	113,812	1,042,337	-928,525	815.84	Increase	Urban settlements increased significantly as towns expanded and the need for settlement space increased
Other land	6,317,037	5,263,616	1,053,420	-16.68	Decrease	Better mapping methods may have helped reduce areas identified as other lands

Source: Directorate of Resource Surveys and Remote Sensing (DRSRS)

3.4 Recent Land Cover Changes 2015–2024

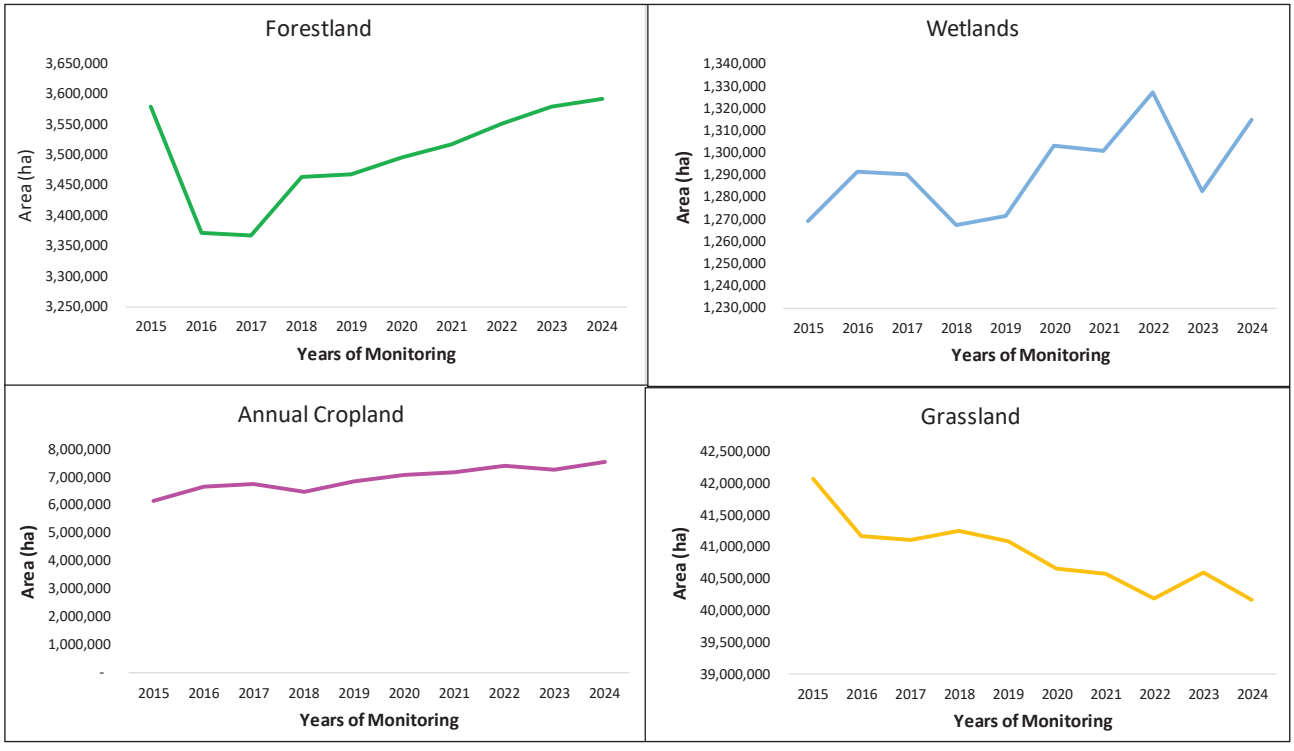
Recent land cover changes in Kenya spanning 2015–2024 demonstrate the effect of recent and current drivers of land use change. They depict interesting changes and dynamics, with significant gains on forests, open water, cropland, urban settlements, and vegetated wetland, while decreases are noticeable in grassland areas (both wooded and open). These changes and dynamics are inextricably linked to conversion for agricultural uses, clearing for human settlement, and infrastructural development. The area under vegetated wetlands increased by about 25,811 ha, which is about 43.51 percent of the total area in vegetated wetlands that existed in 2017. This is probably due to increased rainfall, rising lake levels, or climatic changes.



43.51%

The area under vegetated wetlands increased by about 25,811 ha, which is about 43.51 percent of the total area in vegetated wetlands that existed in 2017.

Figure 5: An illustration of trends (2015–2024) in land cover based on recent drivers of change



Source: Directorate of Resource Surveys and Remote Sensing (DRSRS)



3.5 Land Cover Changes at County Levels

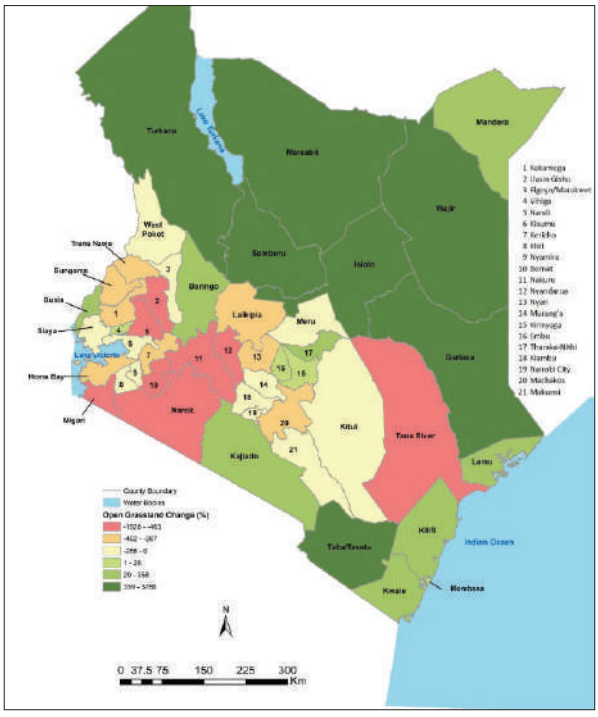
Figure 6 shows varying levels of land cover changes among Kenyan counties. The counties of northern and north-eastern Kenya (Turkana, Marsabit, Samburu, Wajir, Isiolo, and Garissa) show an increase in open grassland areas compared to the other counties of Kenya. This pattern is also illustrated in the southern counties, including Taita–Taveta and Kajiado. Specifically, annual croplands increased most significantly in Makueni and Narok counties, with other notable increases in Kilifi, Kwale, Laikipia and Trans Nzoia.

The croplands illustrated the most significant increases in counties such as Narok and Kilifi and also in other marginal counties like Kajiado, Taita–Taveta, and West Pokot.

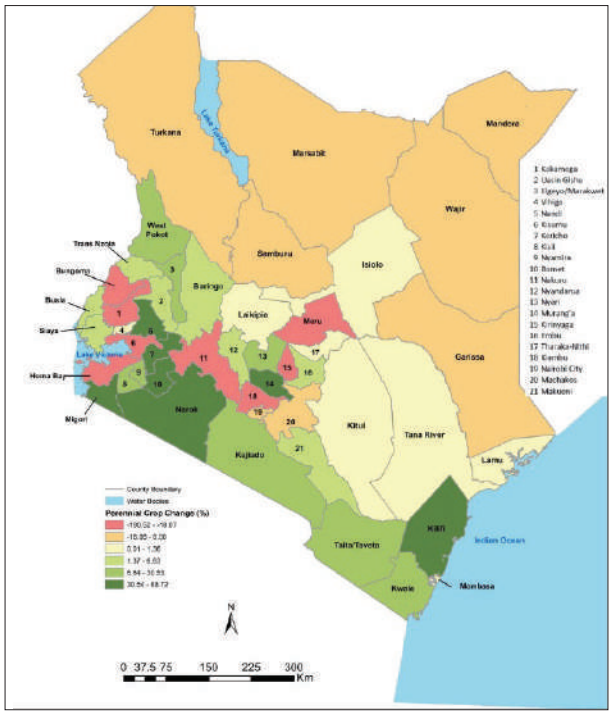
Significant increases in open water bodies were noted in counties with lakes and major rivers. These include Turkana (Lake Turkana and the Turkwel and Kerio rivers), Marsabit (Lake Turkana), Baringo (Lake Baringo, Lake Bogoria, and water bodies along the Kerio river), Nakuru (Lake Nakuru, Lake Naivasha, and Lake Elementaita), and Kitui (water bodies along the Tana and Athi rivers)



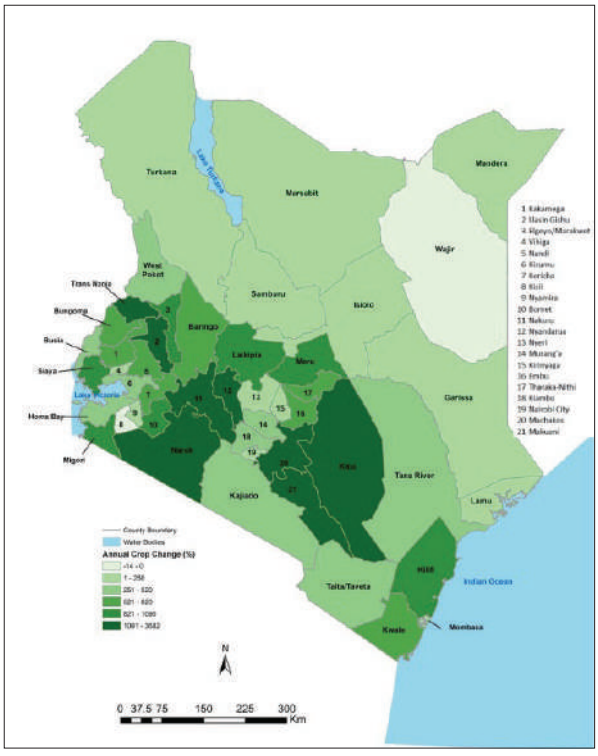
Figure 6: An illustration of land cover changes among counties



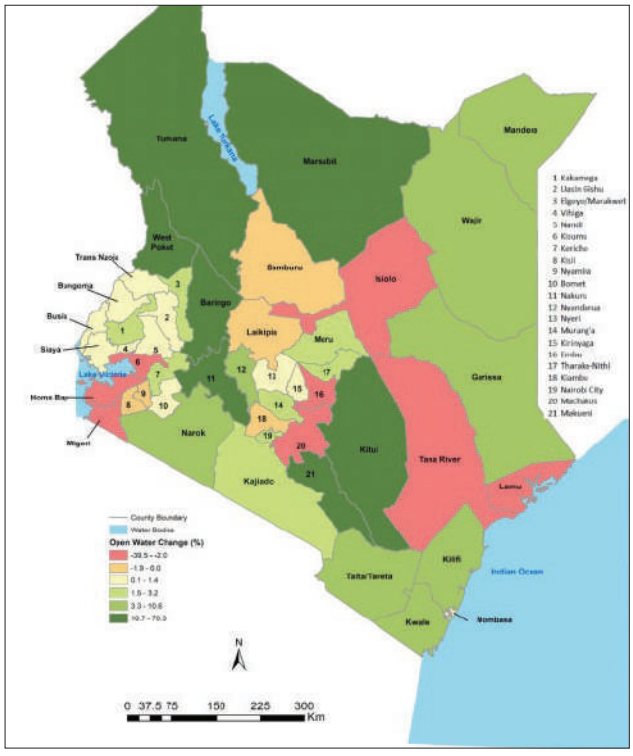
Expansion of open grassland areas



Expansion of cropland areas



Expansion of annual cropland areas



Expansion of open water areas

Source: Directorate of Resource Surveys and Remote Sensing (DRSRS)

04

Land Use Accounts



The land use maps described in chapter 3 illustrate the spatial distribution of the cropland areas and the associated statistics of cropland change over time. This section goes deeper into the agricultural statistics to show the specific crops grown and the trends of area change and production over time.

4.1 Agriculture Land Use

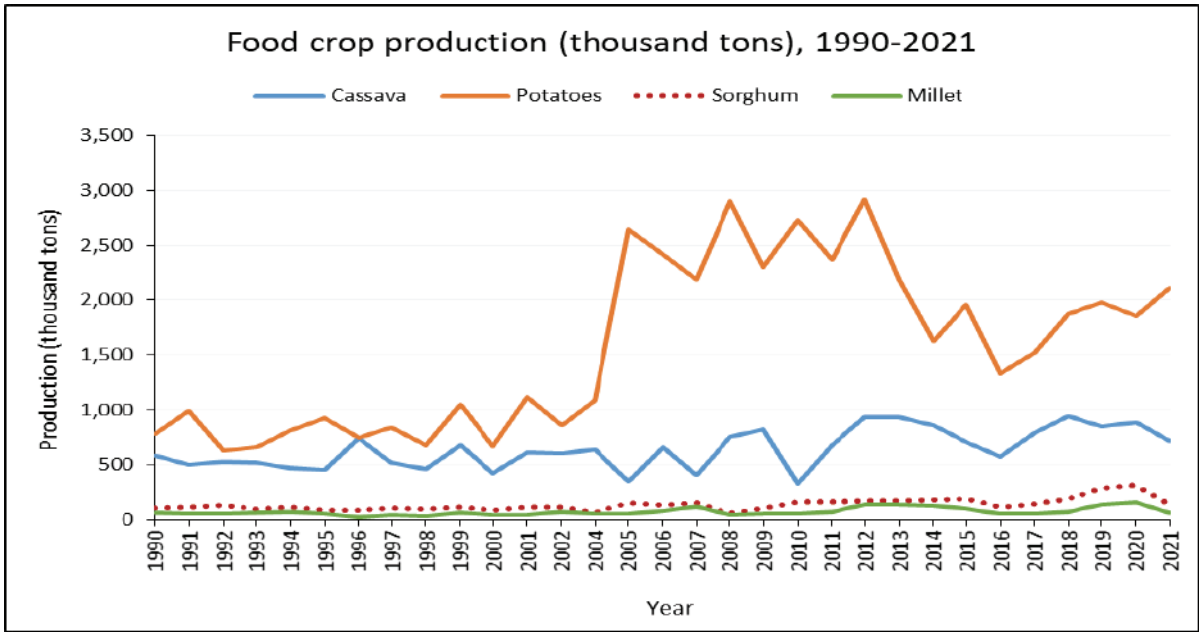
Generally, the production of major crops has grown over time (Table 5:). Figure 7 gives an illustration of the trend of production for the different agricultural crops. For example, maize production recorded the highest increase from approximately 2.3 to 3.3 million tons between 1990 to 2021. These was followed by beans with 0.4 to 0.7 million tons, Irish potato production with 0.8 to 2.1 million tones and rice production from 0.04 to 0.2 million tons over the same time series. These impressive growth rates can be attributed to the expansion of the areas under cultivation and increment in the yields of the crops. Regarding industrial crops, tea and sugarcane production has been on the rise, whereas coffee and barley production has been on the decline, the negative growth in barley and coffee production has mainly been contributed by the sustained reduction in their yields and acreage since 1990.

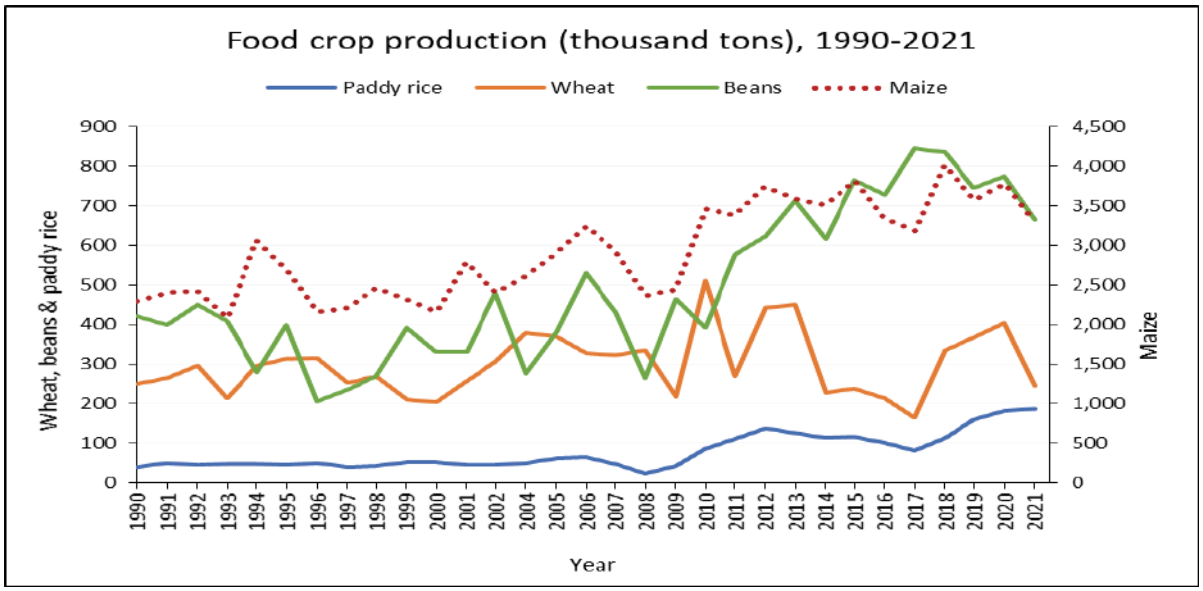
Table 5: Growth in area and production for major crops

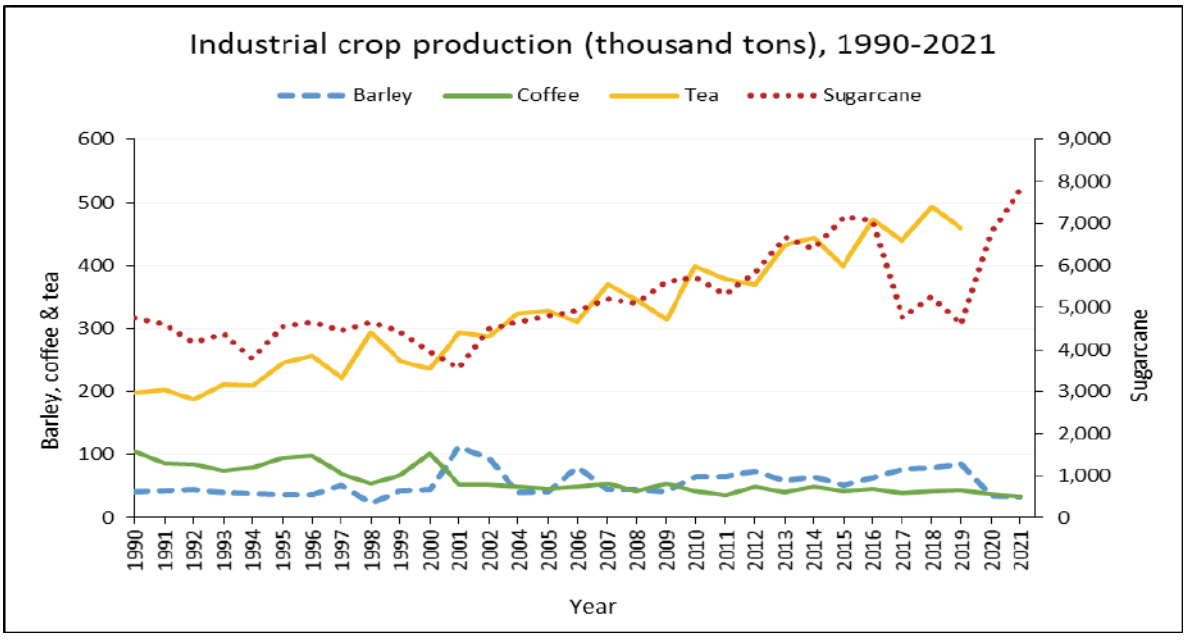
Crop	Period 1990–2001			Period 2001–2011			Period 2011–2021			Period 1990–2021		
	Area (million ha)	Prodn (Tons)	Yield (Hg/ha)	Area (million ha)	Prodn (Tons)	Yield (Hg/ha)	Area (million ha)	Prodn (Tons)	Yield (Hg/ha)	Area (million ha)	Prodn (Tons)	Yield (Hg/ha)
Wheat	-1.24	-1.27	-0.03	-0.86	-0.92	-0.05	-0.61	0.23	0.84	-0.27	0.43	0.70
Maize	1.55	0.19	-0.34	0.38	0.01	-0.37	2.73	1.75	-0.96	1.88	1.74	-0.14
Beans	4.11	-2.94	-6.77	1.15	2.23	1.07	-0.65	2.04	2.71	2.35	3.20	0.82
Irish potatoes	4.54	1.42	-2.98	5.69	-2.39	-7.64	0.16	11.56	11.40	2.89	4.20	1.27
Paddy rice	-0.14	0.60	0.74	-1.33	3.74	5.14	7.69	4.95	-2.54	3.89	4.55	0.64
Cassava	3.18	0.36	-2.74	-0.60	0.04	0.64	-1.26	0.45	1.73	0.45	1.75	1.30
Sorghum	1.33	-0.81	-2.11	-0.77	2.91	3.71	4.91	1.57	-3.18	2.48	2.66	0.18
Millet	-0.20	-3.12	-2.93	0.12	-1.95	-2.07	-1.52	1.00	2.56	1.08	2.67	1.57
Tea	2.17	9.42	7.10	3.83	3.68	-0.14	3.74	2.77	-0.93	3.38	4.18	0.78
Coffee	1.30	-3.43	-4.67	0.35	-1.35	-1.69	-2.32	-2.52	-0.21	-1.51	-3.02	-1.54
Sugar-cane	1.33	-1.18	-2.48	0.23	0.57	0.34	4.01	3.79	-0.21	2.04	1.52	-0.51
Barley	0.03	3.20	3.17	-1.88	-3.89	-2.05	-1.21	-2.24	-1.04	-0.86	1.39	2.28

Source: Kenya Natural Resource Atlas

Figure 7: An illustration of the trends of production for different agricultural crops







Source: Kenya Natural Resource Atlas

4.2 Livestock and Pastoralism

Table 6 presents estimated number of livestock in Kenya over the period 1990–2022, based on the greenhouse gas (GHG) inventory that developed the Biennial Transparency Report (BTR1).[20] Over the period, the number of cattle (both dairy and non-dairy) nearly doubled, increasing from 2,956,540 to 5,497,412 for dairy cows and 7,141,090 to 15,332,722 for non-dairy cows. Similarly, the headcount for sheep and goats also increased, with goats increasing by 20,566,829 which translates to 206 percent. The number of swine, camels, donkeys, and poultry also increased tremendously. These results illustrate a significant increase of livestock-rearing activities in the period 1990–2022. Traditionally, livestock were concentrated in the arid and semi-arid counties, such as Turkana, Wajir, Garissa, Kajiado, Narok, and Marsabit, where production is mainly carried out by pastoralists. However, an advance in agricultural technologies has seen adoption of livestock increase even in humid zones, where intensive and semi-intensive production practices have been adopted.



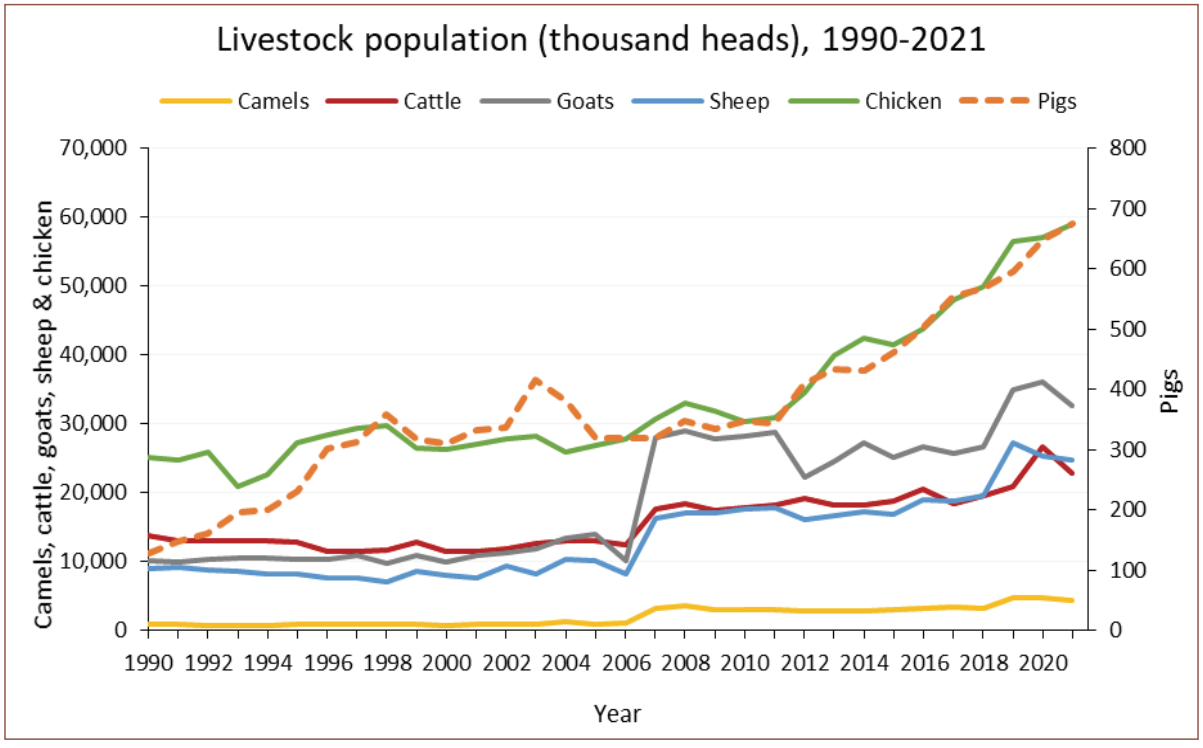
[20] https://unfccc.int/sites/default/files/resource/Biennial%20Transparency%20Report%20-%20Final%202.pdf

Table 6: Livestock number and trends in the period 1990–2022

Livestock type	1990	2000	2005	2010	2015	2020	2022
Dairy cattle	2,956,540	3,335,920	3,579,461	3,376,478	4,242,131	5,112,340	5,497,412
Non-dairy cattle	7,141,090	8,075,377	9,521,486	10,307,309	14,511,047	16,541,255	15,332,722
Sheep	9,823,120	7,939,546	10,033,881	10,835,364	16,808,470	25,345,927	21,333,288
Goats	9,991,791	10,414,814	13,263,776	17,485,713	25,128,075	36,021,177	30,558,620
Swine	128,168	310,700	320,020	240,900	462,037	649,273	792,906
Camels	595,000	717,524	931,308	1,535,473	3,066,998	4,669,739	3,456,483
Donkeys	160,843	416,136	716,614	989,389	1,676,267	1,234,630	1,729,940
Poultry	19,161,000	30,147,000	26,676,000	26,479,300	42,185,323	57,161,777	60,784,715

Source: Kenya GHG Inventory for BTR1

Figure 8: Livestock population trends 1990–2021



Source: FAOSTAT

4.3 Wildlife Conservation

Kenya is endowed with highly biodiverse habitats that support a vast variety of wildlife species. Wildlife resources contribute to the socioeconomic well-being of Kenya in a variety of ways. Wildlife is a major tourist attraction, accounting for over 12 per cent of the Kenya's Gross Domestic Product (GDP),[21] and is a significant source of livelihoods across the country. Moreover, wildlife tourism has multiplier effects on other industries such as agriculture, horticulture, transport, and communications.



4.3.1 Categories of wildlife conservation areas in Kenya

Kenya is endowed with highly biodiverse habitats that support a vast variety of wildlife species. Kenya's wildlife conservation areas comprising of parks, Reserves, sanctuaries and conservancies cover approximately 14,923,459.00 ha of the country's land mass. There are 24 National Parks over 2,950,400 ha, which accounts for 5.08 percent of Kenyan's land, and 26 terrestrial National Reserves over 1,735,880 ha, which is 3 percent of Kenya's total area (Table 6). In addition, Kenya has six marine national reserves covering a total 87,100 ha. There are six National Sanctuaries covering a total area of about 26,579 ha. The list of conservancies is growing steadily and as of April 2023 stands at 206 covering 10,115,900 ha.[22] Figure 9 illustrates the increase in conservation areas under wildlife conservation and forest conservation.

Table 7: Wildlife conservation areas of Kenya

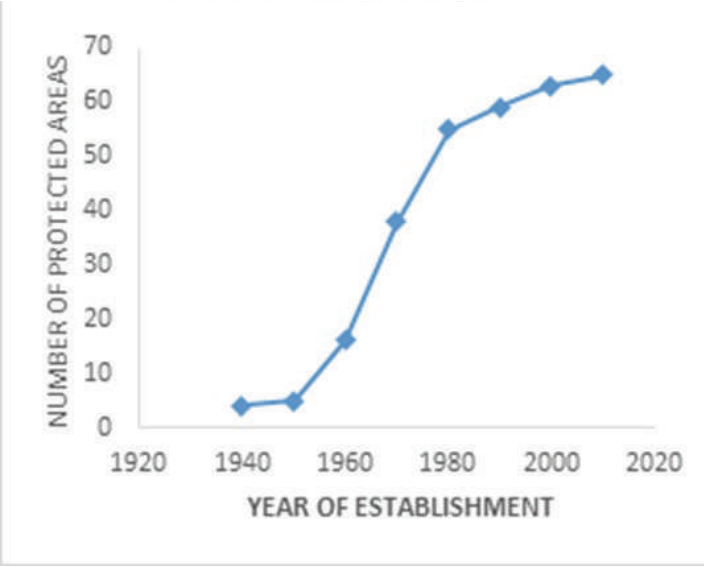
No.	Category	Total number	Area (ha)	% Acreage
1.	National Park - Terrestrial	24	2,950,400	19.77
2.	National Park - Marine	3	7,600	0.05
3.	National Reserve - Terrestrial	26	1,735,880	11.63
4.	National Reserve - Marine	6	87,100	0.58
5.	National Sanctuary	6	26,579	0.18
	Conservancy	206	10,115,900	67.79
	Total		**14,923,459**	**100.00**

Source: Kenya Natural Resource Atlas

[21] https://wildlifedirect.org/wp-content/uploads/2017/02/A-Guide-to-the-Wildlife-Act-of-Kenya-2013.pdf

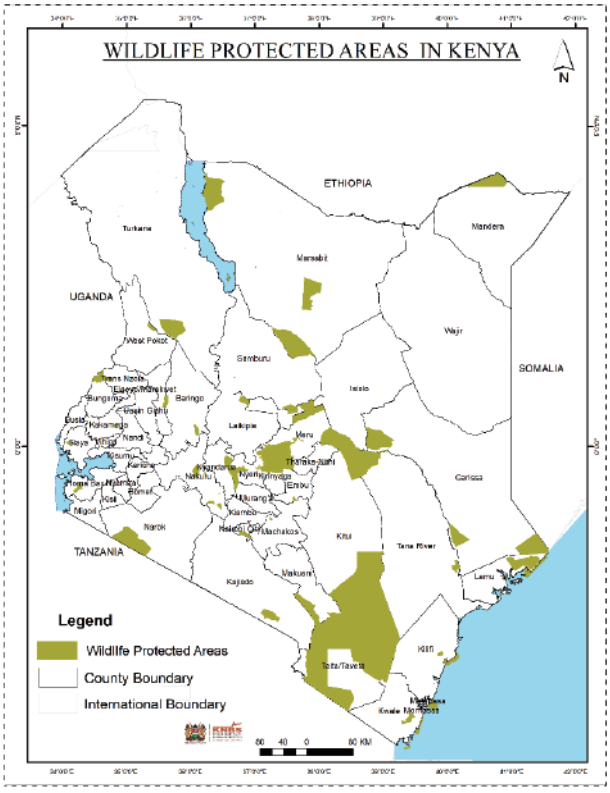
[22] https://kwcakenya.com/conservancies/status-of-wildlife-conservancies-in-kenya/

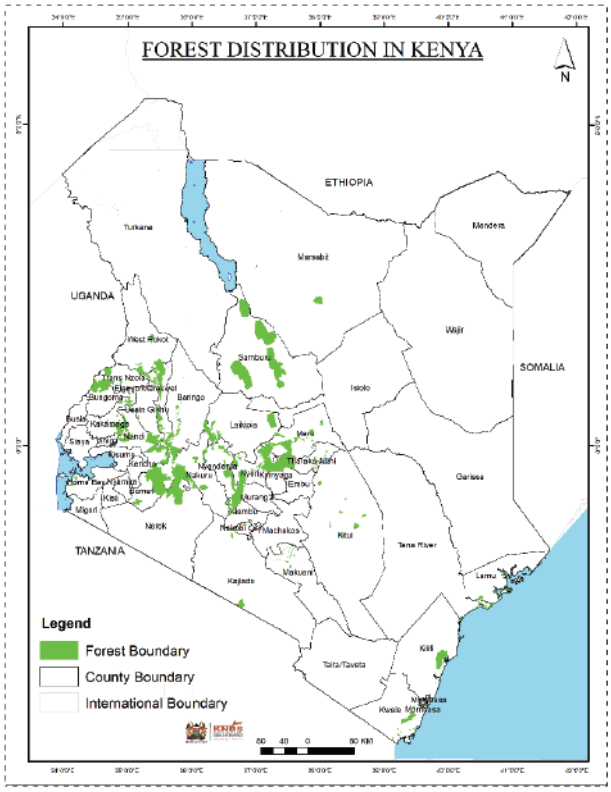
Figure 9: An illustration of the establishment of state-designated protected areas



Source: Kenya Natural Resource Atlas

Figure 10: Maps of Kenya's protected areas under wildlife and forest conservation





Source: Kenya Wildlife Service (KWS) and Kenya Forest Service (KFS)


5.08%
There are 24 National Parks over **2,950,400 ha,** which accounts for 5.08 percent of Kenyan's land, and 31 terrestrial National Reserves over 1,735,880 ha, which is 3 percent of Kenya's total area

4.4 Land Ownership

Under Article 61 of the Constitution of Kenya, land is classified into three categories: public land, community land, and private land.

a) **Public land:** Public land is designated for public use or environmental protection. Depending on its use, it is vested in either the county government or the national government. Public land comprises of 25 percent of total land mass.

b) **Community Land:** Article 63 of the Constitution recognizes community land, which is vested in and is held by communities based on ethnicity, culture, or shared interests. Community land is governed by the Community Land Act No. 27 of 2016 and cannot be disposed of or used except in accordance with this law. Community land comprises of 67 percent of total land mass.

c) **Private land** is owned by individuals or legal entities. Private entities comprise 8 percent of total land mass.

It is important to note that the data on land ownership in Kenya is inadequate. Hence a detailed land ownership account cannot be compiled. Estimated land ownership in Kenya is shown in Table 8. Community land accounts for the largest area of Kenya at 67% and these lands are mainly found in the marginal areas where land is still managed communally.

Table 8: Land tenure systems and their estimated areas

Land classification		Acreage in Ha	Percentage %
Public land	Kenya forests managed lands	2,375,077	4
	Kenya wildlife managed lands	3,970,884	6.7
	Other public entities lands	8,462,991	14.3
Private land		4,736,305	8
Community land		39,666,551	67
Total acreage		**59,203,808**	**100**

Source: Kenya Natural Resource Atlas



05

Challenges in Developing Natural Capital Accounts



5.1 Challenges

The following challenges were encountered in the development of Land Accounts:

1. **Data inconsistency:** Different methodologies were used: SLEEK data (1990–2018) versus sample-based area estimation data from IMPRESS and AIM4Forests (2017–2023). The two mapping methodologies provided a challenge in integrating data, showing that there was a need to identify long-term time-series land cover changes and also be able to explain the impact of recent policy decisions on land.
2. **Incompatible land cover classifications:** SLEEK used 10 classes while sample-based methods used 31 classes, making data alignment difficult. Fortunately collapsing the 31 land cover classes of the sample-based mapping methodology into the 10 SLEEK classes was possible.
3. **Boundary data inconsistencies:** Minor discrepancies in totals due to boundary data errors. This arose because data sets used for the analysis was obtained from the different mandated institutions.
4. **Limited county-level data:** Only 17 counties had completed spatial plans, and some lacked land cover/land use figures. This made disaggregation of national data into the county levels difficult.
5. **Incomplete land ownership data:** Geolocation information for land ownership was insufficient. Noting that rapid urbanization and expansion of agriculture has influenced land value, it would have been appropriate to illustrate this changing trend in land ownership and associated changes in land value.
6. **Settlement data gaps:** Settlement land data had to be sourced externally from the Global Human Settlement Layer (GHSL) as it was combined with "Other lands" in available datasets.
7. **Incomplete land use transition data:** Insufficient data on land cover changes for 2019–2024. The format of the data obtained from the sample-based mapping methodology did not allow the development of land use change matrices. This will be considered in the development of the next version of the Land Accounts.
8. **Lack of monetary valuation data:** Insufficient information on the monetary value of land.
9. **Missing temporal data:** Data gaps for specific years required interpolation.

5.2 Proposals to Improve Data Quality

Some ways of improving data quality would be to:

1. Integrate NCA requirements in the national land cover mapping programs. This will allow the mapping products to respond to the specific needs of the Land Accounts, including land use change matrices and desegregation of data into lower administrative units.
2. Review and validate the data. Conduct independent review of the Land Accounts data to ensure quality and reliability.
3. Develop Monetary and Land Ownership Accounts. Integrate economic valuation and ownership data to support macroeconomic modeling and green finance initiatives.
4. Use Land Accounts for job creation and donor alignment. Identify land transition hotspots to guide employment interventions and align donor programs with national priorities.
5. Deepen statistical and spatial analysis. Apply advanced statistical models and conduct sub-county level analysis to inform localized policies.
6. Raise awareness of natural capital accounting. Promote SEEA-based accounts through briefing notes, forums, partnerships, and online data access.
7. Build capacity in Land Accounting. Provide ongoing training on latest data sources and methodologies, including improvements in settlement mapping.
8. Strengthen institutional coordination. KNBS should lead Land Accounts production with support from the Land Accounts Technical Working Group (TWG), Ministry of Environment, Ministry of Lands, and National Land Commission.

06

Conclusions and Recommendations



6.1 Policy and Institutional Implications

This report presents the changing patterns and trends in Kenya's land assets and discusses possible implications for development planning, governance, and policy formulation. It elucidates critical recommendations to champion effective land and natural resources governance, especially the embedding of these assets in national accounts and socioeconomic planning, including budgeting. The report establishes the various policy instruments for land and natural conservation to develop a sustainable accounting program that links the different institutions with mandates for the use of land resources.

Land Accounts establish the foundational structure for other natural capital accounts, including energy, water, ecosystems, forestry, wildlife, ocean and fisheries. Therefore, they link the different institutional mandates into a common approach. The Accounts help to streamline, create collaboration, and systematize data collection and collation for compilation, analysis, and integration in order to achieve the desired sustainable development goal. This is a key principle under Article 10 of the Constitution of Kenya.

The land use and cover information in this report can inform land-use planning at the community (community land use plans), county (county spatial plans), and national level (spatial plans and integrated inter-county plans for national and shared resources). Land use and cover accounts should also inform Kenya's efforts to build climate resilience, reduce deforestation, and increase forest and tree cover in line with policies and strategies such as the climate change response strategy, the Presidential directive on planting 15 billion trees by 2032 to enhance tree cover, and the restoration of degraded landscapes through the African Forest Landscape Restoration Initiative (AFR100), alongside regional and international commitments in accordance with Articles 2(5), 2(6), and 69 of the Constitution.

6.2 Development of an Institutional Framework

Kenya has taken significant strategic steps towards institutionalizing environmental-economic accounting. The production of the SEEA-based Land Cover/Land Use (LCLU) is a commitment to start implementing the SEEA Central Framework Land Accounts. The formation of the Land Account Technical Working Group (TWG) is a crucial advance in supporting the integration of natural capital into the country's statistical, planning, and policy frameworks. As a result, the Land Accounts TWG is now well-positioned as a central institutional mechanism to drive development of Land Accounts in the future, having developed capacity in accounting and gained knowledge of data and methods needed to produce natural capital accounts. The Land TWG under the supervision of the KNBS will play a vital role in coordinating data access, supporting methodological standardization, and ensuring that the outputs of land accounting are policy-relevant and nationally endorsed.

6.3. Sustainability Measures

This NCA is developed using data and information from ongoing processes such at the periodic surveys of the KNBS; the national land cover mapping program by the DRSRS; boundary alignment by the Survey of Kenya; activities of the National Land Commission; core mandates of the ministries in charge of agriculture, wildlife management, and forestry among others. Development of data-sharing protocols with these institutions allows cheap and sustainable access to this information, making the development of Natural Capital Accounts a sustainable process in the future.

Annexes

Annex 1a: Statistics of accuracy for images developed by the SLEEK program

Class Name	1990				1995			
	Producers Accuracy	95% CI	Users' Accuracy	95% CI	Producers Accuracy	95% CI	Users' Accuracy	95% CI
Dense forest	0.909646	± 0.005091	0.696970	± 0.006731	0.859435	± 0.00470	0.907692	± 0.004113
Moderate forest	0.662968	± 0.004272	0.703704	± 0.003986	0.672655	± 0.00457	0.608696	± 0.004923
Open forest	0.788736	± 0.002399	0.526316	± 0.002819	0.742604	± 0.002930	0.678571	± 0.002382
Wooded grassland	0.897844	± 0.015518	0.901657	± 0.016424	0.909995	± 0.016089	0.886447	± 0.018532
Open grassland	0.748509	± 0.012769	0.727969	± 0.012583	0.737485	± 0.013072	0.757246	± 0.011790
Perennial cropland	1.000000	± 0.001257	0.875000	± 0.001778	0.627645	± 0.002253	0.736842	± 0.001267
Annual cropland	0.774646	± 0.006944	0.745098	± 0.006628	0.744043	± 0.007664	0.736842	± 0.006458
Vegetated wetland	1.000000	± 0.000000	1.000000	± 0.000000	1.000000	± 0.000246	0.750000	± 0.000349
Open water	0.971155	± 0.001186	1.000000	± 0.000000	0.882521	± 0.002384	1.000000	± 0.000000
Other land	0.789662	± 0.009194	0.897436	± 0.006725	0.773969	± 0.009798	0.801075	± 0.008625
	Overall Accuracy = 0.85294 ± 0.038652				**Overall Accuracy = 0.848214 ± 0.040655**			
Class Name	**2000**				**2005**			
	Producers Accuracy	95% CI	Users Accuracy	95% CI	Producers Accuracy	95% CI	Users Accuracy	95% CI
Dense forest	0.795594	± 0.005473	0.741935	± 0.006101	0.746247	± 0.005996	0.562500	± 0.006938
Moderate forest	0.666794	± 0.003545	0.571428	± 0.003308	0.378758	± 0.006466	0.800000	± 0.002077
Open forest	0.827830	± 0.001976	0.652173	± 0.002002	0.451421	± 0.004496	0.739130	± 0.002100
Wooded grassland	0.864798	± 0.015941	0.904761	± 0.014884	0.932594	± 0.016293	0.870129	± 0.019708
Open grassland	0.740334	± 0.013422	0.689542	± 0.013513	0.719444	± 0.013428	0.801652	± 0.011098
Perennial cropland	1.000000	± 0.001181	0.785714	± 0.001720	0.477853	± 0.003338	0.600000	± 0.002246
Annual cropland	0.846403	± 0.009832	0.788617	± 0.011484	0.699307	±0.0103628	0.774509	±0.009530
Vegetated wetland	1.000000	± 0.000465	0.666666	± 0.000650	1.000000	± 0.000000	1.000000	± 0.000000
Open water	0.928043	± 0.002112	0.971428	± 0.001633	0.907419	±0.002347	1.000000	±0.000000
Other land	0.811689	± 0.008161	0.820388	± 0.007465	0.870353	±0.008749	0.849710	±0.008948
	Overall Accuracy =0.834575 ± 0.038404				**Overall Accuracy = 0.838126347 ± 0.042713**			
Class Name	**2010**				**2015**			
	Producers Accuracy	95% CI	Users Accuracy	95% CI	Producers Accuracy	95% CI	Users Accuracy	95% CI
Dense forest	0.939054	± 0.004257	0.907407	± 0.004648	0.827972	± 0.003373	0.768888	± 0.003082
Moderate forest	0.648793	± 0.005207	0.812500	± 0.004302	0.556631	± 0.003167	0.735632	± 0.001780
Open forest	0.494675	± 0.004868	0.833333	± 0.002832	0.394331	± 0.003157	0.675675	± 0.001630
Wooded grassland	0.906336	± 0.017090	0.842456	± 0.020343	0.913249	± 0.013283	0.797169	± 0.017425
Open grassland	0.630431	± 0.015320	0.737051	± 0.012763	0.191470	± 0.011188	0.747191	± 0.009665
Perennial cropland	0.762797	± 0.002143	0.833333	± 0.002043	0.013954	± 0.003374	0.857142	± 0.000445
Annual cropland	0.816901	± 0.008399	0.894736	± 0.006525	0.140308	± 0.009109	0.780626	± 0.004031
Vegetated wetland	1.000000	± 0.000000	1.000000	± 0.000000	0.082476	± 0.003050	0.782609	± 0.000126
Open water	1.000000	± 0.000000	1.000000	± 0.000000	0.020460	± 0.000815	0.981132	± 0.001078
Other land	0.803309	± 0.010038	0.754716	± 0.010001	0.097172	± 0.006305	0.856435	± 0.006863
	Overall Accuracy = 0.826186 ± 0.000001				**Overall Accuracy = 0.793787 ± 0.028597**			

Source: Directorate of Resource Surveys and Remote Sensing (DRSRS)

Annex 1b: Statistics of accuracy for images developed by the AIM4Forests mapping program

2016 -2023	90% Confidence Interval (in ha)							REL
	0	1	2	3	4	5	Total (ha)	90 CI %
Deforestation (natural)	32,051	-	6,211	-	5,847	8,273	34,183	46.5%
Deforestation (planted)	-	-	6,211	4,760	6,749	4,686	11,346	40.0%
Degradation	-	-	6,211	6,730	6,749	3,882	12,020	44.6%
Enhancement (natural)	45,317	-	6,211	6,730	6,749	4,472	46,937	68.0%
Enhancement (planted)	45,317	-	6,211	4,760	6,749	8,001	47,164	49.7%
Reforestation	-	-	12,406	4,760	6,749	1,426	14,972	54.6%
Stable (natural) forest	45,317	80,293	72,639	58,242	31,652	8,534	135,070	5.3%
Stable (planted) forest	45,317	30,201	26,164	26,232	15,698	10,608	68,537	16.4%
Non-forest	95,985	80,897	77,625	63,512	37,496	15,981	165,766	0.3%

Deforestation (natural)	90% Confidence Interval (in ha)							
	0	1	2	3	4	5	Total (ha)	90 CI %
2016	-	-	-	-	-	1,426	1,426	116.3%
2017	-	-	-	-	-	2,845	2,845	58.0%
2018	32,051	-	-	-	3,379	3,477	32,416	112.2%
2019	-	-	-	-	-	3,016	3,016	54.6%
2020	-	-	-	-	3,379	3,331	4,745	53.9%
2021	-	-	-	-	-	3,618	3,618	45.4%
2022	-	-	6,211	-	-	2,466	6,682	89.6%
2023	-	-	-	-	3,379	3,331	4,745	53.9%

Deforestation (planted) true loss	90% Confidence Interval (in ha)							
	0	1	2	3	4	5	Total (ha)	90 CI %
2016	-	-	-	-	-	1,009	1,009	164.5%
2017	-	-	-	-	-	1,426	1,426	116.3%
2018	-	-	-	-	-	1,009	1,009	164.5%
2019	-	-	6,211	-	-	2,466	6,682	89.6%
2020	-	-	-	4,760	3,379	1,426	6,009	97.3%
2021	-	-	-	-	5,847	1,426	6,019	81.5%
2022	-	-	-	-	-	2,252	2,252	73.4%
2023	-	-	-	-	-	1,746	1,746	94.9%

Annex 1b: Statistics of accuracy for images developed by the AIM4Forests mapping program

Deforestation (planted) cyclical	90% Confidence Interval (in ha)							
	0	1	2	3	4	5	Total (ha)	90 CI %
2016	-	-	-	-	-	-	-	-
2017	-	-	-	-	-	1,009	1,009	164.5%
2018	-	-	-	-	-	1,009	1,009	164.5%
2019	-	-	-	-	-	-	-	-
2020	-	-	-	-	-	1,009	1,009	164.5%
2021	-	-	-	-	-	1,426	1,426	116.3%
2022	-	-	-	-	-	-	-	-
2023	-	-	-	-	-	1,009	1,009	164.5%

Degradation	90% Confidence Interval (in ha)							
	0	1	2	3	4	5	Total (ha)	90 CI %
2016	-	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-	-
2018	-	-	-	-	-	2,015	2,015	82.1%
2019	-	-	-	-	3,379	1,009	3,526	132.2%
2020	-	-	-	4,760	-	1,426	4,969	120.6%
2021	-	-	6,211	-	3,379	1,746	7,283	95.0%
2022	-	-	-	-	3,379	2,015	3,934	87.3%
2023	-	-	-	4,760	3,379	1,009	5,924	106.5%

Enhancement (natural)	90% Confidence Interval (in ha)							
	0	1	2	3	4	5	Total (ha)	90 CI %
2016	-	-	-	-	-	-	-	-
2017	32,051	-	-	-	-	-	32,051	164.5%
2018	-	-	-	-	-	1,746	1,746	94.9%
2019	-	-	-	-	3,379	2,662	4,302	67.8%
2020	-	-	6,211	4,760	3,379	1,426	8,642	86.9%
2021	-	-	-	4,760	3,379	2,466	6,337	73.4%
2022	-	-	-	-	3,379	-	3,379	164.5%
2023	32,051	-	-	-	-	1,426	32,083	154.9%

Annex 1b: Statistics of accuracy for images developed by the AIM4Forests mapping program

Enhancement (planted)	90% Confidence Interval (in ha)							
	0	1	2	3	4	5	Total (ha)	90 CI %
2016	-	-	-	-	-	-	-	-
2017	-	-	-	-	4,776	2,845	5,559	61.7%
2018	45,317	-	-	-	3,379	3,882	45,608	90.8%
2019	-	-	-	4,760	-	4,129	6,302	47.3%
2020	-	-	6,211	-	3,379	3,016	7,687	67.7%
2021	-	-	-	-	-	3,177	3,177	51.8%
2022	-	-	-	-	-	1,746	1,746	94.9%
2023	-	-	-	-	-	2,252	2,252	73.4%

Reforestation	90% Confidence Interval (in ha)							
	0	1	2	3	4	5	Total (ha)	90 CI %
2016	-	-	-	-	-	-	-	-
2017	-	-	-	4,760	-	-	4,760	164.5%
2018	-	-	-	-	3,379	-	3,379	164.5%
2019	-	-	8,780	-	-	1,009	8,837	108.2%
2020	-	-	6,211	-	3,379	-	7,070	121.3%
2021	-	-	-	-	3,379	1,009	3,526	132.2%
2022	-	-	6,211	-	-	-	6,211	164.5%
2023	-	-	-	-	3,379	-	3,379	164.5%

2016	90% Confidence Interval (in ha)							
	0	1	2	3	4	5	Total (ha)	90 CI %
Montane - Dense	-	71,177	40,459	25,815	17,350	5,874	87,778	8%
Montane - Moderate	-	16,075	19,567	17,093	8,258	3,477	31,839	26%
Montane - Open	-	13,939	16,391	15,734	8,258	2,845	28,050	29%
Western Rain - Dense	-	13,939	6,211	-	-	3,477	15,651	49%
Western Rain - Moderate	-	-	-	-	-	1,009	1,009	165%
Western Rain - Open	-	-	6,211	-	-	1,426	6,372	127%
Coastal - Dense	-	42,889	31,923	21,665	13,424	5,362	59,472	14%
Coastal - Moderate	-	5,708	8,780	8,239	4,776	3,331	14,542	48%
Coastal - Open	-	5,708	13,864	12,569	9,527	2,845	21,946	34%
Mangrove - Dense	-	8,068	8,780	12,569	3,379	1,009	17,680	47%

Annex 1b: Statistics of accuracy for images developed by the AIM4Forests mapping program

2016	90% Confidence Interval (in ha)							
	0	1	2	3	4	5	Total (ha)	90 CI %
Mangrove - Moderate	-	5,708	6,211	4,760	-	-	9,686	96%
Mangrove - Open	32,051	5,708	-	4,760	-	-	32,902	127%
Dryland – Dense	-	33,937	40,014	30,063	14,981	5,362	62,528	13%
Dryland – Moderate	45,317	13,939	23,914	23,137	12,117	3,331	59,271	27%
Dryland – Open	-	15,046	13,864	17,093	9,527	2,662	28,437	28%
Natural forest	55,490	80,293	73,803	58,689	33,234	11,956	140,231	5%
Private plantations	45,317	17,950	22,282	22,658	14,225	7,538	60,373	23%
Public plantations	-	24,602	15,181	14,242	9,527	9,073	34,809	19%
Planted forest	45,317	30,201	26,870	26,643	17,034	11,369	69,404	16%
Annual cropland	578,506	45,960	83,529	58,392	31,949	9,348	590,149	6%
Agroforestry	177,281	30,201	50,461	41,902	34,183	7,657	194,602	13%
Tea	32,051	17,950	23,914	23,137	14,608	3,016	51,761	23%
Coffee	55,490	5,708	12,406	11,640	5,847	1,009	58,620	58%
Sugarcane	45,317	-	15,181	10,630	13,831	2,662	50,946	44%
Other perennial	106,069	5,708	22,282	15,734	11,156	2,662	110,267	34%
Perennial Cropland	219,768	35,631	61,628	51,479	39,953	8,930	240,190	11%
Wooded grassland	761,602	75,414	108,197	89,657	55,150	16,507	780,246	2%
Open grassland	600,807	30,697	46,922	38,617	18,844	7,036	604,987	7%
Grassland	663,849	77,526	107,640	87,551	54,408	16,492	684,974	2%
Vegetated wetland	45,317	5,708	10,748	12,569	8,258	2,845	49,356	54%
Open water	185,538	5,708	8,780	4,760	5,847	-	185,986	27%
Wetlands	190,832	8,068	13,864	13,432	10,100	2,845	192,262	25%
Treed settlement	55,490	12,732	17,516	14,242	8,916	1,746	61,914	42%
Infrastructure	78,423	15,046	19,567	9,511	3,379	1,009	82,839	43%
Settlements	95,985	19,638	26,164	17,093	9,527	2,015	103,298	30%
Other land	281,689	24,602	20,513	8,239	4,776	1,009	283,667	17%

Source: AIM4forest



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