REPUBLIC OF KENYA

MINISTRY OF AGRICULTURE AND LIVESTOCK DEVELOPMENT

Agricultural Soil Management Policy 2023

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FOREWORD

The Agriculture sector is the mainstay of the Kenyan economy contributing about 27.3 per cent of the GDP directly and another 25 percent indirectly through linkages with other sectors. The sector contributes 75 per cent of industrial raw materials, accounts for 65 per cent of Kenya's total exports and 60 per cent of export earnings. The sector provides 18 per cent of the formal and 60 per cent of the total employment. To transform agriculture into a modern, innovative and commercially oriented sector as envisioned in Kenya Vision 2030, it is imperative that land productivity is improved and sustained through proper management of agricultural soils.

Kenya's agricultural soils perform a large number of economic and environmental functions. Many industries, including farming and food production, forestry and tourism, depend on the sustainable use of soils. Research shows our soils are generally in poor state. Therefore, there is no room for complacency, and pressures on soils need to be taken seriously in order to check on the current state of soil degradation. The most significant of those pressures are climate change, soil erosion and loss of soil fertility. Whilst there are uncertainties as to how exactly the future climate will impact on Kenya's soils, there is a risk that other threats like erosion, compaction, loss of biodiversity and nutrient leaching could be exacerbated. We need to prepare for these future challenges and enhance the soil's capacity to adapt to pressures under a changing climate. The Agricultural Soil Management Policy (ASMP) was developed with key stakeholders from the 47 counties, with the aim of raising the awareness about the services that our soils provide to society and the pressures they face. The aim of the Policy is to instigate a process by which key stakeholders will work together to achieve better soil protection. The multi-functionality of soil requires partnership and coordination with key delivery partners.

It is against this background, that this Agricultural Soil Management Policy has been developed. The policy highlights the various challenges facing our soils and

proposes various policy measures to address them. It proposes a wide range of measures and actions responding to key agricultural soil issues and challenges. It provides a framework for an integrated approach to sustainable management of agricultural soils in the country. It also recommends strong institutional and governance measures to support the achievement of the desired objectives.

HON. MITHIKA LINTURI
CABINET SECRETARY
MINISTRY OF AGRICULTURE AND LIVESTOCK DEVELOPMENT

PREFACE

Agriculture is one of the key drivers of Kenya's economy as envisaged in Vision 2030. However, growth in the sector is constrained by low productivity due to declining soil fertility and deteriorating soil health, among other factors. Various policies, strategies, legislations and guidelines have scattered provisions for soil management but the country lacks a comprehensive policy on sustainable soil management to address the challenges.

The need to put in place a policy framework to manage the country's soil resources has long been recognized and several initiatives and programmes have been implemented in the past with little success. In 2001, the Soil Fertility Initiative (SFI) task force was formed with technical and financial assistance from the Regional Land Management Unit (RELMA/Sida). The major outcome of the initiative was the National Soil Fertility Draft Policy Paper, 2006.

In 2015, an inter-ministerial Taskforce was formed to formulate the Agricultural Soil Management Policy (ASMP) with assistance from the German Technical Cooperation (GiZ). The ASMP has taken into consideration new developments arising from the devolved system of governance as provided for in the Constitution of Kenya, 2010. The policy is informed by the fact that some of the critical agricultural and environmental functions affecting soil health and management have been devolved and there is need therefore to provide an overarching agricultural soil management policy to provide the counties with the necessary conservation and utilization guidelines.

This policy document is the product of a long development process with the concerted efforts of stakeholders in the agricultural sector, particularly, institutions directly dealing with natural resource management. A wide range of individuals and institutions in the private sector, academia, civil society and government agencies and institutions participated in the process. I appreciate and recognize their contributions and efforts.

The document has eight chapters. Chapter One underscores the importance and contribution of agriculture to food security and Kenya's national economy. It highlights several challenges such as increasing soil erosion and land degradation; lack of a comprehensive policy and legislation that focus on restoration and maintenance of agricultural soils and the reasons that have necessitated the formulation of this Policy. Chapter Two reviews the status of sustainable agricultural soil management

in Kenya and highlights the key soil management issues and challenges. The policy addresses the issues of governance through the current status of existing policies, legislations and strategies related to the management of agricultural soils. Chapter Three identifies the effects of agricultural soil management on the environment and in particular on the emerging issues of climate change. Chapter Four deals with the role of research in technology development, dissemination and utilization in agriculture soil management. Chapter Five deals with the status and challenges in fertilizer development and investments in Kenya and Chapter Six is on Cross – cutting issues; Chapter Seven outlines the Implementation Plan for the Policy, with designated roles and responsibilities of all parties. Lastly, Chapter Eight provides a framework for coordination, monitoring and evaluation of the policy implementation.

This policy provides a framework for planning and implementation of agricultural soil management programmes. I therefore call on all stakeholders to embrace the recommendations that are contained in this policy towards ensuring effective soil quality management for improved agricultural productivity.

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KELLO HARSAMA
PRINCIPAL SECRETARY
STATE DEPARTMENT FOR CROP DEVELOPMENT

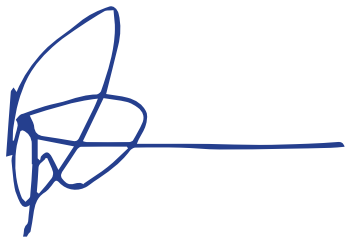
ACKNOWLEDGMENT

The successful development of the Agricultural Soil Management Policy is the culmination of a long and painstaking process which involved wide consultations and inputs of various institutions and individuals without whose commitment the process output would have been impossible to achieve. The State Department for Crop Development is particularly grateful to the Cabinet Secretary, Ministry of Agriculture and Livestock Development Hon. Mithika Linturi, for exemplary leadership and providing the right working environment to facilitate development of the policy. The leadership of the Principal Secretary Prof Hamadi Boga PhD, CBS was critical to the completion of the process and his contribution is therefore highly appreciated. The support and contribution of the Chairman, Council of Governors H.E Hon. Martin Nyaga Wambora, EGH and the Chairman of the Council of Governors' committee for Agriculture and Cooperatives H.E Dr. James Nyoro Karanja who made valuable and facilitated successful county stakeholder consultations are highly appreciated.

The contributions and support from the County Governments through their County Executive Committee Members responsible for agriculture, the intergovernmental thematic working group on policy, legislation and standards, members of staff from the Ministry of Agriculture and Livestock Development, technical directorates, National Environmental Management Authority, Kenya Agriculture and Livestock Research Organization, Universities, private sectors and farmer organizations were found very valuable and are highly appreciated.

Finally and of utmost importance, I acknowledge and appreciate the tireless efforts and commitments demonstrated by the Inter-ministerial Technical Taskforce under the leadership of Eng. Laban Kiplagat as the Coordinator and Mary Kithinji as Chair, with the support of Lucy Njenga, Peter Owoko, Joseph Komu, Janet Oyuke, all of State Department for Crop Development, Dr. Diana Mabogi (NEMA), Dr. Patrick Gicheru (KALRO), Timothy Mwangi (Ministry of Lands), Dan Kithinji (Ministry of Environment and Forestry), Samuel Gutto and Phanuel Webi (Ministry of Water,

Sanitation and Irrigation). Special thanks also go to the staff of the sector ministries who provided information in one way or another, without forgetting the contribution of the GIZ team comprising Dr. Andrea Bahm, Dr. Gerrit Gerdes, David Kersting, Dr. Paul-Mathias Braun, Tom Apina and Shadrack Mutavi and the team of consultants namely Professor Charles Gachene, Dr. Patrick Gicheru and Dr. George Ayaga. The GIZ is also appreciated for their financial support to develop this policy.



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ENG. RICHARD M. KANUI
ENGINEERING SECRETARY (AGRICULTURE)

EXECUTIVE SUMMARY

Agriculture is important in Kenya's national economy as it contributes 27.3% of the Gross Domestic Product and the survival of the Kenyan population is thus directly dependent almost entirely on soils to derive goods and services (KENBS-ESR, 2019). Despite this critical role, the sector has been experiencing several challenges, among them, increasing soil erosion and land degradation; inefficient use of fertilizers; inadequate and inappropriate soil and water conservation measures; high cost of inputs and productive resources such as fertilizer; inadequate knowledge and skills in agricultural soil management; and equally important lack of a comprehensive policy and legislation that focuses on restoration and maintenance of agricultural soils. The importance of soil's ecosystems to sustain human well-being was globally demonstrated during the 68th UN General Assembly when the United Nations declared 2015 as the International Year of Soils.

In the Constitution of Kenya, 2010, Article 71 requires legislation on agreements relating to exploitation of natural resources. Under article 260, natural resources mean the physical non- human factors and components whether renewable or non-renewable including soil among others. There are many sectors with mandate on natural resource management, soil being one of such a resource. Subsequently several policies, legislations and strategies related to soil management exist. These sub-sector policies and strategies that have been developed have failed to directly address soil as an important resource for sustained agricultural production.

Soil constitutes the foundation of agricultural development and ecological sustainability and the basis for agricultural production. Further, soil is the largest store of terrestrial carbon and its preservation may contribute to climate change adaptation and mitigation. Kenya must therefore strive to bring the issue of sustainable soil management to the forefront of public attention in order for the population to recognize and appreciate the important connection that soil has with food, water, climate, biodiversity and life.

Comprehensive sector-wide approach that is multi-sectoral and multi-stakeholder soil management practices for increased land productivity are the prime focus of the Agricultural Soil Management policy. For effective soil management, the policy identified key areas namely Sustainable agricultural soil management; Soil management and environment; Technology development, dissemination and utilization; Fertilizer development and investments; Policy, Legal and Institutional framework and Monitoring and Evaluation of the policy implementation.

Key challenges have been identified and corresponding interventions enumerated. The policy has also identified the need to create an institutional framework for effective management and enforcement of all issues pertaining to soil and water management.

During the implementation stage, this Policy will be complemented by institutional and legal frameworks, sectoral strategies and county development strategies to provide an orderly and rapid development of the agricultural soil management mechanisms and to create an enabling environment for effective stakeholder participation. The policy will further seeks to stimulate and guide the agricultural sector development through targeted technical support, intensified investment in the sector, improved research and technology, extension services and capacity building for both staff and farmer organizations to ensure development and sustainability of agricultural soils.

To address the causes of declining soil productivity, it is therefore prudent that this policy, legal and institutional frameworks on national agricultural soil management (ASMP) be consistent with the prevailing biophysical, socio-economic and technological conditions in the agricultural sector. Therefore, legal and institutional framework are key to ensure regulated and coordinated investment in agricultural soil management. The suggested strategic interventions, legal safeguards provide an enabling environment to support and fast track implementation of this policy for the growth and sustainability of agricultural sector in Kenya.

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ACRONYMS AND ABBREVIATIONS

ASAL	Arid and Semi-Arid Lands
ASDS	Agriculture Sector Development Strategy
ASM	Agricultural Soil Management
ASMP	Agricultural Soil Management Policy
ASTGS	Agricultural Sector Transformation and Growth Strategy
AU	Africa Union
CIAT	International Centre for Tropical Agriculture
COMESA	Common Market for Eastern and Southern Africa
EAC	East Africa Community
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
KALRO	Kenya Agricultural and Livestock Research Organization
KEBS	Kenya Bureau of Standards
KEPHIS	Kenya Plant Health Inspectorate Services
KSTCIE	Kenya Standing Technical Committee on Imports and Exports
NALEP	National Agricultural and Livestock Extension Programme
NASEP	National Agricultural Sector Extension Policy
NCPB	National Cereal and Produce Board
NEMA	National Environmental Management Organization
NIP	National Irrigation Policy
NSWCP	National Soil and Water Conservation Programme
SDG	National Soil and Water Conservation Programme
SIDA	Swedish International Development Agency
SRA	Strategy for Revitalizing Agriculture
UNGC	United Nations Governing Council

DEFINITIONS AND TERMINOLOGIES

Adaptation: Adjustments in ecological, social or economic systems in response to actual or expected climatic stimuli and their effects or impacts.

Agro-forestry: Deliberate inclusion of trees and shrubs into the farming systems.

Bio fertilizer: Substances which contain living organisms which colonize the interior of the plant and promote the growth by increasing the supply or availability of primary nutrients

Carbon sink: A reservoir such as soils and forests that can absorb carbon dioxide from the atmosphere.

Coping: Short term responses that are utilized to face a sudden, unanticipated climatic risk.

Ecosystem: A dynamic complex of macro and microorganism communities interacting with their physical environment as a functional unit.

Ecosystem service: The benefits human populations derive, directly or indirectly, from ecosystem functions

Fertilizer: Any substance or material or mixture of substances added into the soil for the purpose of adding plant nutrients necessary for enhancing plant growth and development.

Greenhouse gases: Gases of the atmosphere, both natural and manmade, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere and clouds.

Inorganic fertilizer: A synthesized substance or material added into the soil for the purpose of adding plant nutrients necessary for enhancing plant growth and development.

Integrated Nutrient Management (INM): Combined use of inorganic and organic fertilizers

Integrated soil fertility management (ISFM): A set of soil fertility management practices that necessarily include the use of fertilizer, organic inputs, and improved germplasm combined with the knowledge on how to adapt these practices to local conditions.

Mitigation: An intervention to reduce the sources or enhance the sinks of greenhouse gases.

Organic Agriculture: A holistic production management system which promotes and enhances agro eco system, health, including bio diversity, biological cycles and soil biological activity.

Organic fertilizer: is any substance or material of plant or animal origin that is added to the soil-plant system in its original form or naturally decomposed form to supply plant nutrients.

Plant nutrients: Essential life-giving plant elements.

Soil: The unconsolidated cover of the earth, made up of solid particles, water and air and capable of supporting plant growth.

Soil conditioners: Any substances or material added to the soil for the purpose of improving the medium for plant growth.

Soil fertility: The capacity of the soil to supply plants with nutrients, water and air.

Soil health: Capacity of a soil to meet performance standards relating to nutrient, air and water storage and supply.

Soil quality indicators: Measurable soil attributes that influence the inherent capacity of the soil to perform its production and environmental related functions.

Soil restoration: Returning degraded soils back to their original productivity.

Soil rehabilitation: Process of returning degraded soil to a functional state

CHAPTER 1 INTRODUCTION

1.1 Background

Agriculture plays a critical role in the four dimensions that embody food security, namely food availability, food accessibility, food utilization and food system stability. Besides food security, agriculture is important in Kenya's national economy as it contributes 27.3% annually of Gross Domestic Product, 65% of total export earnings, employs over 80% of the country's rural work force, provides 70% of raw materials for industry, and provides more than 18% of formal employment (Kenya National Bureau of Statistics, 2015). Despite this critical role, the sector has been experiencing several challenges such as increasing soil erosion and land degradation; subdivision of land into small unsustainable units; inefficient use of fertilizers; inadequate and inappropriate soil and water conservation measures; variations in climatic conditions; inadequate legislation and poor enforcement of the sector's existing laws and regulations; high cost of inputs and productive resources such as fertilizer and irrigation infrastructure; inadequate knowledge and skills in soil management; and equally important lack of a comprehensive policy and legislation that focuses on restoration and maintenance of agricultural soils.

To transform the agricultural sector and build resilience to climate change risks, Kenya needs to focus on increasing productivity and commercialization. To achieve this the country also needs to address the main constraints to increasing agricultural production, productivity and value addition, which are: (a) low use of agricultural inputs; (b) frequent droughts and climate variability; (c) natural resources degradation (particularly soil and water), as a result of nutrients mining and soil erosion; (d) low levels of private investment in the primary production (subsistence commercial-oriented agriculture) and in value addition; and (e) poor rural infrastructure, such as small scale irrigation, roads, marketing and storage.

According to the Agricultural Policy 2021, an unfavorable policy and legal environment in the area of soil fertility management, under which farmers and other stakeholders operate, has exacerbated the problem of declining land productivity. The Agricultural Policy further states that there are hardly any formal institutional arrangements between players in the sub-sector, leading to lack of co-ordination in problem identification for investment programmes and delivery of services.

Soil is the most important resource in agricultural production. It constitutes the foundation of agricultural development and ecological sustainability and the basis for food production. Further, soil is the largest store of terrestrial carbon and its preservation may contribute to climate change adaptation and mitigation. Kenya must therefore strive to bring the issue of sustainable soil management to the forefront of public attention in order for the population to recognize and appreciate the important connection that soil has with food, water, climate, biodiversity and life. Proper soil management practices for increased land productivity are the prime focus of the ASM policy.

1.1.1 History of soil and water conservation measures in Kenya

Soil and water conservation (SWC) in Kenya was introduced in 1930s. Due to serious erosion problems in both the settlers and the African farms, SWC was made compulsory by the African Land Development Board (ALDEV) and the Swynerton Plan (1953-1957). This section contains a summary of soil conservation approaches in Kenya.

Colonial Era (1930 – 1962): Colonial authorities addressed the problem of soil erosion by implementing district level by-laws specific to the *'African held land'* which focused on coffee and cotton. Local administration and Agricultural Technicians rigorously enforced these stipulations and stiff penalties were imposed on farmers who failed to comply. SWC measures that were enforced included contour farming, tree planting, terrace strip cropping and de-stocking.

The lost Decade "No Approach" (1963-1972): Period of laxity by the people towards coerced soil conservation. This was because soil conservation had become both politically and socially untenable. During this period, more terraces disappeared through destruction and neglect than were being constructed coupled with few initiatives towards soil conservation

Revival of Soil Conservation (1972 – 1988): Land degradation was considered to be a serious problem in Kenya during the United Nation Conference on Human Environment in Stockholm in 1972. National Soil and Water Conservation Program (NSWCP) was launched in 1974 with support from SIDA. This programme aimed at increasing and sustaining agricultural production through simple, cheap and effective soil conservation measures. This was individual farm based with a package of tools given out to farmers. Lessons learnt in this phase led to a change in approach to a community based approach, namely the catchment approach.

Catchment Approach (1988 – 1998): This strategy addressed all conservation measures in clearly delineated catchments. The benefit was viewed in terms of high visibility of conservation efforts, continuous treatment of farms, safe conveyance of excess runoff in the high rainfall areas, water harvesting in the arid and semi-arid lands and development of a cadre of highly specialized staff

Focal Area Extension Approach (2000 – 2010): In 2000 the National Agriculture and Livestock Extension Programme (NALEP) was launched. NALEP had the basic elements of Catchment Approach. The approach was more demand driven and holistic in all technical areas. It took over from the catchment approach. However the focal area approach concentrated on all aspects of farm management but was not focused entirely on soil management. After the closure of NALEP a gap has existed in the area of coordination of soil and water conservation in the country.

1.1.2 Policy and legal framework

The primary objective of the SRA, 2004-2014 strategy was to provide a policy and institutional environment that is conducive to increasing agricultural productivity, promoting investment and encouraging private sector involvement in agricultural enterprises and agribusiness. The SRA identified "low and declining soil fertility of land" as one of the factors that continues to constrain the growth of agriculture in Kenya. In particular, SRA 2004-2014 linked well with several position papers, among them Sessional Paper No. 2 of 1994 on National Food policy, the Poverty Reduction Strategy Paper (PRSP), Kenya Rural Development Strategy (KRDS) 2002-2017; Economic Recovery Strategy for Wealth and Employment Creation (ERSWEC) 2003-2007, the Agricultural Sector Development Strategy for 2010-2020 and Kenya Vision 2030. These policy papers also identify soil fertility and institutional related issues as major constraints to land productivity.

There are many sectors with mandate on natural resource management, soil being one of such a resource. The following is a review of existing policies, legislations and strategies related to soil management. It should however be noted that none of these addresses agricultural soil management adequately.

1.1.2.1 Policies and strategies

The Constitution of Kenya, 2010

The Constitution of Kenya (CoK) 2010 is the overarching law that governs natural resources in Kenya. Chapter 5 of the constitution deals with land use and land

tenure and in it are various articles that are relevant to soil fertility. Article 60 requires that all land (Private, Public and Community) be held, used and managed in a manner that is equitable, efficient, productive and sustainable, and in accordance with a set of principles including security of land rights; sustainable and productive management of land resources; sound conservation and protection of ecologically sensitive areas; and the elimination of gender discrimination in law, customs and practices related to land and property in land.

CoK 2010 provides for working to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya; encouraging public participation in the management, protection and conservation of the environment; protecting genetic resources and biological diversity; establishing systems of environmental impact assessment, environmental audit and monitoring of the environment; elimination of processes and activities that are likely to endanger the environment; and utilizing the environment and natural resources for the benefit of the people of Kenya.

Public land is defined to include all minerals and mineral oils as defined by law. Article 69 (1) (a) of the Constitution bestows on the State the responsibility to ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits. The State is required to utilize the environment and natural resources for the benefit of the people of Kenya.

The Constitution of Kenya establishes Community Land to provide a mechanism for direct involvement of people in managing their resources. The conflicts that hamper soil management include the recognition of customary law as one of the sources of law in Kenya (section 3 of the judicature Act, cap 8) while its application has been secondary to statutory law. This has sometimes created conflicts in application of law regarding customary land tenure.

Kenya Vision 2030

Kenya's long-term development strategy is articulated in Vision 2030. The document emphasizes sustainable agricultural growth as a critical element in poverty reduction and addressing inequalities. It recognizes the importance of soil fertility in enhancing agricultural productivity for driving economic growth.

Sessional Paper 1 of 2017 on National Land Use Policy

The National Land Use Policy (NLUP) aims to guide Kenya towards a sustainable and equitable use of land. The policy calls for immediate actions to addressing

environmental problems that affect land such as degradation, soil erosion and pollution. The policy stipulates the principle of conservation and management of land based natural resources, the principle of protection and management of fragile and critical ecosystems including wetlands and arid lands. The policy does not address itself to many thematic areas of agricultural soil management such soil fertility, biodiversity, salinization and agroforestry.

Agricultural Policy 2021

The Agricultural Policy 2020 provides a framework for sustainable development of the agricultural sector based on the requirements of the Constitution, the Kenya Vision 2030, UN Sustainable Development Goals and other national, regional and international development goals in agriculture. Some of the proposed policy statements in the NAP have a direct bearing on soil management. For instance, the policy proposes the promotion of organic farming for sustainable crops production and promote research in utilization of land resources for crops, livestock and fisheries production. However, since it is an overarching policy in the agriculture sector, it does not exhaustively address soil management matters in sufficient depth.

The National Irrigation Policy 2017

One of the strategies of the NIP is to ensure irrigation contributes to the attainment of national targets from the current irrigated area of 161,840 ha to 1,341,900 ha by 2030. The irrigation sub-sector is currently facing many challenges. In particular, the use of poor-quality waters and inappropriate application of farm inputs leading to accumulation of salts in soils with negative effects on land productivity and loss of soils for irrigation farming. The NIP recognizes that soil resources can be a major limitation to the expansion of irrigated agriculture in Kenya. Previous irrigation schemes in the country have been abandoned due to build up in soil salinity and sodicity. Thus soil conditions must first be assessed for irrigation suitability before any irrigation project is undertaken. However, the policy does recommend incorporating holistic agricultural water management (AWM), which includes, among others, soil fertility management and appropriate agronomic practices.

Livestock Policy 2020

Objectives in the policy includes to increase production and productivity in the livestock sector and to promote environmental resilience. One of the main challenges in provision of adequate forage resources is the narrow range of exploited plant materials, productivity and production. The range resources support up to 70%

of the livestock population yet the range environment is extremely fragile. Land degradation and encroachment by other enterprises has led to reduced capacity of the land to support livestock and increased loss of biodiversity. Further, the frequency of droughts has increased due to climate change leading to loss of livelihood resilience of pastoral communities. There is need to minimize animal losses during drought and facilitate faster socio-economic recovery of their owners.

National Environmental Policy 2013

The National Environmental Policy sets out important provisions relating to the management of ecosystems, ecosystem services and sustainable use of natural resources. The National Environmental Policy 2013 advocates for the following on soils: development and implementation of a National Soil Conservation Policy, promotion and support of eco and organic farming so as to maintain soil fertility, promotion of good soil management practices and empowering of the communities in soil conservation.

The key policy statements emanating from the National Environmental Policy and those that have a direct bearing on sustainable soil management, include the Government of Kenya's pledge to: a) formulate an innovative strategy to increase forest and tree cover from the current 7.14% to at least 10% as required under the Constitution; b) develop and implement a National Strategy for Rehabilitation and Restoration of degraded forest ecosystems; c) protect and conserve forests located in key water catchment areas; and d) principles and criteria of sustainable forest management. Community participation and local management and benefit sharing are espoused in all the sectors discussed in the policy. It is noted that this policy has strategies that have direct bearing on soil management, particularly soil's restoration and conservation.

Draft National Land Reclamation Policy 2016

The Policy focuses on protection, management and restoration of degraded lands and threats to land resources. It integrates reclamation, rehabilitation, restoration, and remedial practices. This is a very important policy with regard to agricultural soil management. It has not addressed issues of soil salinity, soil biodiversity and fertilizers.

National Food and Nutrition Security Policy 2011

The 2011 Food and Nutrition Security Policy (FNSP) provides an overarching framework covering the multiple dimensions of food security and nutrition

improvement. It has been purposefully developed to add value and create synergy to existing sectoral and other initiatives of government and partners. It recognizes the need for multi-public and private sector involvement, and that hunger eradication and nutrition improvement is a shared responsibility of all Kenyans.

In this document, the government policy objective is to increase the quantity and quality of food available and accessible in order to ensure that all Kenyans have an adequate, diverse and healthy diet. This will be achieved by working towards sustainable production increases for food that is diversified, affordable and helps meet basic nutrition requirements.

National Agricultural Sector Extension Policy (NASEP) 2012

The National Agricultural Sector Extension Policy (NASEP) sets policy for agricultural extension, and promotion and diffusion of technologies for land management. The NASEP together with its accompanying National Agricultural and Livestock Extension programme (NALEP) was the vehicle for research and dissemination of agricultural soil management information options outlined in the various policies.

Observed strengths of NASEP in promoting sustainable land management include: recognition that land is an important resource in agricultural development, thus soil and water conservation is given priority; support for environmental conservation in all agricultural projects and programmes; recognition of the need for strengthening research-extension linkages for technology adoption and diffusion; and recognizes the role of organized groups such as Cooperatives and farmer groups in the provision of extension services. These can be used in the promotion of sound land management practices. However, NASEP does not address the issue of research for technology development and other support services for agricultural soil management.

National Policy on Gender and Development 2008

The Policy provides a framework for mainstreaming gender issues in policy, legislation and programmes, coordinating, reviewing and implementation of gender based programmes and building capacity of women, men and youth according to their respective interests. The gender policy is particularly relevant to sustainable land management investment since women are the majority workers in agriculture related activities and yet women are also the most discriminated in terms of land tenure. Again the role of the youth in farming has been ignored in this policy.

Urban and Peri-Urban Agriculture and Livestock (UPAL) Policy, 2010

Relevance to SSM is promotion of conservation of the environment by management of waste and other pollutants from the UPAL sub-sector. The challenges that face the UPAL sub sector include; land use, crop and livestock production, technology development, safety of UPAL practices and products, environmental pollution and provision of support services. The major weakness of this policy is that the organic soil amendment products are not guided by any guidelines including soil contaminants.

Arid and Semi-Arid Land Development Policy 2014

Arid and Semi-Arid Lands (ASALs) comprise about 88% of Kenya's total land and the areas suffer from droughts and floods, high degradation rates. ASAL areas are also biodiversity hotspots and experience wildlife-human conflicts. The draft policy promotes integrated development to include increased area under small-scale irrigation, improved extension services and produce marketing to generate income and access to credit by farmer associations.

National Forest Management Policy, 2014

This National Forest Management Policy 2014 provides a framework for improved forest governance, resource allocation, partnerships and collaboration with the state and non-state actors to enable the sector contribute in meeting the country's growth and poverty alleviation goals within a sustainable environment. The contribution of the sector to soil and water conservation and in creating conducive conditions for soil fertility restoration has been recognized in the policy. Also recognized in the draft is the rehabilitation, restoration and protection of degraded forest ecosystems, water towers, catchment areas and other ecologically fragile areas.

National Agricultural Mechanization Policy 2017

The mechanized operations in soil and water conservation, land preparation and other farming activities are low due to inadequate technical skills, inaccessibility and high cost of agricultural mechanization. In addition, improper use of agricultural machinery has continued to exacerbate land degradation. Conservation agriculture machinery are inaccessible and of high cost. Few large-scale farmers have been able to use the technology while medium and small-scale farmers have limited access to the technology.

Integrated National Land Use Guidelines, 2011

The Integrated National Land Use Guidelines (INLUG) 2011 outlines land issues which should be taken into account throughout the country in all land use planning. These include requirements on the quality of the living environment, economical and ecological development of community structures, the preservation of natural values and the built heritage, utilization of natural resources and communication networks. The main challenge of these guidelines is that they are not enforceable.

National Climate Change Response Strategy (NCCRS), 2010

This Strategy draws perspective from the United Nations Forum for Combating Climate Change (UNFCCC) and strives to create a mechanism for combating climate change which is one of the significant drivers of land degradation in Kenya. It recognizes that carbon emissions from deforestation and forest degradation account for about 20% of global anthropogenic emissions. It observes that since the eleventh session of the Conference of Parties (COP-11) to the UNFCCC in December 2005, strategies and incentives for Reduced Emissions from Deforestation and Degradation (REDD) in developing countries have emerged as one of the most active areas discussed during climate change negotiations

Kenya Climate Smart Agriculture Strategy 2017 – 2026

The broad objective of the Kenya CSA Strategy is to adapt to climate change, build resilience of agricultural systems while minimizing emissions for enhanced food and nutritional security and improved livelihoods

Agricultural Sector Transformation and Growth Strategy (ASTGS) 2019 - 2029

To transform Kenya's agricultural sector and make it regional powerhouse, the Government has formulated the Agricultural Sector Transformation and Growth Strategy (ASTGS). The strategy is anchored in the belief that food security requires a vibrant, commercial, modern and equitable agricultural sector that sustainably supports economic development. Building on lessons learned from prior strategies, ASTGS takes an evidence based approach, and a sharp focus on implementation and delivery with the counties at the centre. This approach is the foundation for addressing the challenges that constrain agricultural output, productivity, natural resource management, and the effects of climate and environmental change. It identifies soil fertility improvement as an important factor in agricultural transformation. In line with this strategy, the Agricultural Soil Management Policy

(ASMP) will facilitate restoration and maintenance of agricultural soils in order to increase productivity, improve food security and contribute to poverty reduction while conserving the soil and water resources for future generation.

Kenya National Biodiversity Strategy and Action Plan (NBSAP, 2019-2030)

Links encroachment of agriculture and resulting loss of vegetation; links between soil erosion from hill slope and dry land cultivation and monoculture. Emphasis is on sustainable utilization of resources ecosystem for the benefit of present generations, while ensuring their potential to meet future demands.

1.1.1.1 Relevant Legislations on Soil Management

There are many institutions involved in soil and water management each with their specific Act that give them their mandates. Overlapping roles among various Acts leading to duplication and conflicts have been observed. Further, weak coordination, implementation and enforcement of existing environment and natural resources policies and legislation is evident. None of these acts addresses agricultural soil management adequately. Cap 345 in particular, has inadequacies revolving around quality standards, definition of fertilizers and environmental protection amongst other issues. There is need to develop a comprehensive legal and regulatory framework that addresses adequately all issues pertaining to agricultural soil management. This therefore leads to the need to create an institutional framework for effective management and enforcement of all issues pertaining to agricultural soil management. The following are some of the relevant legislations;

Environment Management and Coordination Act (EMCA), 1999 (amended 2015)

The Environmental Coordination and Management Act of 1999 (EMCA, 1999) is the overarching environmental law in Kenya. The most powerful institution established by this law is the National Environmental Management Authority (NEMA) whose mandate is to coordinate all environmental activities in Kenya. This law should be enforced since it is the overall law on environment

Climate Change Act, 2016

The Act provides for a regulatory framework for enhanced response to climate change; to provide for mechanism and measures to achieve low carbon climate development, and for connected purposes.

Forest Conservation and Management Act, 2016

The Act contextualizes establishment and development of sustainable management of forestry resources. The Act embraces participatory forest management approaches, been practiced officially in the country since 2005, forest concession allocations, easements and benefit sharing among the different forest stakeholders including the local communities. The Act provides for farm forestry which will take pressures off existing forests and act as income generation. This ensures that ecosystem services associated with forested ecosystems continue to be provided.

Land Act 2012

The Land Act provides guidelines for the management of public land, conservation of ecologically sensitive public land, and conservation of land based natural resources. It mandates the National Land Commission to recommend policies on land, acquire land for public purposes, monitor and exercise oversight on land use in the public interest and allocate land for investment including conservation of ecologically sensitive land. The key principles include sustainable and productive management of land resources; participation, accountability and democratic decision making within communities, the public and the Government; and democracy, inclusiveness and participation of the people.

Land Registration Act, No. 300 of 2012

The Land Registration Act, No.300 of 2012 is to revise, consolidate and rationalize the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes. Provides for the registration of public land under Article 62 of the Constitution and includes the coast foreshore, rivers, dam, lake reserves and other reserves which are some of the areas of interest to ASM program.

National Land Commission Act No. 5 of 2012

The Act provides for functions of the National Land Commission. Provides for linkage with the commission, county governments and other institutions dealing with land and land related resources, dispute resolution and research on land related matters.

The Agriculture Food and Authority (AFA) Act No. 13 of 2013

The Act establishes the Agriculture and Food Authority (AFA) whose mandate is to among others prescribe national guidelines for any or all of the following matters:

prohibiting, regulating or controlling the undertaking of any agricultural activity including the firing, clearing or destruction of vegetation when such prohibiting, regulating or controlling is deemed to be necessary for the protection of land against degradation, the protection of water catchment areas or otherwise, for the preservation of the soil and its fertility; requiring the uprooting or destruction, without payment of any compensation therefor, of any vegetation which has been planted in contravention of a land preservation order; requiring the supervision of unoccupied land and prohibiting, restricting or controlling the use of land for any agricultural purpose excluding livestock.

The Kenya Agricultural and Livestock Research (KALR) Act, 2013

Mandates the Kenya Agricultural and Livestock Research Organization (KALRO) to develop and promote SLM technologies and methodologies for the agricultural sector.

Crops Act, 2013

Crops Act has provisions for development of regulations on measures of maintaining soil fertility including soil testing and regulation of soil salinization, chemical degradation and toxic levels in plants and promotion of fertilizer cost-reduction investment projects through provision of incentives and facilities to relevant investors.

Fertilizers and Animal Foodstuffs (Amended Act 2015)

The Fertilizers and Animal Foodstuffs (Amendment) Act 2015 establishes the Fertilizer and Animal Foodstuffs Board of Kenya. With the inclusion of diverse stakeholders in the membership, which will streamline inclusiveness in decision making. The Amended Act provides for the Board to regulate fertilizer industry and develop standards, but it excludes regulation of organic fertilizers, bio-fertilizers and soil conditioners.

Environmental Management and Coordination (Wetlands, Riverbanks, Lakeshores, And Seashores Management Regulations 2009

Wetlands are areas permanently or seasonally flooded by water where plants and animals have become adapted and incorporates riparian and coastal zones. This regulation seeks to ensure wetland resources such as peat soils are utilized in a sustainable manner compatible with the continued presence of wetlands and their ecological goods and services. The sustainable use of wetlands should be

integrated into the national and local land use plans to ensure sustainable use and management of the resources. The main purpose is to provide for the conservation and sustainable use of wetlands and their resources in Kenya. Environmental Impact Assessment and Environmental Audit as required under the EMCA shall be mandatory for all activities likely to have adverse impact on the management of wetlands.

1.2 Importance of soils in the global arena

The Sustainable Development Goals (SDGs) debuted in 2015, the same year as the International Year of Soils. This gave soil scientists an extraordinary opportunity to raise awareness on the fundamental role of soils in achieving multiple SDGs and make valuable contributions to existing challenges. Agriculture, and consequently, soils are at the heart of the SDGs and are fundamental towards achieving them. SDG 2 *(Zero hunger)* is the most straightforward link that connects soils, food production, and healthy living. Nonetheless, soils fulfill a large number of functions and ecosystem services that explicitly bind them with other goals such as SDG 1 *(No poverty)*, SDG 3 *(Good health and well-being), SDG 6 (Clean water and sanitation), SDG 13 (Climate action)*, and SDG 15 *(Life on land)*. It has been agreed upon that cross-sector integrated work is imperative towards achieving the SDGs implying that soils also have an indirect presence in achieving the remaining goals. The 68th UN General Assembly had declared 2015 as the International Year of Soil (IYS 2015). The aim was to raise awareness on the importance of soils for food security and essential ecosystem functions. The Business Principles for Sustainable Soil Management ("Soil Principles") have been developed by the United Nations Governing Council (UNGC) Food and Agriculture Business Principles (FAB Principles) to create awareness of the need to protect the soils through enlightened programs and policy and to support and strengthen the existing policies and policy frameworks on soil conservation. These Soil Principles offer a reference point when considering measures to intensify agriculture or conserve ecosystems. One of the Principles is to encourage the active participation of government and policy makers in the management of soils. In addition, the Sustainable Developments Goals (SDGs) by the United Nations provides an opportunity to elaborate the Soil Principles and place them within the greater framework of a post-2015 SDGs agenda. Kenya therefore needs to take advantage of this global mobilization to advocate for the sustainable management of agricultural soils as part of the post – 2015 development agenda.

Demand for cereals was projected to reach 3 billion tonnes by 2015 (FAO, 2014). In order therefore to meet the related challenges of meeting this projected global demand for cereals and food security, proper soil management practices must undergo fundamental transformations noting that 33 percent of global soils are moderately to highly degraded due to erosion, nutrient depletion, acidification, salinization, compaction and chemical pollution. Sustainable management of the world's agricultural soils has therefore become imperative for reversing the trend of soil degradation and ensuring current and future global food security. This ASM policy is therefore aligned to the global soil management guidelines, goals and targets that recognize the importance of proper management of agricultural soils as a measure towards reduction of poverty and ensuring food security

1.3 The importance of soils in the regional arena

Modern or Green Revolution market-oriented agriculture, that relies on adequate use of external inputs such as chemical fertilizers and appropriate soil and water management practices (including irrigation) has resulted in dramatic agricultural yield increases in certain Third World countries, especially in Asia. But Sub Saharan Africa, Kenya included has been bypassed by these developments. In sub-Saharan Africa and Latin America, more than 70 percent suffers from soil and terrain constraints. More efficient use of soil water and improvements in soil health can lead to average crop yield increases of 79 percent in these regions.

Regional policies, protocols and treaties including the EAC, COMESA and AU affect performance of agriculture in the country. According to Abuja declaration, African countries were set to increase fertilizer use from 8 to 50 kg per ha by 2015. This is still far below the developed countries where, according to World Bank figures, Africa uses less than 14 kg of fertilizer per hectare compared with 150 and 200 kg per ha in East Asia and Europe respectively. The ASM policy provides for the restoration of soil fertility and efficient use and management of agricultural soils if Kenya is to be a key player in food production in the east and central African region.

1.4 The importance of and challenges facing agricultural soil management in Kenya

Research has shown that farmers in Kenya are getting barely 25% of the potential yields. The difference arises from among other factors, inadequate supply,

maintenance and management of plant nutrients, as well as poor tillage practices and soil moisture management.

Soils in Kenya are rapidly losing the ability to supply both the micro and macro nutrient elements in the amounts, forms and proportions required for optimum plant growth. This is attributed to very little use of organic and inorganic fertilizers (average basal fertilizer use in the country is less than 10 kg/ha compared to the recommended level of 75 kg/ha); poor conservation and management of rainwater; very little supplemental irrigation; excessive soil erosion by water and wind without carrying out adequate soil and water conservation measures; land fragmentation; land-tenure problems (land users may not be willing to invest in long-term land improvements such as terracing if they are not sure of reaping the benefits from such work) and inadequate extension services and infrastructure. In addition, tree growing is not focused on the improvement of soil fertility.

Kenya Vision 2030 economic pillar recognizes agriculture as a critical sector in contributing to attainment of the Vision goals that aim at achieving on average, GDP growth rate of 10 % per year up to the year 2030. In order to achieve this target, the agricultural sector is expected to continually grow at minimum of 7% annually. This growth will be achieved through implementation of the agricultural sector flagship projects (such as Consolidated Agricultural Reform Bill; fertilizer cost-reduction investment; Land use master plan and ASAL development projects) whose success is hinged on a sector-wide policy direction. Article 60 (1) (c) of the Constitution also emphasises sustainable and productive management of land resources. The ASMP is in compliance with the constitution, of Kenya, Vision 2030 and the Big Four Agenda.

The Agricultural Policy 2020 has some provisions for the efficient use and management of land. Soils are important component of land resource affecting agricultural productivity. Due to the importance of agriculture to economic development and realisation of the Constitutional requirements, it becomes necessary to have ASMP that will guide the development of the agricultural sector. The current rate of soil degradation in Kenya is not conducive for the projected 7% annual growth of the agricultural sector. Soil degradation in the country is caused by unsustainable land use and soil management practices, and climate extremes. The ASMP proposes interventions that must be put in place for the restoration, proper use and sustainable management of agricultural soils.

An unfavourable policy and legal environment in the area of soil management, under which farmers and other stakeholders operate, has exacerbated the problem of declining land productivity. There are hardly any formal institutional arrangements

between different institutions on matters relating to soil as a resource leading to lack of co-ordination in problem identification for investment programmes and delivery of services. The policy and legal provisions relating directly or indirectly to soil management are thus scattered in a number of policies and statutes. This is due to the fact that there are many players dealing with land resource issues. In particular, the main players in soil fertility management arena in the country include agricultural sector ministries, departments and agencies; as well as private sector, teaching institutions and farmer organizations.

1.5 The agricultural soil management under Devolution

In the advent of the Constitution of Kenya 2010, agricultural soil management issues relating to practices become largely County functions. Following repeal of Agricultural Act CAP 318, the only instrument that applied to agricultural soil management is the Crops Act of 2013. The Act provided for development for guidelines. Agricultural soil management in the devolved system is being handled through the agricultural extension system.

1.6 Scope of the Policy

This policy will guide the agricultural sector in achieving its objectives as envisaged in the Constitution, Vision 2030 and the ASTGS. In addressing the restoration, use and sustainable management of agricultural soils, the policy gives direction on how agricultural soils will be managed for increased crop productivity and production while at the same time conserving the environment. To address the causes of declining soil fertility, it is prudent that this policy, legal and institutional frameworks on agricultural soil management be consistent with the prevailing biophysical, socio-economic and technological conditions in the agricultural sector. The ASM policy thus encompasses sustainable agricultural soil and environmental management with regard to soil and water conservation, soil fertility management, agro-forestry, soil restoration and rehabilitation, technology development, dissemination and utilization of soil management technologies and investments. Legal and institutional frameworks are key in the policy to ensure regulated and coordinated investment in agricultural soil management improvement programmes. Legal, institutional and organisational reforms are envisaged to reflect the changes of mandate and functions owing to devolution of agricultural functions. The policy takes cognizance of various incentives such as subsidies necessary for the agriculture sector's development. The

Policy has been formulated in line with relevant provisions of the Constitution and it identifies current challenges in the management of agricultural soils and outlines guidelines to address them. It provides measures towards sustainable use of natural resources, particularly soils which are expected to boost agricultural production while at the same time conserving the environment. The Policy emphasizes the need for the National and County governments to develop appropriate strategies that will lead to sustainable use of agricultural soils at their respective levels. In this regard, the ASM Policy emphasizes the need for National and County governments to commit adequate resources to enable proper management, utilization, restoration and conservation of agricultural soils.

1.7 Rationale of the Policy

The current rate of soil fertility decline and soil degradation in Kenya is not conducive for the projected 7% annual growth of the agricultural sector. Despite this scenario there has never been a Policy to guide on proper use, management, restoration and conservation of agricultural soils. The various agricultural sub-sector strategies and policies that have been developed have failed to directly address soil as an important resource for sustained agricultural production. As such policy gaps in the management of agricultural soils have been identified in this policy that requires a comprehensive sector-wide approach that is multi-sectoral and multi-stakeholder.

This policy provides a framework for sustainable management of agricultural soils based on the requirements of the Constitution of Kenya, 2010 and the Kenya Vision 2030. It also provides for the domestication of regional and global policies, protocols and treaties including the EAC, COMESA, African Union, Sustainable Development Goals and UNCCD, to which Kenya is a signatory.

The ASMP outlines effective provisions for efficient use of soil as a resource for sustainable agricultural growth and provides for inter-linkages of agricultural support systems such as land use, irrigation, extension, infrastructure and research. The policy also addresses specific institutional and legal reforms essential for the integration of soils management in devolved system of governance.

1.8 Objectives

1.8.1 Broad Objective

The broad objective of this policy is "to contribute to economically and environmentally viable, and socially acceptable development opportunities for agricultural production in Kenya in order to reduce poverty and improve food security through improved soil management."

1.8.2 Specific Objectives

The Specific objectives are to:

1. Promote efficient and sustainable use of soil as a resource for increased agricultural productivity.
2. Provide the framework for developing and applying appropriate agricultural soil management technologies towards restoration and maintenance of soil fertility;
3. Mainstream agricultural soil management improvement in both National and County governments' planning agenda;
4. Provide a framework for research and dissemination and utilization of appropriate technologies on agricultural soil management;
5. Establish institutional and legal framework for reviewing and for proper coordination of agricultural soil management activities;
6. Create an enabling policy environment for public and private investments in agricultural soil management improvement programmes and projects.

CHAPTER 2 SUSTAINABLE AGRICULTURAL SOIL AND WATER MANAGEMENT

2.1. Soil and water conservation

Historical evidence shows that many parts of the country were experiencing high rates of erosion in the 1930's leading to a decline in agricultural productivity. This was attributed to intensive cultivation of steep slopes without effective soil conservation measures, deforestation, cultivation of river banks, improper farming practices, and to overgrazing. The problem is even much more aggravated currently in communally owned land where farmers are not keen to invest in soil conservation measures. The same applies where farmers do not have title deeds for their farms and thus reluctant to investment in long term soil conservation measures such as terracing. Consequences of soil erosion are many such as declining crop yields, reduction in livestock carrying capacity, depreciation in value of land, siltation of streams and dams leading to poor water quality and flooding of streams.

The existing statutes are not adequately enforced to address issues of soil conservation on cultivated slopes, along river banks, around water bodies (riparian areas) and catchment areas. With regard to the conservation of riparian and catchment areas, the ASDS 2010 – 2020 has recognized poor land use practices and river bank cultivation as some of the key factors that have resulted in increased runoff, soil erosion and siltation of dams and other water reservoirs. The Strategy has thus recommended for the protection and conservation of the environment as well as for the formulation and implementation of programmes and projects that promote protection and conservation of catchment areas and river banks.

Challenges

1. Large parcels of land that are owned communally where no individual user takes responsibility for soil and water conservation.
2. In areas where land users lack title deeds for the land they cultivate, they are not adequately motivated to invest heavily in soil and water conservation.
3. Under freehold ownership land there is over sub-division and over exploitation of land leading to soil degradation.

4. Inappropriate land tillage practices that has led to deterioration of soil physical properties and increased soil erosion.
5. Encroachment of the riparian land that results in increased erosion and pollution of rivers
6. Inadequate and inappropriate soil and water conservation measures.
7. Inadequate capacity development in soil and water conservation.
8. Limited dissemination and uptake of soil and water conservation technologies due to poor linkage between research and extension and lack of farm planning.
9. Inadequate coordination between various players disseminating soil and water conservation interventions.
10. High cost of labour for soil and water conservation
11. Lack of information on costs and benefits of soil conservation technologies

Policy statements

The National Government will:

1. Prioritize land adjudication in the communally owned land thus encourage individual land users to take responsibility for soil and water conservation.
2. Hasten the issuance of title deeds to privately owned land so that such land owners can feel motivated to invest heavily in soil and water conservation measures.
3. Provide for land use strategies to assist farming communities achieve optimum soil productivity and make land use planning an integral part of land adjudication processes.
4. Establish and support a National Agricultural Soil Management Coordination Unit that focuses on soil and water management activities in order to have effective coordination between various players disseminating soil and water conservation technologies.
5. Develop regulatory framework to protect areas prone to degradation.
6. Enhance partnership in the area of research, dissemination and utilization of appropriate soil and water conservation technologies.

The County Governments will:

1. Sensitize and capacity build the communities in the communally owned land on appropriate land use practices.
2. Develop guidelines for use of communally owned land.
3. Promote the establishment and maintenance of centres of excellence to demonstrate appropriate soil and water conservation technologies.
4. Promote soil and water conservation interventions including adoption of conservation agriculture principles to increase crop production.
5. Support community soil and water management associations for community owned land
6. Promote farm planning.
7. Implement regulations and guidelines to protect areas prone to degradation
8. Enforce appropriate land use regulations.
9. Establish incentives to facilitate access and affordability of appropriate technologies and equipment for soil and water conservation.
10. Prioritize and mainstream soil and water conservation agenda in programmes and projects.

2.2. Soil Health

2.2.1. Soil fertility decline

Agricultural productivity in Kenya is characterized by low crop yields due to increased soil degradation and declining soil fertility as a result of inefficient management of the natural resources (Agricultural Policy 2021) Continuous mono-cropping practices that characterize farming systems result in high negative nutrient balances, declining yields and increased poverty.

Increase in poverty and soil degradation has accentuated the demands on the fragile natural resource base such as the wetlands, steep slopes of the hills and the riparian areas for crop and livestock production, further increasing environmental

degradation. Reversing the soil fertility declining trend and improving the livelihoods, food security, and income of the farmers will require increased adoption of soil fertility enhancing strategies together with the introduction of viable incentives to encourage farmers to address the issue of soil fertility decline.

High fertilizer prices, high rates of rural poverty, underdeveloped farm input and commodity markets and an aging farming community continue to exacerbate the declining trends in soil fertility. According to results of a national soil fertility survey of 2014, over 50% of all sampled soils in the country had below optimum levels of soil pH, soil organic carbon, nitrogen, phosphorus, potassium, zinc and copper (MoALF, 2014). Thus the originally fertile lands that yielded 4 to 6 t per ha of maize have been degraded with cereal crop yields of less than 1 t per ha becoming common (MoALF, 2014). Soil management strategies that restore and increase the soil nutrient status, improve the physical, chemical and biological properties of the soil, are needed to reverse the disastrous trend and cushion the future viability of the Kenyan food systems.

2.2.2. Soil fertility replenishment

The current use of an average of 10 kg per ha of fertilizer by Kenyan farmers leads to high nutrient mining and hence the need for soil nutrient replenishment. This replenishment can be done through the addition of inorganic and organic fertilizer. However a more sustainable approach is through integrated soil fertility management (ISFM).

2.2.2.1. Inorganic fertilizers

Kenya Vision 2030 aims at transforming the agricultural sector to be an innovative, commercially oriented and modern sector by increasing productivity through provision of widely accessible inputs particularly fertilizer and certified seeds. The vision identifies the cost of fertilizer as one of the constraints of high crop production. This problem was also highlighted during the KeFERT Round Table Conference held at KICC in October 2018. Cumbersome acquisition processes, late delivery and adulteration were also mentioned as some of the other constraints facing fertilizer subsidy programme. Due to its cost, fertilizer use has remained low estimated at 31 kg per ha compared to the recommended 125 kg per ha. In addition to the cost, other factors contributing to low fertilizer usage include negative perceptions by farmers, low value-cost ratios (VCRs) of fertilizers, high poverty levels and inadequate knowledge. Due to the crucial role of fertilizers in enhancing land productivity, the government has addressed it in various documents. The Kenya

Vision 2030 proposes a three tier reduction strategy to be implemented through bulk procurement, local blending and manufacturing. The three tier cost reduction strategies is one of the flagship projects of the vision 2030.

Despite the beneficial effects of inorganic fertilizers, continued use of acidifying fertilizers such as Di-ammonium Phosphate (DAP) has led to increased soil acidity of most soils in Kenya especially in the maize growing areas. Yet this type of fertilizer is among the top 3 fertilizers imported in Kenya. (Fertilizer Statistics Overview KENYA 2012 -2015). To enhance efficient use of fertilizers by farmers, there is need for farmers to be trained on the right fertilizer types and application rates depending on the crop and the soil types. Emphasis should be laid on soil analysis to inform on the soil fertility status for corrective nutrient replenishment measures.

Challenges

1. Limited access to and availability of right type of fertilizers.
2. Adulteration of fertilizer.
3. Unfavorable terms of trade between fertilizers and outputs.
4. Inadequate knowledge by extension service providers and input suppliers on the importance of soil testing.
5. Inadequate/ unaffordable soil testing services leading to inappropriate use of fertilizers.
6. Inadequate awareness, knowledge and skills in fertilizer application
7. Weak enforcements of environmental regulations for sustainable soil management

Policy statements

The National Government will:

1. Implement the three-tier cost reduction programme.
2. Facilitate access to fertilizers through making it affordable and timely available
3. Support a sustainable national agricultural farm input credit scheme.
4. Implement programmes for capacity building targeting farmers and other fertilizer value chain players.

5. Support and build capacity on soil testing services, both human and infrastructure
6. Provide for mandatory analysis of fertilizer nutrient content to curb adulteration and ensure product labeling to indicate nutrient element content
7. Promote manufacturing of blended fertilizers

The County Government will:

1. Establish soils testing laboratories that will provide site specific information on fertilizer recommendations.
2. Facilitate establishment of private soils testing laboratories that will provide site specific information on fertilizer recommendations.
3. Promote supplier development programmes to improve market access for the right type of fertilizers.
4. Ensure compliance with product safety and quality standards.

2.2.2.2. Organic fertilizers

Most of the small-scale farmers use organic fertilizers such as farmyard manure and compost and recycle crop residues as a means of sustaining and improving the fertility level of soils. Organic fertilizers provide organic matter which not only provides nutrients to the soil but also improves the physical, chemical and biological status of the soil. However, the limited amounts of organic sources of plant residues and their very low nutrients content work against reliance on them as major sources of nutrient supply. Moreover, the beneficial policies and Acts that reinforce the efficient use of organic resources such as the prohibition of the burning of crop residues have been weakly implemented due to lack or weak institutional arrangements for reinforcement.

Challenges

1. Lack of appropriate packaging and labeling of organic fertilizers.
2. Lack of standards for organic fertilizers.
3. Danger of use of contaminated raw materials.
4. Inadequate material for composting.

5. Lack of a regulatory organization and / or legislation to deal with organic fertilizers.

6. Inadequate information on organic fertilizers.

Policy statement

The National Government will:

1. Develop a regulatory framework for organic fertilizers.

2. Ensure standardization of organic fertilizers.

3. Develop standards and guidelines for organic fertilizers.

The County Government will:

1. Sensitize farmers and service providers on organic fertilizers preparation and use.

2. Promote testing for quality of organic fertilizers

2.2.2.3 Bio – Fertilizers

There has been an increased trend in the use of inoculant fertilizers in the country. This is attributed to the existing public / private partnership in the commercialization of BIOFIX. BIOFIX is a cheap alternative to nitrogenous fertilizer. It has shown promising results when used as a source of nitrogen for a wide range of legumes. Some of the benefits of using inoculant fertilizers are: saving on the use of chemical nitrogenous fertilizers by enhancing N fixation, low cost (one packet of inoculant at Ksh 100.00, which is less than 1 USD, can be used to plant a debe or about 20 kg of bean seeds), easy to apply, gives increased yields of both grain and fodder legumes and does not pollute the environment. This technological option of substituting the biological fixation of atmospheric nitrogen for inorganic nitrogen fertilizer has great potential but is yet to reach most of the farmers in the country mainly because of its inaccessibility and inadequate awareness.

Whereas the country has legislation on inorganic fertilizers, bio-fertilizers are not mentioned. Bio fertilizers are also not mentioned in the current national fertilizer use recommendations. Only the Kenya National Environmental Action Plan (NEAP) does mention bio-fertilizers as an environmentally friendly alternative to chemical fertilizers. It, however, fails to recognize the policy gaps in Kenya's agricultural research and development planning. The use of bio-fertilizers has gained popularity

as shown by the import requests received by Kenya Plant Health Inspectorate Service (KEPHIS), working under the Kenya Standing Technical Committee on Imports and Exports (KSTCIE).

KEPHIS, as a secretariat to KSTCIE, facilitates the process of risk assessment before introduction of live organisms. These include live biological controls, bio- fertilizers, bio-stimulants, organic fertilizers, their products and other regulated articles. Once risk assessment is complete, products approved for introduction are referred to relevant research institutions for efficacy or registration.

KSTCIE constitutes public, private agencies of which the public agencies include; Pest Control Products Board, Kenya Agriculture and Livestock Research Organisation, Kenya Wildlife Service (KWS), National Environmental Management Authority (NEMA), National Museums of Kenya (NMK), Directorate of Veterinary Service, State Department of Crop Development, universities among others. This role is efficiently executed by KEPHIS mainly because of their mandate under the Plant Protection Act, CAP 324, but not without challenges.

In the Fertilizers and Animal Foodstuffs Act, CAP 345 the term "fertilizer" does not include manure, compost, wood ash, gypsum or refuse when sold in its original condition and under the same name, nor does it include organic fertilizers, other than lime. This law has had its deficiencies in ensuring effective regulation of the fertilizer claimed products including bio- fertilizers.

Challenges

1. Uncoordinated regulation of bio-fertilizers.
2. Limited awareness by extension staff and farmers on the existence and use of bio fertilizers
3. Inadequate capacity by KEPHIS for testing the products` identity, quality, safety and efficacy.
4. Lack of a legal framework to govern bio fertilizers
5. Inadequate culture preservation centres to serve as reference banks for the biological material both locally collected and imported.
6. Inadequate technical capacity to address farmers soil health issues

Policy Statements

The National Government will:

1. Develop regulatory legal framework for bio-fertilizers.
2. Support capacity building on use of bio-fertilizers in soil management.
3. Strengthen institutions like KEPHIS for testing the products` identity, quality, safety and efficacy
4. Strengthen relevant bodies to establish culture preservation centres to serve as reference banks for the biological material both locally collected and imported.
5. Build technical capacity to address soil health issues

The County Government will:

1. Implement regulatory requirements for bio-fertilizers.
2. Support capacity building on use of bio-fertilizers in soil management.

2.2.2.4 Organic Agriculture

People are increasingly becoming health conscious. In response to this, organic farming has gained currency globally. The issues around organic farming include research and development, standards and guidelines, commercialization, quality assurance (regulation and control).

Organic farmers aim to produce healthy food from a balanced, living soil. Organic agriculture is sustainable, keeping soils productive and alive, and helps to minimize contamination of the earth's water supplies. It excludes the use of chemical fertilizers and pesticides, plant growth regulators, and livestock feed additives. Genetically modified organisms (GMOs) are not allowed in organic farming. As far as possible, organic farmers depend on crop rotation, green manure, compost, mulching, biological pest control, and mechanical cultivation to maintain productive soil and control pests.

In Kenya, organic agriculture sub sector is relatively small but growing fast especially in fruit, vegetable and honey production. There are a few companies

listed as producing organic products for local and international markets. The main products for export markets consist of vegetables, salad pre-packs, herbs, spices, essential oils, nuts, coffee, tea and cold pressed oils. Organic agriculture remains largely underdeveloped and its contribution to the GDP is not documented, it has a potential to contribute to the growth of the agriculture sector through mitigating the effects of climate change.

Challenges

1. Inadequate technical knowledge on organic agriculture among farmers and extension service providers.
2. High labour requirements.
3. Inadequate research and training on organic agriculture.
4. Complicated and expensive process of certification.
5. Limited supply of high quality organic agriculture inputs that are accessible and affordable.
6. Unfavourable legal and regulatory framework for the growth and development of organic agriculture.

Policy Statements

The National Government will:

1. Promote making of organic farm inputs
2. Develop a legal and regulatory framework for the organic agriculture sub sector.
3. Develop standards and quality control procedures for organic agriculture.
4. Enhance research and technology development in organic agriculture.

The County Government will:

1. Strengthen research-extension-farmer linkage on organic agriculture.
2. Promote use of organic farm inputs
3. Build capacity of extension officers and farmers in organic agriculture

2.2.2.5 Soil Biodiversity

Soil biodiversity is an essential component of soil health, and constitutes a major fraction of terrestrial biodiversity, responsible for the key ecosystem functions of decomposition and nutrient cycling. The reduction of below-ground biodiversity (BGBD) decreases agricultural productivity and also decreases the resilience of agricultural ecosystems so that they are more vulnerable to erosion, pests, diseases, and the general degradation of the land.

Soil biodiversity tends to decrease with the increasing intensification of farming practices (e.g. use of pesticides, inorganic fertilizers, heavy machinery). While in general chemical treatments and tillage aim at improving soil fertility, trade off with soil carbon storage and decontamination services, mulching, composting and crop rotations all contribute to improve soil structure, water transfer and carbon storage.

Concerns about the loss of soil biodiversity related with land use change have been raised in the country. Even as agricultural activities intensify, this subject has received relatively little attention. There is a need to keep agricultural soil ecosystems as healthy and sustainable as possible so that the biodiversity loss, which is usually high in agricultural systems, is reduced through increased conservation and management of the soil and its associated biota.

Challenges

1. Inadequate inventory on soil biota.
2. Poor burning practices like burning of crop residues and weeds before cultivation thus destroying biodiversity especially macro and micro fauna
3. Inappropriate farming practices that have led to increased loss of soil biodiversity
4. Lack of awareness on the importance of soil biodiversity on ecosystem services

Policy Statement

The National Government will;

1. Develop and maintain a comprehensive inventory of soil biota in the country.
2. Promote and facilitate capacity building on soil biodiversity conservation

The County Government will;

1. Develop and maintain a comprehensive inventory of soil biota in the county.
2. Sensitize and capacity build the farming communities on appropriate land use practices
3. Promote and facilitate capacity building and training geared towards providing practical and relevant advice in the field of soil biodiversity conservation

2.3 Agroforestry

Several factors have contributed to a rising interest in agroforestry since 1970s, which among them includes: increased deforestation; soil degradation and scarcity of land because of population pressures and growing interest in farming systems, intercropping and the environment. Agroforestry systems also contribute to soil and water conservation and increasing soil fertility. The extent of this, however, depends on the initial soil condition, use and management.

The contribution of the Forestry sector to soil and water conservation has been highlighted in the National Forest Management Policy, NFMP (MoEW&NR, 2015) and the Agriculture (Farm Forest) Rules, 2009. The NFMP appreciates the benefits that farm forestry provides. Trees are an essential part of diversified farm production, providing both subsistence products and incomes while contributing to carbon sequestration, soil fertility improvement and soil and water conservation. According to the National Forest Management Policy 2015, the current forest cover of 6.99% of the land area of the country is still below the constitutional requirement of 10%. In particular the NFMP 2015 does mention the benefits that forests provide to soil and water conservation such as enhancing the soil's ability to sustain diverse ecosystems by conserving the productive capacity of the land through reduced soil and nutrient loss. Given the role of land degradation in exacerbating the impacts of climatic extremes such as drought, agroforestry technologies that improve soil conditions have the potential to help ease the stress caused by climate change in the future.

Challenges

1. Weak institutional support mechanisms.
2. Inadequate quality planting materials.
3. Inadequate tree tenure rights benefit sharing and conflict resolution mechanisms in agroforestry.
4. Inadequate Agro ecological zone (AEZ) specific research on agroforestry models.
5. Inadequate research, extension, research–linkages and ignorance of the advantages of agroforestry.
6. Delayed returns on investment and weak market access for agroforestry produce.
7. The environmental and economic value of agroforestry products and services is undervalued, and not given adequate attention.
8. Absence of an institutional mechanism for coordination and convergence of synergies among actors.

Policy statements

The National Government will:

1. Support agroforestry research,
2. Support capacity building in agroforestry
3. Encourage increased participation of the private sector in agroforestry.
4. Promote linkages between research and extension on matters of agroforestry.
5. Support agroforestry as a course curriculum in educational institutions and motivating youths to grow and conserve trees.

The County Government will:

1. Support agroforestry extension
2. Improve farmers' access to and promote the development of quality agroforestry planting materials.
3. Support private sector participation in agroforestry development.
4. Establish incentives to farmers for adopting agroforestry.
5. Support adaptive research on matters of agroforestry.

2.4 Land reclamation

Agricultural land degradation manifests itself in many ways, which include: unsustainable loss of soils through erosion; loss of vegetation; increasing scarcity of clean water sources and bare land surfaces; gullies due to soil erosion; landslides; desertification and invasion of intrusive species. These are largely attributed to inappropriate soil and crop management practices. Land reclamation is therefore required to put back degraded soil into productive status.

In Kenya, an estimated US $390 million dollars or 3% of the Gross Domestic Product (GDP) is lost annually due to land degradation (Land Reclamation Policy, LRP, 2013). Some of the other policies and strategies that have a direct bearing on land rehabilitation include; National Water Policy, Agriculture Policy, National Disaster Policy, National Climate Change Strategy, Wetlands Policy, policies covering Mining and Mineral Resources, Environmental and Wastes Management and, Irrigation Policy.

The NLR Policy 2013 provides for reclamation and conservation of lands hitherto subjected to natural and/or anthropogenic disturbances, and thereby preserving natural resources, to promote the protection of water resources and soil. In particular, the policy mentions decline in crop yields due to soil nutrient losses through erosion but does not explicitly state how soil fertility loss can be addressed.

Challenges

1. Increasing agricultural land and environmental degradation leading to decline in agricultural soil productivity.
2. Reduced soil bio-diversity and unsustainable agricultural production systems.

3. Inadequate investments by the National and County governments towards the development of sustainable agro-ecological zone- based land reclamation interventions for the agricultural sector.

4. Lack of coordination and integration of land reclamation initiatives for use in agriculture, forestry, recreational industry and wildlife habitats, among many others uses.

Policy statements

The National Government will:

1. Support land reclamation initiatives for use in agriculture, forestry and agro-recreational industry.

2. Develop appropriate agricultural soil reclamation guidelines and standards and provide mechanism for continuous monitoring, evaluation and reporting on implementation and compliance

3. Support identification and mapping all degraded soils and support their reclamation program.

4. Formulate development projects and programs to enhance resource mobilization for sustainable agricultural land use systems.

5. Coordinate linkage of watershed management to restoration of the health and fertility of the soils to respond to climate change and the effects of frequent sporadic floods and droughts.

The County Government will:

1. Identify and map all degraded soils and support their reclamation program.

2. Formulate development projects and programs to enhance resource mobilization for agricultural land reclamation.

3. Promote appropriate soil management technologies that will lead to enhanced land reclamation that will lead to agricultural productivity

4. Link watershed management to restoration of the health and fertility of the soils to respond to climate change and the effects of frequent sporadic floods and droughts.

5. Promote education and public awareness through participatory approaches to inculcate land rehabilitation initiatives and reduction of land degradation.

6. Implement programmes for reclamation and restoration of degraded soils for capacity building targeting farmers and other fertilizer value chain players

2.5 Soil restoration and rehabilitation

Severe soil degradation and habitat loss in Kenya have been reported in literature since the 1930s. As degradation continues, it becomes increasingly difficult and costly to rehabilitate and restore affected lands. Studies have shown that enclosures are effective in restoring the nutrient status and quality of degraded soils. Rehabilitation of degraded arid environments tackles the problems of land degradation, biodiversity loss, climate change and poverty simultaneously. Successful local actions can have a national impact and should therefore, be encouraged and supported. Combating land degradation is essential to ensure long term soil productivity, especially in semi-arid environments. Methods such as tilling, gully control, water harvesting, destocking, ripping and seeding are practiced to control land degradation but are not common because of their high capital requirements.

Current policies, regulations and strategies do not adequately address the restoration and rehabilitation of agricultural soils. Weak coordination, implementation and enforcement of existing environment and natural resources policies and legislation are thus evident.

Challenges

1. Low adoption of soil restoration best practices and innovations.
2. Inadequate credit lines for purchase of equipment and inputs that promotes soil restoration and productivity.
3. Inadequate incentives and benefit sharing mechanisms that promote the culture of soil restoration and rehabilitation e.g. Payment for Ecosystem Services (PES).
4. Inadequate support mechanisms for agricultural soil management for public and private service providers.
5. Inadequate adaptive research in soil restoration and rehabilitation that is agro-ecological zone specific.
6. Inefficient law enforcement mechanisms on land degradation.

Policy statements

The National and County Governments will:

1. Establish and maintain an inventory of degraded soils.
2. Promote and facilitate capacity building and training in the field of soil restoration and rehabilitation.
3. Strengthen and enforce laws governing the management of agricultural soils
4. Facilitate establishment of a multi-disciplinary service or agency to coordinate and regulate public and private service providers engaged in the restoration and rehabilitation of agricultural soils.
5. Establish landscape scale mechanisms that offer technical, incentives and other support needed for farmers/private land owners to soil resources.
6. Provide sustainable funding mechanism for adaptive research in soil restoration and rehabilitation that is agro-ecological zone specific.
7. Enhance long-term investment in land rehabilitation by integrating land rehabilitation into national programmes and projects.

2.6 Soil remediation

Environmental pollution is on the increase due to industrialization in the country. This has led to increased levels of contaminants such as heavy metals and pesticide residues in the agricultural soils. The effect is further reduction in production due to toxicity of such contaminants for plants and related human ailments. Soil pollution may also result from secondary contamination of water supplies.

Soil remediation aims at reducing contaminants to levels which are 'suitable for use in this context for agricultural productivity. A review of the Environmental Management and Co-ordination (Waste Management Regulations 2006) indicate that there are no soil quality standards to guide on the cleaning of contaminated soils in Kenya. Soil quality standards for soil contaminants in relation to agriculture are needed to set guidelines for remediation strategies. .

Challenges

1. Weak implementation / enforcement of existing policies and legislation (the Environment Management Policy 2013, EMCA 1999 (Amended 2015).
2. There are no guidelines for soil quality standards in relation to agriculture.
3. Lack of harmonization of laws on soil pollution that would provide an added advantage of adequately addressing the problem of soil pollution.

Policy statements

The National Government will:

1. Map all contaminated soils in the country.
2. Ensure that the 'polluter pays principle' is adhered to by industries and any other polluting entity.
3. Facilitate Remediation of all contaminated soils.
4. Ensure enforcement of hazardous waste regulations.

The County Government will:

1. Enhance implementation of all recommendations of audit reports in Environmental Impact Assessment (EIAs) and SEAs.
2. Support community efforts on environmental safety.

CHAPTER 3 SOIL MANAGEMENT AND ENVIRONMENT

3.1 Effects of poor soil management on the environment

Poor agricultural soil management practices such as ploughing downslope and continuous use of agrochemicals can have a serious adverse effect on the environment. Soils mismanagement and degradation practices include compaction and poor drainage, depletion of essential plant nutrients, rapid loss of organic matter, accumulation of salts and acidification. Soil degradation accelerates soil erosion and destruction of landscapes. Streams and lakes become silted with sediment and nutrients lost from agricultural fields, damaging fish and aquatic life. Contamination of ecosystems from excessive use of pesticides and fertilizers are on the increase in the country. Environmental quality is often compromised whenever soils are not well managed affecting the well-being of the environment.

Challenges

1. Weak enforcement of the environmental regulations for sustainable soil management.
2. Conflict in the various legislations that regulate agricultural soil and land management practices.
3. There exist many land-related laws, some of which are incompatible, which has resulted in complex land management regimes, giving rise to fragmented interventions, poor land administration and inadequate provision of agricultural services.
4. Inadequate knowledge and skills on soil management

Policy Statements

The National Government will:

1. Harmonize the existing laws to enhance the adoption of more integrative approaches to natural resources management (NRM), including the more sustainable land use for agricultural production.

2. Strengthen the Public Complaints Committee for environmental degradation related issues.
3. Strengthen the environmental courts.
4. Develop capacity development strategy on soil management and environmental conservation

The County Government will:

1. Enhance compliance with environmental regulations.
2. Support the Public Complaints Committee for environmental degradation related issues.
3. Support strengthening of the environmental courts.
4. Implement capacity development strategy on soil management and environmental conservation

3.2 Climate change and variability impacts on agricultural soils

Climate change and variability is associated with extreme temperatures and rainfall events which negatively affect agricultural productivity. High rainfall leads to increased vegetative growth which provides good soil cover. Excessive rainfall can lead to flooding and leaching of nutrients, causes waterlogging and land mass movement of soil (land and mud slides). Long dry spells lead to reduced vegetation cover leading to the soil being exposed to wind and water erosion. High temperatures and drought lead to loss of soil carbon leading to low soil fertility. Extreme drought and high temperatures associated with climate change also may lead to aggravated incidences of forest / grassland fires which lead to loss of soil organic matter. The rate of soil organic carbon sequestration with adoption of recommended technologies depends on soil texture and structure, rainfall, temperature, farming system and soil management. Strategies to increase the soil carbon pool include soil restoration and woodland regeneration, no-till farming, cover crops, nutrient management, manuring and sludge application, improved grazing, water conservation and harvesting, efficient irrigation, agroforestry practices and growing energy crops on spare lands.

The National Climate Change Policy and strategies have been proposed and will enable the country to facilitate a coordinated, coherent and effective response to the local, national and global challenges and opportunities that climate change

presents. The draft National Climate Change framework policy also aims to enhance adaptive capacity and build resilience to climate variability and change, while promoting low carbon development pathways.

Challenges

1. Developing specific predictions at spatial and temporal scales relevant to planning is still challenging.
2. The capacity to respond to the adverse impacts and inherent uncertainty of climate change remains very low.
3. Weak enforcement of strategies to combat climate change and variability.
4. Low budget allocation to mitigate the effects of climate change on soil health
5. Inadequate awareness on climate change

Policy Statements

The National Government will:

1. Facilitate the establishment of an accurate climate early warning system to enhance preparedness in managing sudden climate variability and weather extremes.
2. Develop awareness raising strategies and capacity development on adaptation and mitigation measures as per the climate change action plan.
3. Support climate smart agriculture.
4. Build and strengthen research capacity on climate change and related soil environmental issues.

The County Government will:

1. Implement accurate climate early warning system to enhance preparedness in managing sudden climate variability and weather extremes.
2. Develop awareness raising strategies and capacity development on the opportunities for adaptation and mitigation measures as per the climate change action plan.
3. Promote climate smart agriculture and associated technologies.

3.3 Soil extractive Industries

Soil extractive industry is an important sector in Kenya and is increasingly gaining importance and attention. Economic activities that fall under extractive industries include but not limited to extraction of minerals, quarrying, sand and soil harvesting and oil extraction. Despite its growing importance to the Kenyan economy, serious concerns have been raised on the industry's impacts on the environment and food production systems. It has been argued that at all stages of extractive industry – from exploration and operations through to closure – land, water and air are prone to pollution further aggravating the already degraded ecosystems in the country. Strict enforcement of existing legislation to ensure thriving extractive industry for national economic gains without compromising the sustainability of agricultural soils, the environment and ecosystems as a whole is needed.

Challenges

1. Waste products from extractions suffocate the growth of vegetation hence leaving soil bare and barren.
2. Environmental Impact Assessments and SEAs mitigation measures are weakly implemented by extracting companies.
3. Inadequate awareness and education by the general public on the importance of a health soil as well as a clean and healthy environment.

Policy Statements

The National Government will:

1. Strengthen the capacity of Environmental Regulatory agency to effectively enforce environmental related regulations.
2. Undertake mapping of soil extractive minerals that are not yet discovered and that are economically viable for extraction country wide using the appropriate mapping techniques.

Policy Statements

The County Government will:

1. Implement/enforce environmental related regulations.
2. Support mapping of soil extractive minerals that are not yet discovered and that are economically viable for extraction

3. Enhance public participation in the environmental impact assessment of all soil extractive projects.

3.4 Infrastructure development and soil management

Socio-economic development is a major priority for Kenya. Sustainable environmental management during the development process is also a priority. The challenge is how to balance these issues in order to guarantee environmental integrity. For instance, during road construction, extensive surface erosion in form of gullies have been seen to occur in areas where water flow from the roads at discharge points like diversions or culverts is discharged down-slope to the farm lands. There is also no clear policy direction on the responsibility for the control of runoff from the road to adjacent land, and with experience from soil erosion damages caused by road drainage; landowners are unwilling to allow water discharge onto their land.

Ideally the law should ensure that these activities are undertaken and managed to achieve intended development objectives so long as they retain the integrity of the environment, thus performing their role in the search for sustainable development. Another problem associated with infrastructure development and soil management is the sustainability of public and smallholder irrigation schemes. In particular, most irrigation schemes end up degrading the soils as the water quality used for irrigation under such circumstances is not suitable for irrigation. More often than not such irrigation schemes are also initiated without first assessing the suitability of the soils for irrigation.

In ASAL areas, harvesting of runoff and storage of the same into water pans and or dams makes it available for domestic / livestock use and supplementary irrigation. The siting of permanent watering points encourages settlement and overgrazing around the immediate neighborhood of the structures leading to soil degradation.

The EMCA requires mandatory environmental impact assessment and Audit (EIA/A) before commencement of projects such as road construction, water infrastructure and submit a report specifying measures to ensure sustainable development. The government is now routinely demanding EIA studies prior to infrastructure development. The EIA process requires collaboration between NEMA and sectorial lead agencies and public participation.

Challenges

1. Increased siltation of open water bodies such as rivers, dams and water pans from road runoff.
2. Loss of life for humans and livestock as well as agricultural soils due to run off as a result of infrastructural works.
3. Weak enforcement of environmental management plans regarding infrastructure development.
4. Loss of agricultural soils through change of use such as urbanization and mining,

Policy statements

The National Government will:

1. Facilitate soil survey services in areas ear marked for irrigation in order to assess the suitability of soils for irrigation in such areas.
2. Support development of agricultural soils management plans

The County Government will:

1. Support full compliance with the environmental management plans and existing regulations to prevent damage of agricultural lands due to channeling of road runoff.
2. Ensure that roles and responsibilities of stakeholders on soil and water conservation activities along roads are clearly defined.
3. Support soil survey services in areas ear marked for irrigation in order to assess the suitability of soils for irrigation in such areas.
4. Facilitate development of agricultural soils management plans

CHAPTER 4 TECHNOLOGY DEVELOPMENT, DISSEMINATION AND UTILIZATION

4.1 Research and development

The contribution of research and development in agricultural development cannot be over emphasized. The main goal of research is to serve as an instrument through which to improve people's living standards by stimulating growth and increased productivity in critical productive sectors of the economy.

Research remains an important component of soil management. Currently, there is a large number of research activities and projects related to soils being implemented in various institutions either of local or international status in Kenya. The major local institutions undertaking soils research in the country include KALRO, KEFRI, the public Universities and some private firms to a limited extent, while international institutions include World Agroforestry Centre (ICRAF), ICIPE, CIMMYT, ACT and CIAT among others. Various technologies have been developed in the areas of integrated soil fertility management including the bio fix inoculants, conservation agriculture, agroforestry systems, soil and water conservation, water harvesting and irrigation in addition to development of appropriate tools and equipment. However, the research activities are often disjointed with each institution or project implementing activities independent of each other. This often has led to duplication of efforts in certain areas. Despite the government efforts to establish a number of Research and Development (R&D) institutions as well as training of researchers in the country, the benefits of research have not been fully realized. Only few research results have been converted into tangible technologies.

There is weak research-extension linkage which affects dissemination of research findings to end-users. Effective research-extension linkages would address socio-cultural factors, costs, accessibility and suitability of new technologies that determine the rate of adoption of research findings. Research institutions have inadequate capacity in terms of personnel, funding and equipment to undertake soils research.

Challenges

1. Limited communication amongst research institutions dealing with various aspects of soil as well as amongst inter- and trans-disciplinary researchers.
2. Research findings not properly disseminated and researchers' language is not simplified to suit the targeted users
3. Lack of well-articulated research and development policy on soil management
4. The National Science and Technology Policy does not explicitly give guidance on ways to address important gaps found in the R&D system.
5. ITK and innovations in sustainable soil management not recognized
6. Inadequate incentives to invest in R&D.
7. The system of research management and funding is weak and not properly coordinated.
8. Researchers have not been adequately rewarded on the basis of their research results, partly on account of poor marketing and little protection of intellectual property rights.

Policy Statement:

The National Government will:

1. Strengthen research laboratories to conduct soil management related research.
2. Prioritize setting of soils management research agenda and development of research infrastructure across counties.
3. Develop capacity of research institutions to undertake soils research.
4. Support institutions of higher learning to undertake increased training of soil scientists
5. Promote collaboration with national, regional and international research organizations in soils research.
6. Support the development and publication of user friendly farmers' and extension staff agricultural soil management practices manuals
7. Support and promote investment in soils research and analysis

The County Government will:

1. Support soil dissemination of research findings on agricultural soils and Indigenous Technical Knowledge.
2. Develop mechanisms that strengthen research-extension-farmer linkages.
3. Collaborate with national, regional and international research organizations in soils research
4. Facilitate development and publication of user friendly farmers' and extension staff agricultural soil management practices manuals

4.2 Dissemination and adoption of technologies

Kenya's agriculture is dominated by small scale farmers (75% of the total production). There are wide variations among the small scale farmers in the management practices and husbandry skills. Therefore, provision of quality extension services is critical for the improvement of small holder productivity including appropriate soil management technologies, farm income, and hence poverty reduction.

The National Agricultural Sector Extension Policy (NASEP) was developed by key sector ministries with the objectives of making extension service delivery more effective and efficient. It has strong focus on promotion of pluralistic and demand driven extension service. It addresses funding modalities and regulation of extension service. Despite its elaborate focus on improving extension services in Kenya its effectiveness has not been felt.

Declining effectiveness of the extension services is a major factor constraining progressive adoption of sustainable land management technologies and innovations, hence slowing growth of Kenyan agriculture. An effective agricultural extension service that provides stakeholders with relevant knowledge and information can improve agricultural productivity. Such information should include improved soil management technologies and innovations, improved seeds and planting materials, crop husbandry, post-harvest management and marketing.

Targeting soil management extension service provision has already been necessitated by declining agricultural productivity. Access to the right soil management technologies for site-specific inputs at the right time is intended to increase farmers' ability to optimize the use of their resources. There is little formal

collaboration among extension providers, a situation that has led to lack of synergy and poor access to extension support services.

The adoption of soil management technologies has been low and this has had a negative effect on agricultural land management. Through this policy farmers and other relevant stakeholders will be encouraged to adopt modern agricultural soil management practices and appropriate technologies to increase crop productivity and efficiency. Cooperation and collaboration in soil management research and technology, and information sharing will be promoted with local, national, regional and international partners.

Challenges

1. Inadequate personnel and funding for agricultural extension service.
2. Limited collaboration among extension service providers resulting in conflicting messages to end-users.
3. Weak research- extension- farmer linkage.
4. Inadequate involvement of farmers in soil management technology development leading to low adoption
5. Inadequate institutional arrangements to support implementation of soil management programmes.

Policy Statements

The National Government will:

1. Support use of ICT in agricultural soil management
2. Support involvement of end users in identifying soil management priority research areas.

The County Government will:

1. Facilitate an effective pluralistic extension service including use of ICT
2. Ensure quality assurance and regulation in extension service provision.
3. Facilitate participatory soil management technology development and adoption
4. Involve end users in identifying soil management priority research areas.
5. Strengthen research – extension – farmer linkages

CHAPTER 5 FERTILIZER DEVELOPMENT AND INVESTMENTS

5.1 Fertilizer Access

(a) Fertilizer Investment Programme

Since 1991, the fertilizer industry has been liberalized and the various fertilizer merchants import the fertilizer and distribute it through a network of agro dealers. Kenya mainly relies on imported fertilizer with minimum amounts being blended locally. Bulk of imports is by private sector and Government agencies notably KTDA and NCPB. The consumption of fertilizer in Kenya is estimated at 500,000 metric tonnes per year. Major sources include USA, Europe, Middle East, Asia and South Africa with China, India and Singapore emerging as new sources.

Kenya Vision 2030 and ASTGS aim at transforming agriculture into an innovative, commercially oriented and modern sector by increasing productivity through enhancing availability of widely accessible fertilizers and seeds. The ASDS, developed from Kenya Vision 2030, has addressed the high cost of fertilizer through the implementation of the three-tier flagship fertilizer cost reduction strategy of; bulk procurement, local manufacture and blending as well as the establishment of a fertilizer and seed fund.

(b) Bulk Procurement (Government Subsidy Programme)

The fertilizer market was liberalized in 1991 and the private sector imported and sold the fertilizers without any Government controls. However, in 2008 due to the rise of the price of crude oil and effects of the post-election violence, the local fertilizers price rose from ksh. 2,500 to over ksh. 6,500 per 50 kg bag of DAP. The Government introduced the subsidized fertilizer in 2008 mainly to stabilize fertilizer prices which had become unaffordable to most of the farmers. The price of the subsidized fertilizer stands at Ksh.1800 and ksh.1500 for planting and top dressing fertilizers respectively. On the hand the market price for DAP and CAN is KSh. 3,300 and 2,900 respectively. The subsidized fertilizer amounts to 30% of the total annual national demand of 500,000 metric tons, while the private sector meets the rest. However, the subsidized fertilizers were only availed through the National Cereals and Produce Board, a State Corporation, forcing farmers to travel significant distances to access the fertilizer. In 2015 the government introduced the

electronic fertilizer subsidy management system where farmers access fertilizers from accredited private agro dealers countrywide in addition to the NCPB. This system brings the fertilizer closer to the farmers and also involves the private sector who had earlier felt threatened by the subsidy programme. However, the subsidy programme where money was wholly sourced from Treasury, was a short term stop gap measure to avail fertilizers to the farmers while a long term solution was being designed. In addition, adulteration and late disbursement to the farmers of the subsidy fertilizers have been a major problem.

(c) Local fertilizer manufacture and blending:

The Kenya National Fertilizer Development Strategy and Action Plan identifies local fertilizer manufacture and blending as one of the strategic actions to address fertilizer in Kenya by making it easily accessible and available to the farmers. The Government has identified strategic partner in the establishment of a fertilizer blending and manufacturing plant in the country. This plant is already operational. Going by the declining trends of other essential plant nutrients in Kenyan soils for example, trace elements such as copper, zinc and iron, there is need for fertilizer blends that match the requirements of farm- specific nutrients. It is anticipated that since transport cost of imported fertilizers contributes a substantial part of the cost to the farmers, local production will lead to lower prices.

There are initiatives to develop local production of biological fertilizers due to the increasing awareness in organic farming. Small scale production of organic fertilizers is on-going. There is some capacity to manufacture some soil conditioners such as lime in the country.

(d) Establishment of a Fertilizer and Seed Fund:

In efforts to enhance provision of fertilizer to farmers at affordable prices, the Government established The Fertilizer and Seed Development Fund under 'Public Financial Management (Fertilizer and seed development fund) Regulations, 2014'. This is a revolving fund from which the resources would be used to purchase fertilizer when international prices are favourable and also ensure timely availability. The fund would finance the subsidy fertilizers for vulnerable farmers and make the programme sustainable; affordable credit to fertilizer stakeholders along the value chain; soil analysis; seed research and bulking; establishment of seed storage facilities; quality control for fertilizers; and capacity building for beneficiaries (vulnerable farmers).

Challenges

1. High transportation costs leading to high prices of fertilizers.
2. Centers for distributing fertilizers are poorly distributed making accessibility difficult
3. Inadequate raw materials for local manufacture of fertilizers.
4. Limited range and timely availability of fertilizer types
5. Inadequate availability of soils laboratories for testing the quality of organic and inorganic fertilizers
6. Inadequate enforcement mechanisms for biological and organic fertilizers due to unclear mandates of various state agencies.
7. Lack of structures for sustainability of the fertilizer subsidy program.
8. Inadequate bulk fertilizer storage facilities.
9. Unfavorable terms of trade between farm inputs and outputs.
10. Limited data / information to guide on site specific fertilizer recommendations
11. Weak enforcement of existing legislations.

Policy Statements

The National Government will:

1. Support private sector investment in fertilizer production and storage.
2. Implement mechanisms to ensure accessibility, availability and affordability of the right type of fertilizers by the vast majority of smallholders.
3. Support further exploration and geological work to establish the availability of the critical raw materials for fertilizer manufacturing in the Country.
4. Support research on fertilizer recommendation to guide the manufacturing and importation of the right type of fertilizers for the different soil conditions in the country.
5. Improve on infrastructure to reduce transportation costs for fertilizers.
6. Ensure fertilizers are sourced and procured through incentives including but not limited to zero-rating, credit and subsidy provisions.

The County Government will

1. Promote efficient distribution and timely access to fertilizers in partnership with the private sector
2. Support provision of high quality and affordable fertilizers inputs for use along crops commodity value chains.
3. Promote regular fertilizer testing in liaison with researchers, extension staff and farmers
4. Strengthen inputs and equipment surveillance mechanisms to ensure compliance with set standards.
5. Promote manufacturing of soil specific blended fertilizers and provide appropriate incentives to attract investors.

5.2 Quality assurance

Adulteration and other malpractices in the fertilizer market have been noted and the situation is likely to worsen as the number of players increase. Quality assurance is required to guard against malpractices in the handling of fertilizers in the country. Imported fertilizer is tested for quality at both the point of origin and point of entry by the Kenya Bureau of Standards (KEBS) but the acts of distributors and retailers are unregulated and malpractices become rampant during packing and repackaging. In addition, locally produced organic fertilizers are often not graded and the nutrient composition is not clearly indicated in the packaging.

Challenges

1. Lack of enforcement mechanisms due to unclear mandates of various state agencies despite existence of standards for inorganic fertilizers.
2. Lack of proper labeling and certification of fertilizers
3. Lack of standards for organic and biological fertilizers.
4. Inadequate capacity for quality assurance analysis which includes laboratories, equipment and personnel.
5. Lack of small packages affordable to small scale farmers.

Policy Statements

The National Government will:

1. Develop and support enforcement of standards for organic and biological fertilizers.
2. Support capacity development for quality assurance
3. Enhance fertilizer Quality Assurance

The County Government will:

1. Enforce the regulations and the standards.
2. Undertake capacity development for quality assurance
3. Upscale fertilizer quality inspectorate

5.3 Soil management investments- soil testing

There exist soil testing facilities in the private and public institutions. However they are few and far from their clients and their charges are high. Costs of analysis are often unaffordable by the smallholders and in some cases the time taken to receive the results is longer than appropriate.

There is shortage of qualified staff to run the laboratories and inadequate capacity to make accurate recommendations based on the results. There is also lack of coordination amongst the active laboratories to ensure standardization of analytical methods for harmonized recommendations based on laboratory results. This has given room to often conflicting soil management recommendations being provided to farmers.

Challenges

1. Inadequate number of accredited soil analysis laboratories.
2. Inadequate soil testing and analysis infrastructure and, personnel.
3. Lack of standardization of laboratory soil analysis methods.
4. High costs of soil analysis
5. Lack of regulatory framework for soil testing and analysis.

Policy statements

The National Government will:

1. Promote the establishment of accredited regional laboratories manned by qualified staff.
2. Develop standards for soil analysis for the laboratories.
3. Provide mechanisms for lowering the cost of soil testing laboratory services
4. Support the capacity building (human resource and operating facilities) and improvement for collaborating organizations in the area of soil fertility management.
5. Develop a regulatory framework for soil analysis.

The County Government will:

1. Support frequent soil testing for all farms and timely release of lab results Support the capacity building (human resource and operating facilities) and improvement for collaborating organizations in the area of soil fertility management.

5.4 Resource mobilization

The government budgetary allocation towards fertilizer development and investment is often inadequate. Effective funding of the soil management will require public – private partnership to bridge the budgetary gap. The implementation of such an initiative should take cognizance of the private sector and multilateral and bilateral development partners. The intrinsic value of soil to national and local agro ecological and economic productivity is not adequately manifested in financial planning and decision making, thus challenging long-term sustainability as the soils resource degrades. While efforts to internalize the external costs of soil degradation in monetary units have been made by scientists, little attention has been given to elicit the mobilization of resources both human and capital to counteract the continued degradation.

Challenges

1. High cost of fertilizer associated with infrastructure
2. High cost of establishment of soil and water management structures
3. Inadequate funding to soil and water conservation activities
4. Long bureaucratic procedures for infrastructure investment in the country.

Policy Statements

The National Government will:

1. Support development of fertilizer associated infrastructure to attract private investment.
2. Support mechanism to bring down the cost of doing fertilizer business.
3. Establish mechanism to fund soil and water conservation works

The County Government will:

1. Prioritize soil and water conservation in annual work plans and budget.
2. Establish mechanism to bring down the cost of doing fertilizer business.
3. Fund soil and water conservation works

CHAPTER 6 CROSS CUTTING ISSUES

6.1 Inroduction

Cross-cutting issues in this case refer to aspects that affect agricultural soil management either directly or indirectly but are not limited to soil management. They include gender, HIV/AIDS and other pandemic diseases such as COVID 19, Public-Private-Partnerships, and climate change and resource-use conflicts

6.2 Gender and agricultural soil management

According to Kenya Institute for Public Policy Research and Analysis (KIPPRA) Special Paper No. 29 2019, women aged 35-64 years were the majority in food crop production (28%) while in cash crop production the majority were male of 34-64 years at 34 per cent. Such gender-based inequalities constrain agricultural growth and poverty reduction measures by affecting labour productivity in terms of access to and control of productive resources. Poor production technologies have not attracted the youth to agriculture leading to an aging labour force; this has affected production and productivity. Both levels of government recognize that inequitable gender relations have affected sustainable management of agricultural soils and that focusing on all involved in productive processes can partly address the problem. The main challenge is to overcome undesirable practices that perpetuate gender inequalities especially in crop value chains.

Challenges

1. Lack of appropriate gender sensitive soil management technologies
2. Inadequate capacity building for youth and women in soil management
3. Lack of affordable and innovative soil management products for youth and women

Policy Interventions

National and County governments will:

1. Promote appropriate gender friendly agricultural soil management technologies

2. Develop capacity of women and youth in agricultural soil management
3. Promote affordable and innovative products and packages in agricultural soil management for women and youth

6.3 HIV/AIDS and COVID 19

The different endemic and pandemic diseases that humanity has experienced, such as the HIV / AIDS and COVID 19 have had a great impact on the Kenyan economy, the environment and any human activity, such as agriculture. There is sufficient evidence to affirm that these diseases have an important effect on the food supply chain, mainly affecting food demand and consequently food security, with a great impact on the most vulnerable population. The illness and subsequent death of workers have an enormous impact on agricultural productivity and earnings... On average, 1,400, 000 adults aged 15 years and over are living with HIV. Preliminary findings of the Kenya Population-based HIV Impact Assessment (KENPHIA) 2020 survey indicated that Kenya's HIV prevalence now stands at 4.9%. According KENPHIA the prevalence of HIV in women is at 6.6%, twice which in men at 3.1% showing a significantly higher burden of the disease in women compared to men. As of June 2021, the cumulative COVID 19 was 180,498 cases and 3514 deaths.

Challenges

1. The main challenge is to contain these diseases and reduce their socio-economic impacts

Policy statements

The National and County Governments will:

1. Promote production and use of nutritious food and nutritionally enhanced food products for the infected people
2. Link the affected people with relevant agencies towards involvement in income generating enterprises.
3. Promote research and production of vaccines to manage and control the diseases

6.4 Public-Private-Partnerships

The importance of Public Private Partnership (PPP) in agriculture is understood in terms of a shared mechanism among partners for input, resource, market, risk, technology and benefits. In addition, review of various studies indicated the visibility of PPP in various facets of knowledge management, capacity building of women and youth, development of high end technologies, processing and market promotion and gender mainstreaming in agriculture. Despite such potential benefits, the private – public sector players within the agricultural soil management are disjointed and often in competition while their synergies would lead to improved performance in agricultural production. Inadequate Public-Private-Partnerships affect primary production and financing of the soil management technologies

Challenges

1. Lack of effective collaboration between the private – public sector players
2. Undue competition between the private – public sector players

Policy Statements

The National and County Governments will:

1. Promote close cooperation and partnership between the public and private sector partnerships
2. Facilitate growth of the private sector and encourage its organization into producer, processor, marketing associations and other relevant groups.

6.5 Climate Change

Climate change can have a very big impact on soils and the functions that soil performs. In agriculture, climate change will affect crop production as changes in soil, air temperature and rainfall affect the ability of crops to reach maturity and their potential harvest. The unique balance between the soils and the climate affects the nature and distribution of the natural ecosystems, providing water, nutrients and a growing medium. As climate changes, so too will the soil's ability to support current ecosystems. In addition climate change can lead to poor crop growth, increased surface runoff and flooding of agricultural lands and emergency of new crop diseases and pests. These problems, are causing increasing concern about declining food security, sustainable development of agriculture and challenges

related to climate change mitigation and adaptation. To minimize these effects it is important to encourage good environmental practices and enhance resilience to adverse climate change impacts.

Policy statements

The National and County Governments will:

1. Prioritize implementation of the National Climate Change Action Plan 2013-2017.
2. Promote adoption of climate change research findings relevant to agricultural soil management
3. Provide early warning response and ensure preparedness for adverse climate change effects in collaboration with other agencies.

The County Government will:

1. Promote adoption of Climate-Smart Agricultural approaches.

6.6 Resource-Use Conflicts

Agriculture relies heavily on finite resources such as land and water which are competitively sought by actors pursuing different interests. Due to scarcities, resource-use conflicts are bound to arise. These conflicts may result in loss of crops, human life and livestock thus disrupting crop and soil management activities resulting in negative effects on livelihoods and economic development. Strategic measures that would ameliorate conflict arising from natural resource utilization are required. To implement these, an awareness of principles of sustainable resource management has to be created as well as for chances arising from mutual understanding of resource needs and from the joint simultaneous or consultative use of natural resources among user groups.

Challenges

1. Lack of effective mechanisms for conflict resolutions

Policy statement

The National and County Governments will:

1. Develop effective mechanisms for conflict resolution among pastoral, agro-pastoral, livestock and farming communities and other stakeholders.

CHAPTER 7 INSTITUTIONAL FRAMEWORK

7.1 Introduction

he Ministry of Agriculture and Livestock Development will develop an Implementation Plan that will designate the roles and responsibility of all parties. The Plan will also include a set of performance indicators and measures to assess progress towards the effective restoration, conservation and management of agricultural soils in Kenya. Further, the framework will provide for institutional strengthening and capacity building for effective delivery of agricultural soil management services, including mechanisms for financing the implementation of the policy. The implementation framework will incorporate an integrated approach, joint planning and participation of stakeholders. The focus will be addressed through coordinated programmes and projects. These include: institutional reforms, operations and maintenance, research and technology development, information gathering and management, monitoring and evaluation, capacity building and training, and infrastructural development. This Policy underscores the government's commitment to increase the public-private partnerships (PPP) to strengthen sustainability of the sector.

7.2 The National and County governments

The National government, in collaboration with County governments and other relevant stakeholders will review this policy as may be necessary to respond to emerging development and implementation issues. The envisaged framework shall feed into the wider establishment of new institutions, review and re-organize the existing institutions and other mechanisms to operationalize this policy. The National government in consultation with County governments and other relevant legal and parliamentary committees will formulate an ASM Act.

The National government in consultation with the County governments and other stakeholders shall develop an ASM strategy investment plan to implement the ASM policy. County governments may develop their own specific ASM strategic and implementation plans in line with the National strategy and guidelines. National and County governments will respectively take responsibility for development of annual implementation plans for ASM policy. Whenever appropriate, the National

or County governments will individually or concurrently establish institutions to address new developments in the agricultural soil management sub sector.

7.3 Institutional Framework

The National Government shall establish and set up a National Agricultural Soil Management Unit that will be responsible for coordination and implementation of the ASM policy activities. The National and County Governments shall set up mechanisms to strengthen functional linkages between the Ministry of Agriculture and Livestock Development and the ministries responsible for finance, land, water, forestry and environment. The two levels of government shall make efforts to strengthen linkages between researchers, extension service and the farmers to enhance research and development as well as technology adoption in sustainable soil management practices. The main players in soil and water management arena are summarized in **Table 1.**

Table 1: Legal Institutions under the ASM Policy

Institutions	Roles	Key linkages
1. Ministry of Agriculture and Livestock Development (MoALD)	1. Responsible for mobilization of resources 2. Oversee, in collaboration with County governments, the formulation of agricultural soil management (ASM) laws and policies, provide sector regulation, coordination and guidance, and monitoring and evaluation. 3. Appoint officers and carry out other mandates as may be specified in the Agricultural Soil Management Policy 4. Report to Parliament as may be necessary, on the state of, and needs for, soil management in the country. 5. Promote the cooperation of other ministries, state corporations, research institutions and agencies of the national Government, county governments, as well as private sector, non-Government organizations in order to encourage broad support for restoration, conservation and proper management of agricultural soils. 6. Overseeing implementation of the ASM policy 7. Creating an enabling environment for commercialization of agriculture in which smallholder farmers will be assured of good returns if invest soil fertility enhancing strategies.	Other Sector ministries e.g. Ministry of Environment & Forestry ; Ministry of Water Sanitation and Irrigation; Ministry of Lands; Ministry of Energy; Ministry of Public Service, Youth and Gender Affair; Ministry of Petroleum and Mining County Department responsible for Agriculture; Sector Development Partners and Private Sector and financial institutions and development partners such as GiZ, GDC, SIDA, EU, DFID, IFAD, ADB, World Bank

Institutions	Roles	Key linkages
	8. Revitalizing and strengthening public and private creditors to provide affordable loans to farmers for farm operations and purchase of inputs. 9. Provision of agricultural services including research liaison and extension services in collaboration with County governments other service providers guided by the NAEP. 10. Provision of strategic research services through KALRO. 11. Formulation of National projects and programmes in collaboration with County governments and other relevant stakeholders. 12. In consultation with County governments, develop an investment plan and respective strategic plans for sustainable soil management. 13. Develop capacity of research institutions to undertake soils research. 14. In conjunction with County governments will prioritize collaboration with national, regional and international research organizations in soil management. 15. Support the development of new soil management technologies and innovations to enhance crop production.	

Institutions	Roles	Key linkages
2. National Agricultural Soil Management Unit (to be established with the mandate of overseeing and regulating the nations' soils' resource use and management)	1. Oversight and coordinate, in collaboration with County agriculture soil management units, soil's related activities including quality assurance of soil improvement inputs 2. Collaborate and liaise with other agencies involved in ASM at local, regional and international levels; 3. Capacity building, coordination of technology and research development in the areas of ASM; 4. Establish a national Agricultural Soil Management Information System ASMIS); Sourcing of information on soil and water management and disseminating the same to stakeholders; 5. Inventorying key stakeholders involved in Agricultural Soil Management 6. Acting as a bridge between institutions involved in soil fertility and agricultural soil management matters; 7. Establishing a forum for exchange of information between key stakeholders involved in ASM 8. Regulating soil analytical methods and data from different laboratories to conform to quality and accuracy of results for farmer advisory services. 9. Participating in validation of research results on soil management improvement in readiness for up-scaling the applied technologies[1];	National and County Agricultural Sector Departments all national and county institutions responsible for natural resource management; development partners and other financial institutions ; private sector and farmer organizations; extension, research and farming communities; and standards institutions

Institutions	Roles	Key linkages
	10. Monitoring enforcement and coordinating implementation of legal and policy instruments relating to ASM. 11. In consultation with County governments, spearhead implementation of the ASM policy, guidelines and standards. 12. Monitoring and evaluation of ASM activities and their impacts; 13. Mainstreaming agricultural soil management related statutory obligations such as environmental, water, land and forestry 14. Capacity builds farmers and support development of ASM curriculum in Agricultural Training Institutions. 15. Setting up within its structure a Soil Survey Practitioners Board that will advise and oversee the operation and management of strategic soil projects where soils plays a significant role such as in irrigation projects 16. Setting linkages with relevant professional bodies such as the Soil Science Society of East Africa (SSSEA) and other training institutions for improved staff development in the field of sustainable soil management practices	

Institutions	Roles	Key linkages
3. County Governments	1. Oversight and coordinate in the County soil management units, soil's related activities including quality assurance of soil improvement inputs 2. Capacity building, coordination of technology adoption and adaptive research development in the areas of ASM; 3. Provide linkages to the national Agricultural Soil Management Information System (ASMIS); Sourcing of information on soil and water management and disseminating the same to stakeholders; 4. Inventorying key county stakeholders involved in Agricultural Soil Management 5. Participating in validation of research results on soil management improvement in readiness for up-scaling the applied technologies[2]; 6. Enforcement and coordinating implementation of legal and policy instruments relating to ASM. 7. Implementation of the ASM policy, guidelines and standards. 8. Participating in monitoring and evaluation of ASM activities and their impacts; 9. Mainstreaming agricultural soil management related statutory obligations such as environmental, water, land and forestry 10. Training farmers and support development of ASM curriculum in Agricultural Training Institutions. 11. Providing technical advisory and other support services in proper soil management practices.	All actors in the agricultural sector

Institutions	Roles	Key linkages
4. KALRO	1. Prioritize setting of agricultural soil research agenda and development of research infrastructure across counties. 2. Promoting demand- driven research in soil management. 3. Provide for dissemination of research findings and ITK. 4. Provide for mechanism of sharing of ASM research findings. 5. Developing mechanism that strengthens research-extension-farmer and linkages. 6. Promoting research in proper utilization and management of soil resources for crops production. 7. Encourage institutions of higher learning to undertake demand-driven soils research and share findings.	KALRO and linked to county governments other local, regional and international research institutions; Universities; farmer training centers; private sector; Civil Society, farmers and farmers organizations
5. Universities and other institutions of higher learning	1. Identify key training priority areas in ASM for the sub-sector in collaboration with the National and County governments and other relevant stakeholders. 2. Development of relevant training curricula by the universities and other institutions of higher learning in collaboration with the National and County governments and other relevant stakeholders. 3. Undertake scheduled training in ASM in collaboration with relevant stakeholders. 4. . Establish mechanisms for information sharing amongst stakeholders 5. Keep pace in technology changes and ensure continuous staff development in ASM through regular review of training needs assessment.	MoALF&C, ASM Unit; closely linked to public and private universities; and other training institutions, locally, regionally and internationally

Institutions	Roles	Key linkages
6. KALRO and Universities	1. Carrying out research on soil fertility and plant nutrition and make appropriate soil fertility management recommendations 2. Provision of soil testing and analytical laboratory services on soil, water, fertilizer and plant tissues. 3. Conducting socio-economic studies associated with soil and water resources. 4. Developing best farm management practices that combine well with fertilizer use and soil and water conservation works 5. Regular appraisal of soil and water management practices 6. Conducting applied research with extension organizations and farmers 7. Involvement in ASM-related collaborative research with private firms, and other public bodies. 8. Provide mechanisms of establishing County research – extension liaison officers 9. Give higher priority to commodity-based research to exploit the principle of comparative advantage by targeting specific farm enterprises in agro-ecological zones in which they are naturally adapted for production with ease.	MoALF &C; County governments; MoALF &C ; ASM Unit other local, regional and international research institutions; Universities; farmer training centers; private sector; Civil Society, farmers and farmers organizations
7. Agriculture, and Food Authority	Formulation of land use regulations	ASM Unit, Universities, and research institutions, private sector

Institutions	Roles	Key linkages
8. KEPHIS	1. Oversee regulatory functions on organic and bio fertilizers 2. Monitoring soil, fertilizer and water quality to ensure quality assurance. 3. Inspection and analysis of soil, water and fertilizer materials for purposes of enforcing the rules and regulations there under. 4. Provides analytical infrastructure for soil fertility inputs	KEBS, and other accredited soil laboratories, KSTCIE, KOFA, KOAN, KALRO, Government Chemist
9. MENR	1. Oversee implementation of the environmental policy and EIA. 2. Enforce Environmental Management Co-ordination Act (EMCA) on soil and water pollutants.	NEMA, MoALF&C, KALRO, Other research organizations, Universities
10. NEMA	Responsible for the overall environmental management including those related to agricultural soil management and specifically to monitor and enforce Environmental Quality Standards Regulations	MoALF&C, GEF, UNEP
11. KEBS	1. Establishment of quality standards of all products on the Kenya market under the provisions of the Standards Act (Cap 496) of the Laws of Kenya. 2. Developing fertilizer standards, quality control and certification of fertilizer materials in collaboration with National Agricultural Soil Management unit MoALF&C, KALRO and KEPHIS 3. Provides and administer the standards of soil fertility inputs	NEMA, KEPHIS, soils accredited labs, KSTCIE, KALRO, Universities
12. Radiation Board	1. Responsible for ensuring compliance to standards in respect to radioactive materials in soil fertility inputs	NEMA, KEBS
13. NLC	To conduct research related to land and the use of natural resources, and make recommendations to appropriate authorities	MoALF&C, MoEN&F, KALRO, MoL MoWS&I

CHAPTER 8 COORDINATION, MONITORING AND EVALUATION OF THE POLICY IMPLEMENTATION

8.1 Coordination

It is important that all actors of this policy are coordinated whilst implementing the policy. The Ministry of Agriculture and Livestock Development shall be responsible for coordinating all stakeholders of this policy. The Agricultural Sector Ministries have an important role to play in ensuring a holistic approach in the implementation of the policy. Proper coordination on the implementation will lead to awareness creation to all stakeholders to accrue a number of benefits which include integral and optimal utilization of the efforts and resources from all players. The established coordination mechanism shall interface with county coordination systems essentially producing a national system.

The County Governments shall be responsible for coordinating all stakeholders implementing this policy at the county level. The Agricultural Sector County Departments have an important role to play in ensuring a holistic approach in the implementation of the policy. Proper coordination on the implementation will avoid duplication of efforts amongst the stakeholders, conflicts on the use of resources and interventions and ensure a holistic approach on land and water resources development and on integrated soil fertility management.

8.2 Monitoring and Evaluation

Monitoring on the implementation of the ASM Policy is an ongoing process. This will ensure focused sustainable land management for the realization of the objectives. Monitoring will be participatory involving all the stakeholders and beneficiaries. The Ministry of Agriculture and Livestock development together with relevant MDAs and in collaboration with the County Governments shall collect, compile and analyze information on the implementation of various soil management interventions from other implementers of the policy. The information will be processed so as to compare the various benchmarks with actual implementation of the interventions.