Lamu County Government

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COUNTY GOVERNMENT OF LAMU

COUNTY ENVIRONMENT ACTION PLAN

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Contents

Foreword

The environment which provides a wide range of ecological goods and services is the foundation for sustainable development. It is from the environment that humanity sources water and raw materials for supporting manufacturing and subsistence consumption among many other essential resources paramount for driving socio-economic development. This valuable environment however faces a myriad of challenges that have been threatening its capacity to support the ecosystem services for sustainable development. The global forests, wild animals and freshwater resources are reported to be declining, some at an alarming rate presenting uncertainty for the future.

Concerned by the proceeding trends in environmental changes, the global community previously commenced initiatives for addressing environmental conservation challenges. Some of the notable initiatives can be traced to the Earth Summit held in Rio de Janeiro in 1992 which came-up with various recommendations, among them Agenda 21. Key to the Agenda 21 was provision for Global Environment Action Planning to provide global strategies for enhancing environmental conservation. The Agenda 21 also advocated for countries to domesticate the Global Environment Action Plan through the development of National Environment Action Plans (NEAP).

Kenya domesticated Agenda 21 provisions in 1994 when the first National Environment Action Plan was developed which recommended the enactment of a framework law, now the Environment Management and Coordination Act of 1999 to foster integration of environmental concerns in development planning. This framework law provided for an elaborate integration of environmental concerns in national policies, plans, programs and projects. In 2015, the framework law (EMCA, 1999) was reviewed to realign with the Constitution of Kenya 2010. Key to the review was the provision for County Environmental Planning through the development of County Environment Action Plan (CEAP) under section 30. This CEAP which is the first ever for the Lamu County, therefore is a great milestone for mainstreaming Environmental Planning, management and conservation in Lamu County. The County Government is committed to the implementation of this CEAP through its integration in future CIDPs and during the review of current CIDP.

ISSA TIMAMY
H. E. The Governor
County Government of Lamu

Preface

Environmental planning presents a fundamental approach for steering sustainable environmental conservation. In Kenya, the process takes various forms with the process entailing development of County Environmental Action Plans (CEAPs) which is provided for under EMCA, 1999 (and the EMCA amendment Act of 2015) being the legally recommended approach for counties. The process of development of the CEAPs is guided by the Environmental Action Plan Preparation Guidelines issued by the Cabinet Secretary responsible for matters environment as provided under EMCA, 1999. The guidelines provide a standardized approach for CEAPs development across counties enabling consolidation of the CEAPs to build the National Environment Action Plan which is also provided under EMCA, 1999.

Endowed with rich, unique and diverse range of treasures of flora, fauna and scenic undulating landscapes, the Lamu County considers CEAP as a critical tool for guiding the County in managing its unique environmental heritage. This is mainly because the process of development of the CEAP entails an elaborate reflection of the situation of the County environment by harnessing a wealth of information from various secondary sources and through stakeholder consultations. This is with a view to deriving practical and appropriate time bound actions for mitigating threats to the environment and the resources supported by various County ecosystems.

Indeed, Lamu County like many other counties has witnessed various environmental conservation challenges that threaten not only the flora and fauna but the sustainability of the socio-cultural economy of the County. The ocean for instance suffers pollution by marine litter and effluents from the urban centres while the beautiful mangroves have been facing deforestation from illegal harvesting. Similarly, there are concerns of overgrazing at the County rangelands and siltation across rivers of the County among other environmental challenges across the County.

The development of this County Environment Action Plan meant to provide actions for mitigating a range of County environmental challenges therefore comes at an opportune time, providing a roadmap for addressing these challenges. The CEAP takes cognizance, provides linkages and aligns with other County planning frameworks particularly the development of the County Integrated Development Plan (CIDP). The CEAP will therefore serve an important reference in the mainstreaming of environmental issues during the review of the CIDP 2018 -2022 including the development of the third generation CIDP.

I note that the County Environment Action plan covers a broad range of environmental elements of our County and thus is the most comprehensive document describing our environment. The CEAP therefore can be applied across many sectors in addressing and integrating environmental concerns. In this regard I call upon all of us working towards the betterment of the Lamu County Environment to rally behind this policy document to mainstream the relevant provisions of the CEAP to our various development plans in order to ensure that we continue to advance the County socio-economic agenda while safeguarding the right of Kenyans to a clean and healthy environment.

Mbarak Mohamed Mbarak
County Executive Committee Member
Public Health, Environment, Sanitation and Natural Resources
Lamu County

Acknowledgement

The County Environment Action Plan is considered an important source of information in an effort to mainstream environmental concerns into the County sectoral planning and development processes. Therefore, the County Environment Action Plan is an important document for catalyzing sustainable development that provides for the respect of environmental conservation interests. It also outlines commitments of the County Government and other stakeholders for supporting environmental management in order to fulfill the requirement of the Constitution of Kenya, 2010 of creating a clean and healthy environment for all Kenyans.

A fundamental component of this County Environment Action Plan is that it brings salient Environmental issues of Lamu County into the County Planning agenda, particularly those requiring enormous investment, and those whose impact and magnitude are large in space, extensive in length of time and those considered emerging. In so doing, all these impacts are flagged as County Environment Planning issues and given prominence for consideration in all County planning processes. I note that this County Environment Action Plan 2022-2026 was prepared by the County Environment Committee with broad consultations involving national government lead agencies, representatives of various County Government departments, Public benefits organizations, representatives of the public and the private sector. The breadth of the stakeholders involved in this process therefore truly presents the face of Lamu County environmental situation and issues.

I therefore wish to express my great appreciation to the representatives from County Government of Lamu, Members of the County Environment Committee, the Public Benefit Organizations, Private Sector, National Government and all other stakeholders who made tireless efforts to produce this first ever Lamu County Environment Action Plan. The process of Development of the County Environment Action Plan was financially supported by Nature Kenya through funding from The Restoration Initiative (TRI) child-project for Kenya. I wish to thank Nature Kenya for the support.

I wish also to extend my gratitude to the NEMA team led by Dr. Charles Lange for providing technical backstopping to this process which made the completion of this County Environment Action Plan possible.

Lastly, I wish to thank H. E. the Governor, County Government of Lamu for providing an enabling environment for the team to undertake this process.

Ahmed Rashid Dirie
Chief Officer
Public Health, Environment, Sanitation and Natural Resources
County Government of Lamu

Executive Summary

The Lamu County Environment Action Plan (CEAP 2022-2026) is a strategic planning document to support integration of Environment into County sectoral development planning. The Environment Plan which covers 18 components of environment in the County is designed around 4 strategic objectives covering stewardship, sustainability, transformation and devolution in environment management. For each of the 18 components of the CEAP, a summary of the County profile and outlook is presented emanating from environmental assessment and profiling. The assessment generated key environmental issues from which corresponding strategic actions aimed at providing solutions for the environmental impacts were designed. The environmental profile resulted from an analysis that employed several tools, including DIPSIR and opportunity framework analysis and following the EAP preparation guidelines.

The criteria for prioritizing County environmental issues was based on their impact as well as prevalence and spread across the County. The prioritization also considered issues that are localized and those that are emerging.

The Lamu County Environment Action Plan (CEAP) 2022-2026 further provides for strategic logic and the Theory of change (TOC) reasoning through the Vision, Mission, Goal and strategic objectives of the plan. Through the strategic objective on environmental stewardship, the plan envisages protection and nurturing of natural resources for the County, allowing them to grow through risk identification and management. Under environmental sustainability objective, the plan envisages carefully drawing on the environment the basic needs and leaving the environment better than it was found. Under environmental transformation, the plan proposes a complete change of strategy for doing business in order to obtain desired transformation through optimizing on value of natural resources and environment and finally taking the opportunity for mainstreaming environment and natural resources conservation by all County sectors through devolution of environmental actions and responses.

The CEAP County profile and outlook present critical information on the 18 aspects of the County covering: size, extent and placement; geography and physiography; land and soils; climate change and variability; water resources and pollution; wildlife, biodiversity and tourism; coastal marine and wetlands; forests and woodland ecosystems; agriculture, livestock and fisheries; settlement, urbanization and transport; energy, mining, industry and trade; health, sanitation and waste; environmental hazards and disaster; research, technology and innovation; environmental education, information and communication; environmental governance, compliance and enforcement; people environment, economy and development; environment and climate finance. These environmental aspects of the County provide in-depth assessments covering the status and issues or challenges. The challenges have been later summarized for ease of reference.

The CEAP further presents the strategic actions required to address each of the County environmental challenges profiled, the implementation and investment plan to support delivery of the strategic actions. The CEAP also includes a monitoring and evaluation plan providing for fast-tracking progress in the realization of the CEAP commitments. The CEAP if implemented as envisaged, will bring transformation in environmental management in Lamu County while steering clearly the socio-economic development of the County.

Acronyms and Abbreviations

CEAP	County Environment Action Plan
CIDP	County Integrated Development Plan
DIPSIR	Drivers Pressure State Impact and Responses
EAP	Environmental Action Plan
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
KALRO	Kenya Agricultural and Livestock Research Organization
KEFRI	Kenya Forestry Research Institute
KMFRI	Kenya Marine and Forestry Research Institute
KWS	Kenya Wildlife Service
KFS	Kenya Forest Service
NWHSA	National Water Harvesting and Storage Authority
NEAP	National Environment Action Plan
NEMA	National Environment Management Authority
NGOs	Non-Governmental Organizations
PCB	Pest Control Board
WRA	Water Regulatory Authority
WRUA	Water Resources Users Association

CHAPTER ONE

1.0 INTRODUCTION

1.1 The Genesis of Environmental Planning in Kenya

The integration of environmental concerns into economic development first came to the fore of global environmental agenda during the United Nations Conference on Human Environment and Settlement held in Stockholm, Sweden in 1972. Twenty years later the related United Nations Conference on Environment and Development (UNCED) was held in June 1992 with one of the key milestones of the conference being the declaration of Agenda 21. The Agenda 21 among others recommended for state parties to develop National Environment Action plans to serve as policy documents for guiding mainstreaming of environmental concerns to national development Agenda. In fast-tracking the provision of Agenda 21, Kenya developed her first National Action Plan in 1994.

1.1.1 The National Environmental Planning – National Environment Action Plan (NEAP)

In 1999, Environmental Management and Coordination Act No. 8 of 1999 was enacted to strengthen environmental governance in Kenya. The Environmental Management and Coordination Act, 1999 domesticated Environmental Planning through dedication of part IV of the Act to Environmental Planning mainstreaming. Specifically, EMCA provides for preparation of periodic Environmental Action Plans at National and county level. Over the years, four Environmental Planning cycles have been undertaken in-line with the provisions of EMCA 1999 covering; 1994 - 1998, 1999 - 2003, 2004 - 2009, and 2010 - 2014. In 2015, EMCA 1999 was amended through the EMCA amendment Act of 2015. The amendment Act provides for CEAPs to be prepared every 5 years providing room for their incorporation in the NEAP which will be prepared after every 6 years.

1.1.2 County Environmental Planning – County Environment Action Plan (CEAP)

The review of the Environmental Management and Coordination Act was undertaken in 2015 to align EMCA, 1999 to the Constitution of Kenya 2010. The amended Act gives counties greater responsibility in Environmental Management and in preparation of their County Environment Action Plans (CEAPs). Section 30 of EMCA (Revised 2015) 1999 gives the County Environment Committee, a committee established by the Governor under EMCA section 29, the responsibility for preparation of the County Environment Action Plan. The Act further provides for the development of Environmental Action Plans preparation guidelines to be issued by the Cabinet Secretary (CS) in the ministry responsible for environment upon recommendation by the National Environment Management Authority (NEMA). These guidelines were issued by the Cabinet Secretary in 2017.

Lamu County Environment Action Plan has therefore been developed in line with the National guidelines and as per the provisions of the EMCA (Revised 2015) 1999. The County planning process was delayed for some time to allow the County Government of Lamu to constitute and gazette the County Environment Committee as per the requirement of the law.

1.2 Linkages of Environment Action Plan to other Development Policies and Legal Frameworks including Sustainable Development Goals

Environment and natural resources sector is the foundation for sustainable development in Kenya (NEMA, 2018). The environment and natural resources sector contributes an estimated 42% of the country's Gross Domestic Product (GDP) and about 70% of Kenyan livelihoods (NEMA, 2018). In 2011, it was estimated that the total global ecosystem services provided by nature was ***USD 125 – 145*** trillion per year as provided in the Global Land Outlook of 2017 (UNCCD, 2017). The pivotal role of environment and natural resources in driving sustainable development and the cardinal purpose for Environmental Action Plans which is to provide policy direction for sustainable conservation of environment and natural resources present for strong linkages and complementarily between EAPs and development policies and allied legal frameworks.

In this respect, the national development blue print popularly known as the Kenya Vision 2030 under the social pillar provides clearly for key aspects of environment and natural resources prioritized in NEAP (GoK). Similarly, the Vision 2030 implementation frameworks referred to as the Medium Term Plans (MTP), mainstream provisions of the Environmental Action Plans. Under the devolved governance, the County Integrated Development Plans (CIDPs) largely provides for environmental profiling and the strategies or actions the County Governments will pursue to realize sustainable development without compromising conservation of environment and natural resources. On the legal frameworks front, the Constitution of Kenya 2010 in article 42 provides for a clean and healthy environment for all Kenyans providing a strong connection between the aspirations of EAPs and the supreme law for Kenya. Similarly, article 69 and 70 of the Constitution of Kenya 2010 provide for specific measures and enforcement actions respectively for advancing environmental conservation, providing further linkages between the EAPs and the Constitution of Kenya 2010. Apart from EMCA (Revised 2015) 1999, many other sectoral laws such as the Forest Management and Conservation Act, 2016, Wildlife Management and Conservation Act, 2013 among others complement EAPs and thus have many linkages. From the devolved governance front, the County Governments Act, 2012-part XI on County planning, section 102 (d) provide for principals of County planning and development to protect and develop natural resources in a manner that aligns national and County plans. More so this CEAP provides for enhancement of Sustainable Development Goals particularly goal 3, 6, 11, 13, 14, 15 and 17

In this regard, this Lamu County Environment Action Plan has been developed largely to comply with provisions of EMCA and further provide an enabling mechanism for advancing the national and County policies, plans and legal frameworks on environment and natural resources. Some of the key plans mainstreamed to the CEAP include; the Second Lamu County Integrated Development Plan (Lamu County Government, 2018), Integrated Coastal Zone Development Plan (2019-2023), Lamu County Spatial Plan, 2016, the Tana River Delta Conservation and Development Master Plan (Mireri, 2010), the Land Use Plan for the Tana River Delta (Odhengo et al., 2012), Sustainable Management of Deltas in Kenya – Policy and Decision Dialogue, National Water Master Plan 2030, Draft National Biodiversity Strategy and Action Plan (NBSAP), the National Environment Action Plan 2018 -2024 and the National Strategy for Achieving and Maintaining over 10% tree cover by 2022. At the global scene, the CEAP reflects on some issues of the Sustainable Development Goals (SDGs) while from the continental level complements the African Union Agenda 2063.

1.3 The Principles of the County Environment Action Plan

The principals guiding the plan are informed by the principles of the Constitution of Kenya, 2010 and those of Environment Management and Coordination Act (revised 2015), 1999 as well as the County Governments Act, 2012. These include the principles of sustainable development, governance, accountability, rule of law, access and benefit sharing, access to information, disclosure and public participation and protection and development of natural resources in a manner that aligns national and County plans. This is in addition to principles enshrined in EMCA which include the polluter pays principle, precautionary principle and respect for socio-cultural practices and indigenous communities of the target area. These principles will guide the key thrusts of the CEAP that cover; environmental stewardship, environmental transformation, environmental sustainability and devolution of environmental management.

1.4 Rationale and Purpose of the County Environment Action Plan.

Planning is a central role of the devolved governance as provided in the County Governments Act, 2012 Part XI and key to the County planning is on environmental and natural resources protection and conservation. Further, the Environmental Management and Coordination (Amendment) Act, 2015 provides for the development of the County Environment Action Plan by the County Environment Committee. More so, advancing the provisions of the Constitution of Kenya 2010 such as the principals and values of governance in particular sustainable development provided in article 10, ensuring Kenyans have a clean and healthy environment as provided in article 42 as well as advancing actions provided in article 69 require environmental planning. The development and implementation of the key development policies such as Kenya visions 2030 and associated Medium Term plans, the County Integrated Development Plans (CIDPs), the County Spatial Plan, the Physical Development Plans, Urban Development Plans, as well as the *Big Four Agenda* and other development plans which require environmental considerations also require environmental planning inputs. Therefore, the County Environmental Actions Plan is in compliance to the legal requirement and is an enabling policy document for guiding sustainable development at the County level.

1.5 The Scope of the County Environment Action Plan

The CEAP spatially covers environment context of Lamu County focusing on key themes provided in the Environment Action Preparation guidelines (NEMA, 2016). This is the first CEAP of Lamu County and will cover the period from 2022 to 2026.

1.6 The Vision, Mission, Goal and Strategic Objectives

The Theory of Change (TOC) was employed in deriving the Environmental Action Plan Vision, Mission, Goal and Strategic Objectives and include;

1.6.1 Vision

The CEAP's Strategic Vision is: *A Clean, safe, healthy and sustainably managed environment*

1.6.2 The Mission

To conserve the environment and sustainably develop Lamu County

1.6.3 Strategic Goals and objectives

The overall goal of the County Environment Action Plan (CEAP) 2022-2026 is; '*To attain environmental stewardship, sustainability and maintain a transformational approach to environmental and natural resource management in Lamu County by 2026*. The four strategic objectives therefore cover Environmental *stewardship, Environmental Sustainability, Environmental transformation and Devolution* of environment and natural resource management. The CEAP strategic objectives include:

i. To Enhance stewardship in environmental resources management in Lamu County

ii. To Enhance environmental sustainability

iii. To Transform environment sector of Lamu County

iv. To strengthen the uptake/implementation of devolved environmental functions

CHAPTER TWO

2.0 THE COUNTY ENVIRONMENT ACTION DEVELOPMENT PROCESS

The development of the Lamu County Environment Action Plan was coordinated by the Department of Public Health, Environment, Sanitation and Natural Resources on-behalf of County Environment Committee awaiting gazzetment as provided in section 30 of Environmental Management and Co-ordination Act (Revised 2015), 1999. The County is at the advanced stages of gazetting the County Environment Committee to be chaired by the County Executive Committee Member in charge of environmental matters in the County. Through technical backstopping by a technical team from the National Environment Management Authority (NEMA), the County Environment Committee embarked on the CEAP preparation process following the Environmental Action Plan preparation guidelines previously issued by the Cabinet secretary, Ministry of Environment and Natural Resources in 2017 as stipulated in section 40 (5) of the Environmental Management and Co-ordination Act (Revised 2015), 1999.

Section 38 of the Environmental Management and Co-ordination Act (Revised 2015), 1999 specifically provides for NEAP and CEAP to: (a) contain an analysis of the natural resources of the County with an indication as to any pattern of change in their distribution and quantity over time; (b) contain an analytical profile of the various uses and value of the natural resources incorporating considerations of intergenerational and intragenerational equity; (c) recommend appropriate legal and fiscal incentives that may be used to encourage the business community to incorporate environmental requirements into their planning and operational processes; (d) recommend methods for building national awareness through environmental education on the importance of sustainable use of the environment and natural resources for County development; (e) set out operational guidelines for the planning and management of the environment and natural resources; (f) identify actual or likely problems as may affect the natural resources and the broader environment context in which they exist; (g) identify and appraise trends in the development of urban and rural settlements, their impacts on the environment, and strategies for the amelioration of their negative impacts; (h) propose guidelines for the integration of standards of environmental protection into development planning and management; (i) identify and recommend policy and legislative approaches for preventing, controlling or mitigating specific as well as general adverse impacts on the environment and prioritize areas of environmental research and outline methods of using such research findings. The profiling of County environment outlook specifically employed known tools for interrogating the environment including DPSIR framework analysis, opportunity framework analysis and scenario analysis.

The process therefore as guided by the provisions of the EAP preparation guidelines started with extensive desktop review to gather requisite information for drafting the CEAP. Several relevant secondary information sources were traced and reviewed to collect information, consolidate and analyze the information and draft the CEAP following the provisions of the Environmental Action Plan preparation guidelines and the Environmental Management and Co-ordination (Amendment) Act, 2015. The draft CEAP was subjected to a process of County stakeholders' consultations as provided by the Environmental Management and Co-ordination Act (Revised 2015), 1999 and the Constitution of Kenya 2010.

Following drafting of the CEAP by the County Environment Committee and subsequent stakeholder consultations, the report was presented to the County Assembly Committee on

Environment which later presented it to the County Assembly for adoption in compliance with the Environmental Management and Co-ordination Act (Revised 2015), 1999. The adopted CEAP will be implemented to provide the desired outcomes and impact during the CEAP life time. The strategic actions for the CEAP were prioritized using different tools including multi-criteria analysis, pair wise ranking and impact rating. Figure 1 presents the flow of the CEAP preparation process through implementation.

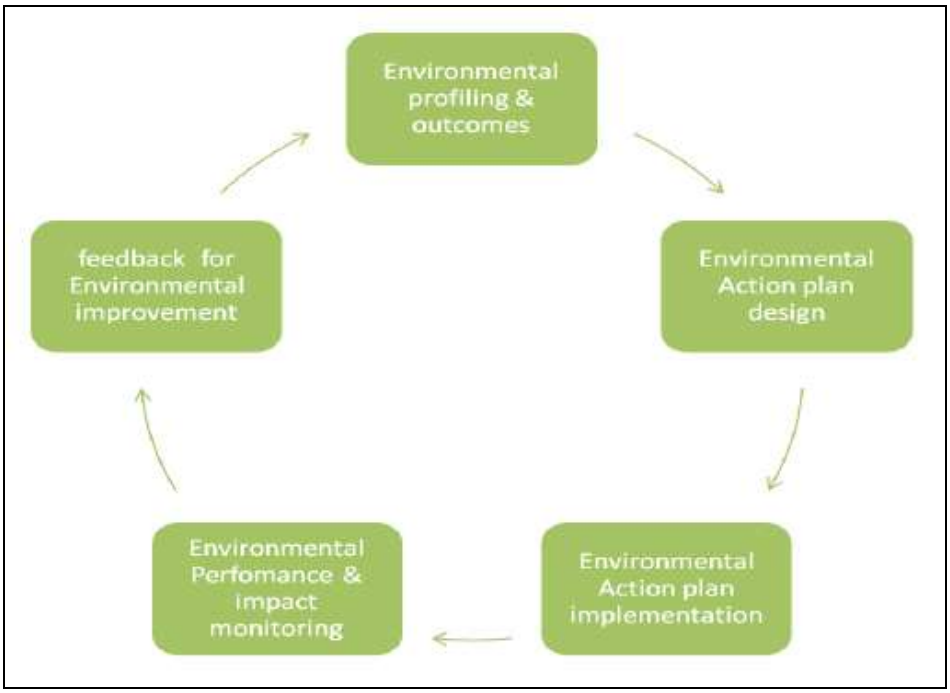

Figure 1. Environment Action Planning process framework flow chart

CHAPTER THREE

3.0 THE COUNTY ENVIRONMENT PROFILE AND OUTLOOK

3.1 County size, extent and placement

Lamu County covers an area of 6,607 Km^2 and is located between latitudes $1^0$40' and 20^{03}0' South and longitudes 40^0 15' and $40^0$38' East in the coastal region of Kenya (Lamu County Government, 2018). The County borders Tana River County to the Southwest and Garissa County to the North, Somali Republic to the Northeast and Indian Ocean to the South with a coastline of approximately 130 Km.

3.2 Geology and Physiography

The County geology is defined by Quaternary to recent sediments mainly of limestone to coral reef stones with sandstones formed from Permo-Carbonferrous through the Tertiary in four Mega-sequences that show variation in grain sizes, porosity and permeability, compaction, shaleness and cementation (County Government of Lamu, 2018). Geophysical studies on Embayment to determine its structure and stratigraphy revealed major transgression and regression cycles that dominated the area during different Mesozoic times and these depositional cycles together with tectonics associated with rifting and separation of Gondwanaland and also of Madagascar from Africa and the occasional doming of central Kenya resulted in a highly deformed basement with thick sedimentary cover due to subsidence and tilting (Simiyu, 1989). Physiographically the major physical features in Lamu County are the Sand dunes which are major water catchments for the County particularly at the Lamu Island, the vast Indian Ocean, some lakes such as Lake Kenyatta, rivers, the mangrove forests along the coastal zone and some forests. The County is largely flat with the highest elevation being about 70 metres above sea level around Walu area (Simiyu, 1989). Section of the famous Tana River delta is also associated with Lamu County and form part of another key physiographic feature of the County.

3.3 Land and soils

The Land of Lamu County is largely flat with a coastal strip connecting the Indian Ocean to the terrestrial environments. Land ownership within Lamu County falls under different categories of land tenure (Ogada et al., 2017). Some of the agricultural lands which are mainly small in size are held under freehold (private ownership), whereas ranches are under leasehold while other types of land tenures include public land and community land (Ogada et al., 2017). According to the County Government of Lamu Integrated Development Plan 2018 -2022, a large portion of land in the County remains unregistered which include areas in Kiunga, Faza, parts of Hindi, Manda Island, Witu and Bahari (Lamu County Government, 2018). Most of these areas are ancestral lands and the government is hastening the process of resettlement whose aim is to also conserve the Swahili villages in the County (Lamu County Government, 2018). A large portion of land set aside for ranch purposes still remains idle and under stocked (Lamu County Government, 2018). Farming is a major activity, especially around the Lake Kenyatta settlement scheme (Ogada et al., 2017). In 2011, it was estimated that the area under the settlements was more than 300km^2 and the impact of settlement had fundamentally changed the natural vegetation and migratory patterns of wildlife (DeJong & Butynski 2011).

Most soils of Lamu County particularly along the coastal zone are commonly sandy developed from either coral rocks, sediments deposited by the sea and rivers, or from sand dunes and soil fertility is moderate to low (Ogada et al., 2017). There are two distinct types of soil; the red loam soils with high clay and silt content, and brown sandy soils with high sand and silica content (Ogada et al., 2017). Sandy soils are especially prone to depletion of nutrients and loss of fertility if not managed properly (Ogada et al., 2017). The soils around the mangrove areas are predominantly unconsolidated collarine, with poor water holding capacity and extreme alkalinity (Boxen et al.,

1987). Sediment deposition is extensive within the sheltered creek waters. Much of the sediments in Kiunga Marine National Reserve could be originating from the adjacent agricultural hinterlands through alluvial deposition (Brakel, 1984).

3.4 Climate change and variability

The County climatic conditions can be said to be between the Tropical Monsoon and Arid Steppe Hot climate with rainfall pattern being bimodal and influenced by the Monsoon winds (Lamu County Government, 2018). Rainfall is characterized by two rainy seasons with the short rains occurring from October to December and long rains from March to August (Ogada *et al.,* 2017). The average annual rainfall in the County range from the highest of over 1000mm in areas like Lake Kenyatta settlement scheme, Hindi, immediate area surrounding Witu with the western side of Lamu Island receiving less than 500 mm of rainfall and are suitable for development of ranches (Ogada *et al.,* 2017; Lamu County Government, 2018). The mean annual minimum and maximum temperatures range between 24^0C to 34^0C respectively and the hottest months are December and April while the coolest months are May and July (Lamu County Government, 2018). The mean annual potential evapotranspiration rate is 2300mm (Ogada *et al.,* 2017). According to the County Environmental Performance Index of 2018, the County was noted to have challenges in addressing solid waste which could contribute to emission of Greenhouse gases that cause global warming and thus could fuel climate change (NEMA, 2018).

3.5 Water Resources and pollution

The inland plain of the County is punctured with seasonal water bodies being mostly large swampy areas and wetlands such as Lake Mkungunya, Lake Amu, Lake Moa and Lake Kenyatta in Mpeketoni which is the only open water site which though has been drying during exceptionally dry periods (Lamu County Government, 2018). Several areas located in Dodori, BeleBele in Hindi, Ziwa la Magarini, and Chomo Ndogo - Chomo Kuu along the Hindi-Bargoni road, Luimshi and Kenza on Nairobi Ranch and Kitumbini and Ziwa la Gorjji in Witu are occasioned by rain water to swamps (Lamu County Government, 2018). Four major catchment areas notably; Dodori Coastal zone, Duldul, the Lamu Bay drainage and Tana River catchments are the key water catchments for the County and only few seasonal streams which flow from the west towards the south eastern part of the County (Lamu County Government, 2018).

There are ox-bow lakes which are important for fisheries, communities also exploit shallow wells for irrigation farming since the water levels in the sand dunes decrease from about 12m to 0.9m or 1.2m (Ogada, et al., 2017). The Tana delta which exists on the border between Lamu and Tana River County is also a major water resource for the County. Lagoons which separate beaches and cliffs from fringing coral reefs with depths varying from a few centimeters to over 10 meters depending on the shore topography and presence of tidal channels are other water resources found in Kiunga, Mikokoni and Kiwayu areas (ESF Consultants, 2016). The hydrogeology studies of Lamu Basin have led to the development of the Lamu Water Supply wells at Chomo wells, the Hindi-Magogoni wells and the Lake Kenyatta (Lake Mukunganya) wells (ESF Consulants, 2016). The hydrogeological studies have also led to the discovery of groundwater occurrence in Sand dune aquifers of recent dunes, at Shella and Makafuni on Lamu Island and Kiongwe on the mainland as well as Karst aquifers developed in fossilized coral limestone on the mainland through percolation into sink-hole type depressions like at Belebele and Chomo (ESF Consultants, 2016)

With very low altitude on the island, the water table is high and there is the real risk of cesspits and latrine may leachate to mix with groundwater (ESF Consultants, 2016). The second and related likely source of water resources pollution is that of solid waste disposal. According to (ESF Consultants, 2016), solid waste is disposed on open dumpsites and hence leachate from open dumpsites can easily serve as contaminants to pollute shallow groundwater. Studies done by

Giorgio, (2005) gave nitrate concentration above 50 mg/l which is above the recommended guideline maximum value by WHO drinking water standards suggesting possibility of seepage from pit latrines due to the drawdown effect where latrines fall within the area of well influence (ESF consultants, 2016). The study also returned Total Dissolved Solids (TDS) results in the field being over 2000 mg/litre indicating high concentration of salts and salinity for groundwater resources in some parts of Lamu County. At the marine ecosystems, the water resources potentially experience pollution from land based sources from effluent discharges and rain-runoffs including plastic pollution. These sources of water resources pollution though require detailed investigations. The farming practices along the delta is likely causing pollution from biopesticides while inland sources of plastic are believed to cause water pollution with plastics at the rivers and ocean. However, patterns of pollution require to be investigated.

3.6 Wildlife, Biodiversity and Tourism

Lamu County hosts rich wildlife resources from the vast dry landscapes through coastal forests and wetlands to the marine ecosystems in Indian Ocean. According to Ogada et al., (2017), the distribution of wildlife in the County is related to vegetation type and the presence of water. Some of the key wildlife species common at the various parts of the County include: Lions,Cheetahs,Leorpards,elephants (*Loxodonta africana*) in areas around Witu Forest Reserve and the Boni-Dodori forest., Buffalos (*Syncerus caffer*) in areas around Siwa grassland, coastal bush-land thicket and northern wooded savannas, Hippopotamus (*Hippopotamus amphibius*) in Lake Kenyatta and the Lumshi swamp, Topis (*Damaliscus lunatus*), Waterbuck (*Kobus ellipsiprymnus*) and Zebra (*Equus quagga*) at the ecosystem around Lake Amu and Lake Kenyatta . Oribi (*Ourebia ourebi*) have also been reported in the County at areas around Lake Amu and Lake Kenyatta (Amin et al 2014). According to ESF Consultants (2016), Hirola (Beatragus hunteri) and Wild dogs (Lycaon pictus) occur at Boni National Reserve and Dodori Forest. The Dodori Creek serve as breeding place for dugongs (Dugong dugon) (ESF Consultants, 2016). The County is also rich in bird life with an estimated 229 species of birds from 61 families having been reported from the combined northern coastal forest ecosystems ranging from Kipini to the Boni-Dodori forest complex (Ogada et al., 2017). Five species of birds are listed as threatened in the International Union for Conservation of Nature (IUCN) Red List and include; the White-headed Vulture (*Trigonoceps occipitalis*), Lappet-faced Vulture (*Torgos tracheliotos***)** and Basra Reed Warbler (*Acrocephalus griseldis*) classified as critically endangered, while Somali Ostrich (*Struthio molybdophanes***)** and Martial Eagle (*Polemaetus bellicosus*) are vulnerable (Ogada et al., 2017). Six other species classified as near threatened include: Southern Banded Snake Eagle (*Circaetus fasciolatus*), Bateleur (*Terathopius ecaudatus*), Crowned Eagle (*Stephanoaetus coronatus***)**, Curlew Sandpiper (*Calidris ferruginea*), Fischer's Turaco (*Tauraco fischeri*) and Plain-backed Sunbird (*Anthreptes reichenowi*) (Ogada et al., 2017). A total of 30 bird species are restricted to this area illustrating the County value as a bird habitat (IBA) and biodiversity hotspot (Ogada et al., 2017). The rich wildlife resources can be attributed to the diverse ecosystems of the County. The rich wildlife however face some threat such as poaching and habitat alterations.

The County has several tourism products particularly the pristine beaches and sand dune landscapes, many heritage sites and monuments, cultural tourism and biodiversity. The County is endowed with tourism support infrastructure including the recently tarmacked Lamu-Garseni high way, Lamu Airport and Mkokoni airstrip that makes it easier for tourists to access both Kiunga Marine Reserve and Dodori National Reserve The tourism sector in Lamu has recently faced myriad of challenges including insecurity and the COVID 19 pandemic However there are a number of untapped tourism related opportunities that calls for tourism product diversification. These include: eco-tourism, homestay tourism, sports tourism, health and wellness tourism among others.

3.7 Coastal Marine and wetlands

The coastal, marine and wetlands resources of Lamu County comprise the Tana delta, lakes, swamps, marshlands, seasonal rivers and the ocean. Lamu County has no permanent rivers except Tana River which straddles both Tana River and Lamu County border and flows to meet the Indian Ocean in an open estuarine delta (ESF Consultants, 2016). The seasonal rivers are Dodori, Arosen, Duldul, Mkondo wa Bargoni, Mkondo wa Kareni, Kitoko and Mkondo wa Mkuyuni near witu. Other important inland wetlands are Dodori creek, Mto wange creek, Ndau Bay, Mto wa Hidio, Mto wa Kipungani and Mto wa Mkunumbi and Kibokoni Lakes which flow from northwest to the southeast, none reaching the Indian Ocean (ESF Consultants, 2016). These wetland resources form unique habitats for aquatic plants and animals.

Most of the County's lakes are quite small and shallow and are typical ox-bow lakes such as Lake Moa, Kenyatta and Dide Waride which are remnants of various meanders of the Tana River (ESF Consultants, 2016). Some of the lakes especially the smaller ones have marsh-like characteristics, and are recharged by rain water. Marshlands are common in Mkunumbi, Baharai, Hongwe, Witu and Hindi Wards. The marshland resources provide fallback grazing areas for livestock during the dry season owing to their water retention capacity.

In the Eastern parts of the County, there are Lagoons found in Kiunga, Mikokoni and Kiwayu areas which serve as stretches of sea water partly separated from the sea by low, narrow, elongated strips of land, reef crests or sand bars separating beaches and cliffs from fringing coral reefs (Richmond, 2002). The depths of lagoons vary from a few centimeters to over 10 meters depending on the shore topography and presence of tidal channels and seagrass beds are commonly found in coastal lagoons with sandy bottoms, while coral heads and micro-atolls may be well developed on more consolidated substrates (ESF Consultants, 2016). The Coastal lagoons are important source of food as they are accessible when fishing on the outer reef which is prevented by rough ocean water (Richmond, 2002).

The Tana delta which form part of the Lamu County wetlands including the coastline and offshore islets, at times hold exceptional concentrations of water birds. Internationally important populations have been recorded here for no fewer than 22 species, making the delta one of the key sites in the country for water bird conservation (Mireri, 2010). The delta also supports one of the very few breeding sites for colonial water birds in Kenya. This is largely near Idsowe, south of Garsen, on Ziwa la Matomba, a seasonally-flooded lagoon where the birds nest in a thicket of *Terminalia brevipes*, usually between May and September but also at other times if the lagoon is flooded. Up to 5,000 colonial water birds of at least 13 species have been recorded nesting here, including *Anhinga rufa* (up to 100 pairs), *Ardea cinerea*, *A. purpurea*, *Egretta ardesiaca*, *Ardeola ralloides* and *Nycticorax nycticorax*, *Casmerodius albus*, *Mesophoyx intermedia* and *Egretta garzetta*, *Anastomus lamelligerus*, *Threskiornis aethiopicus* and *Plegadis falcinellus*, and *Platalea alba*.

The marine environment in Lamu host a range of marine biodiversity such as marine fish, Sea turtles, Dugongs, molluscs, lobsters and prawns but require further inventories. There has been significant siltation in some river beds and oxbow lakes. Increased siltation of the riverbeds and oxbow lakes has been blamed on poor land use practices upstream of the delta as well as prolonged severe droughts followed by rainstorms and floods. More so, the marine environment continues to face increasing pollution from marine litter which is mainly composed of plastics.

3.8 Forests and woodland ecosystems

According to ESF Consultants (2016), the varying soil types keeps the vegetation changing with the Silt and sand largely supporting scrub bushes, scatter palms and indigenous trees and scrubs while the parts that have drainage problems due to low altitude in the region are mainly host grassy open swamps. The coastline dominated by sandy beaches have mainly mangrove with the County hosting the largest land area with mangroves that support bivalves, snails and other benthic

invertebrates (ESF Consultants, 2016). The wooden bushlands are a common terrestrial vegetation feature confined to the stabilized sand dunes, Beach ridges, low and high level coastal plains and bottomland plains while the black clay soils also support wooden bushland dominated by *Acacia tortilis, Acacia zanzibarica, Commiphora sp, Euphobia spp, Acacia melifera, Trichilla emetic* and *Teminalia spp* (ESF Consultants, 2016). In Areas around Witu, the dominant woody plants include; *Lannea schweinfurthii, Oldfieldia somalensis, Manilkara sulcate, Salacia madagascariensis, Nectaropetalum kaessneri, Uvaria acuminate, Cassipourea euryoides, Diospyros spp., Combretum spp, Strychnos spp., Heinsia crinite, Dovyalis sp., Grewia plagiophylla, Philenoptera bussei* and *Cassia* spp. (Ogada et al., 2017; Kuchar Mwendwa 1982).
At Pate Island, Riverine forest occur and they are predominantly composed of woody vegetation found along waterways including *Acacia spp, Afzelia quanzensis, Indigofera Spinosa, Dalbergia melanoxylona* and *Termimalia spp* which dominate riverines of Dodori and Lugga Milimani (ESF Consultants, 2016). Perhaps the most important type of natural vegetation in Lamu County is the mangrove forests and thickets and Pate Island supports largest mangrove forest archipelago and the island is surrounded by mangroves conferring high productivity to the surrounding fisheries and also providing valuable mangrove products for local communities (ESF Consultants, 2016). Large concentrations of mangroves in the County occur in areas such as Ndau, Kiwayu, Kiunga, Kizingitini, and Mikokoni and Siyu and include species such as *Rhizophora mucronata, Brugueria gymnorhiza, Ceriops tagal, Sonneratia alba, Avicenia marina, Lumnitzera racemose* and *Xylocarpus granatum* (Kairo et al., 2002; ESF Consultants, 2016). A salt marsh specially found at landward margins of Kiunga and Mikokoni areas are dominated by halophytic (salt tolerant) herbaceous plants which includes; glassworts (*Salicomia spp. And Sarcocomia spp.),* the cord grasses (*Spartina spp*) and several grasses and sedges including green algae and *Zostera species*. Dwarf shallow-like shrub thickets of halophytes typical for this region littoral zone are common on the mainland, and species include *Ipomea species, Perus species, Suaeda species* and *Tephnosia species.* An invasive tree species called *Prosopis Juliflora* has spread in to the area and is threatening to replace most of the indigenous vegetation. The natural forests provide a range of building products that include poles, posts and timber, used on subsistence and commercial level, and supports the building of cottage industries. Often, harvesting of these products has led to degradation of some of the critical forests. The County as at 2018 though had a forest cover estimated at 33.9% which is one of the highest in the country.

The Restoration Initiative and County Environment Action Plan

The restoration initiative is a global agenda which is built around the Bonn challenge commitments on forest landscape restoration perspective. The concept is to bring 150 million hectares of degraded and deforested land into restoration by 2020 and 350 million hectares by 2030. The initiative has witnessed enormous global support and to date more than 100 million hectares have been pledged to the Bonn Challenge. In Africa, seventeen nations have contributed 63.3 million hectares and continue to spearhead the initiative through programmes such as AFR100. This initiative (Forest landscape restoration) is founded on a process of regaining ecological functionality and enhancing human well-being across whole deforested or degraded landscapes. The process therefore on offering of multiple benefits and land uses over time. The implementation of the initiative is promoted not only through just planting trees but multifaceted approaches including but not limited to only restoring landscape but also including naturally regenerated areas, agro-forestry, on-farm trees, mangroves, protected areas, plantings of trees and other woody plants like bamboos, and others. Through this diverse approach, restoration takes an active dimension that brings local communities and other stakeholders together to identify and implement appropriate restoration activities suitable to their local situations. The initiative has registered major benefits across the landscapes where it has been initiated.

In Kenya, The Restoration Initiative has also gained momentum and the country has made commitments in the range of 5.10 million hectares towards forest restoration initiative. Various restoration activities are ongoing largely under the leadership of the Ministry of Environment and Forestry to bring the country to a forest cover of 10% by 2022. The country has since stepped up this target with an ambitious goal of planting 15 billion trees and increase the forest cover to 30% by 2032. The country has also benefited from two GEF funded projects to leverage the government efforts and among them is the Tana River Delta project entitled "Integrated natural resource management and restoration of degraded landscapes in the Tana Delta" to be executed by Nature Kenya. The project which will be one of the game changers in restoration initiatives in Kenya will bring restoration work to Lamu County and therefore contribute to the implementation of the County Environment Action Plan. Major strategic actions to address the environmental challenges of the County revolve around forests afforestations, reafforestations and restoration. The County has previously suffered major losses of key forest landscapes which are key for unique, endemic and even threated biodiversity. Fortunately, though, as at 2018, the County tree cover stood at 33.9% way above the constitutional threshold of 10%. The County Environment Action Plan has placed a commitment of increasing the County tree cover to 45% by the CEAP end life in 2026. Working jointly with partners such as Nature Kenya, the Lamu County Government will therefore rollout an ambitious forest landscapes restoration which has been mainstreamed to the monitoring and evaluation plan.

3.9 Agriculture, livestock and fisheries

Crops

Crop farming, pastoralism and fishing are the main agricultural activities of the County. A wide range of crops that include maize, cowpeas, cassava, coconut, cashew nut, bixa, cotton, simsim, citrus, and tomatoes among others are grown in the County under rain-fed system. The productivity of these crops is still below optimal levels expected mainly due to low use of farm inputs and unreliable rainfall.

Lamu County Crop Production Statistics for 2020-2-21.

Crop	Area (acres)	Yield in Tons	Value in '000 Kshs
Maize	34162	71,740	1,793,500
Cashew nut	42730	12,819	512,760
Cotton	3533	5,300	254,400
Mango	13708	23,304	466,080
Watermelon	25214	73,120	1,462,400

Source: Lamu County Annual Progress Report for 2020-2021

There are no large irrigation schemes in place and only a number of individual farmers who have adopted simple irrigation technologies especially around swamps, water pans and shallow wells practice irrigation farming (Lamu County Government, 2018). The County has experienced a general expansion of acreage of both food and cash crops due to increased access to farm tractor services offered by County Government at subsidized cost (Lamu County Government, 2018). At the farm level, farmers are faced with the problem of land degradation impacting negatively on

crop production mainly due to reduction of soil fertility, increased soil compaction and reduced water infiltration (Lamu County Government, 2018). Some farming practices such as shift cultivation and "slash and burn" practiced mostly in Lamu East and the indiscriminate bush clearing ("*Witemere*") in Lamu West exacerbate degradation of the land (Lamu County Government, 2018). Current farming trends have not realized optimal farm productions levels especially due to climate change challenges causing low, erratic and unreliable rainfall accompanied by a shift in days of onset and cessation of rains. Farmers are also experiencing outbreak of new pests especially fall armyworm, increased mite incidences and millipedes. Most of the hybrid seeds have experienced low yields compared to traditional landraces. Parts of Hongwe ward have experienced high flooding incidences in the recent past affecting food production due to serious waterlogging. Coping mechanisms used by farmers have been excavation of drains to drain excess flood water as well as planting Nerica rice. Use of fertilizer and pesticides in mainly practiced in Lamu West for control of pests in horticultural crops mainly watermelon and tomato in Bahari and Hongwe and in cotton production. There is a serious problem of misuse of pesticides in Bahari and Hongwe for water melon, tomato and cotton production. Farming in Lamu East is mainly organic as use of farm inputs is very low considering there are no input stockists available. Presently there are no agro-based industries though some farmers' groups and individuals process cashew nut though frying mainly in Mpeketoni and Amu Island though this is done on a very small scale. Agricultural waste mainly stover is recycled through animal feeding and poses no significant environmental threat.

In management of the environment, it will be important to come up with a policy on management of pesticide containers as they pose the greatest risk to the environment. This gives the community an opportunity to incinerate the wastes. The Department of Agriculture should work with stakeholders and promote increased use of organic pesticides as they are safer to the environment. Coconut shell which are normally left lying around act as mosquito breeding sites and need to be used as fuelwood. The traditional method of "*slash and burn*" is harmful to the environment and should be discouraged as it destroys the soil micro-flora and pollutes the environment and destruction of fragile plant species.

Farmers need to be encouraged to adopt mixed farming practices, crop rotation, conservation tillage, regenerative agriculture, and push and pull methods to reduce environmental degradation. Promotion of cottage industries as well a policy on Cottage Industries would be a big milestone in sorting marketing problems for farmers in Lamu. Lamu being a major producer of simsim may need further research on simsim to come up with high producing varieties.

Livestock

The main livestock species reared are Cattle, Sheep, Donkeys, Goat and Poultry (Lamu County Government, 2018). Cattle and goats are reared in 2 rearing systems: Pastoralism mainly practiced in Hindi (Kibokoni, Kilimani and Bargoni), Mkunumbi (Ndambwe, Mkunumbi, Koreni), Bahari Ward (Mlei, Lake Amu) Hongwe war Lumshi A&B, Pangani) Witu ward (Moa, Chalaluma, Didewaride, Nagele, Kitumbini, Nairobi area) (Lamu County Government, 2018). There are 20 ranches/grazing reserves in the County in four Status i.e. operational ranches which are four (Witu Nyongoro DAC Ranch, Witu Livestock Cooperative Ranch, Amu Cooperative Ranch and Mokowe Kibokoni Cooperative Ranch) and the rest of the ranches are idle and not operational (Lamu County Government, 2018).

Fisheries & Blue Economy

Fishing practices: Results of the most recent frame survey (Government of Kenya, 2016) indicate that over 20 gear types are used, with the five most common including gillnets, basket traps, handlines, and beach seines. Some fishers use a combination of fishing gears to target different species to optimize their catches and hence maximize profitability. Most fishers in Lamu use longline hooks for fishing (4,659), followed by gillnets (1,847) and monofilament nets (1,134). Other gears used are handline (616), scoop net (582), hooked sticks (147), hand gathering (146), prawn seins (126), basket traps (105), reef seins (72), beach seins (64), trolling lines (50), small basket traps (31) and fence traps (20). Use of prohibited gears such as beach seines and monofilament nets remains prevalent despite being designated as illegal since 2001 (Kenya Gazette Notice No. 7565). Beach seines are among the most destructive, significantly capturing a high proportion of juveniles and reducing coral cover in areas where they are used (KMFRI, 2018). Beach seines are most abundant in Lamu County constituting 49% of the total number of fishing gears recorded.

The use of monofilament is regarded as one of the causes of ghost fishing which is described as the continuation of fishing by fishing gear of which control has been totally lost. The use of monofilament can be both active and passive. Active monofilament may be lost due to entanglement with bottom obstructions such as wrecks and reefs, whereas the passive ones may also be lost due to rough weather or accidentally damaged or dragged away by active fishing gear or by vessels. Both types of monofilaments, if defective, may also be discarded at sea by fishermen. Passive monofilament, may continue to fish for several years after control over the gear has been lost, and thereby may cause a substantial unaccounted fishing mortality. In addition, although they are highly selective for target species, lost passive fishing gear can continue to function, catching target, non-target, and even protected species (A. Ayaz et al.; 2006)

Fish keeping practices and their impact on the environment: Aquaculture in Kenya gained ground during the initiation of the implementation of the Fish Farming Enterprise Program (FFEP) or shortly Economic Stimulus Program (ESP) in FY 2010/11 period. The objective of this government program was to create wealth and employment to the vulnerable members of society. Fisheries as a sub-sector identified fish farming as its core contribution to address unemployment amongst the youth and other members of the society. Towards this end, Lamu was allocated four hundred (400) fish ponds for construction, 200 in each sub County of Lamu West and East. However, due to topographical constraints of Lamu East, almost all the fish ponds were constructed in Lamu west. In Lamu, most of our fish ponds were to be rain fed through water harvesting but due to the foregoing i.e. adverse climate (prolonged drought), etc., the venture has been on the downward trend leading to pond abandonment and the number of fish farmers hanging on since the ESP initiation is vague. Draining these ponds may lead to the introduction of non-native species to the natural water bodies, or even fertilizing the water bodies which may lead to hypoxic conditions and finally fish suffocation. The draining of fish ponds may also cause siltation of natural water bodies.

Climate change vulnerability of fisheries sector: Due to the drought, high temperatures, siltation and reduced depth levels (which are attributed to climate change), the physical-chemical parameters of the lakes has also changed leading towards salinity and it is feared that quite a number of fish species have disappeared under the current conditions. This situation has also led into destruction of the fishermen's boats due to being under dry docking for prolonged periods without any activity. As per the foregoing, there is no doubt that the social economic status of the fishing community who once relied on these vibrant lakes for income generation have plummeted over the years to unprecedented levels and there arises need for intervention.

This scenario has been evident in our County where it has impacted negatively on water levels in ox bow lakes of Mpeketoni and Witu and other small dams and pans. The truth is that it has threatened the life of some lakes in our County and hence in effect the livelihoods of the communities who depend on these natural resources to meet their day to day needs. The situation has been seen in declining trends in fresh water fish production on monthly basis and this scenario does not auger well on these communities' poverty levels which has increased over time.

Due to these state of affairs, there arises the need to arouse a serious approach through well thought intervention measures in consultation with the relevant stakeholders to improve/restore the status, including management and conservation of these ecosystems in maintaining the inherent biodiversity amongst other ecological issues.

Fisheries wastes can be nuisance to the environment. However, they can be converted to fish feeds which have high nutritional value.

Appropriate production systems: For decades, Lamu community has been over depending on inshore capture fisheries leading to decrease in marine productivity. Therefore, to alleviate the pressure on marine capture fisheries, we need to re-orient the fishers to direct their fishing efforts to inland water resources and mariculture. Since the ox-bow lakes, dams and water pans in Lamu County have realized their water capacity levels, there has been a stakeholders' concern that the production levels have gone down and thereby creating a dire need to restock the aforementioned resources. This will ensure food security in the County as enshrined in the Four Big Agenda. Mari-culture, farming of marine species, can also reorient fishers to focus on complementary livelihoods and alleviate pressure on marine capture fisheries.

The potential in **fish processing and value addition** to create more job opportunities to youths and women, increase wealth and also generate more revenue to the County has not been addressed. In order to take advantage of the existing potential in fish processing and value addition of fish products, it is recommended that the sector partners with private investors in Lamu by having refer containers in Kiunga, Kizingitini, Mtangawanda, Amu and Mokowe. These landing sites are either strategically positioned to act as aggregating centers for fish landed in neighboring landing sites or over years have recorded high fish landings. A profitable medium sized cottage needs to process at least 4-6 tons of fish per day. The challenge is always the ability to supply the processing cottage with fish without resorting to frequent costly closures due to unavailability of fish. However, there is a potential business sense to exploit existing immense potential in fish processing and value addition. While it is viable for one to primarily focus on fishing only, it is imperative to be cognizant of the fact that processing is more profitable because of the value addition to the catch which ultimately creates more opportunities to youth and women in the community. On the other hand, a stand-alone fish processing cottage can also be fed by Distance Water Fishing Fleets owned by foreign countries as Kenya does not have Kenya flag ships for fishing.

Fish Marketing: once fish caught in Lamu waters is landed at the landing sites, is weighed and sold to the fish traders who later on ferry the same for the markets in Malindi and Mombasa. However, a market dichotomy does exist where whole fish and, tuna and tuna like fish which are seasonal (caught between the month of September and April using long lines and hand lines) are sold in Mombasa while the smaller fishes (with acceptable size as per fisheries regulations) from the reef and seagrass are sold locally within Lamu. It is important to label (eco-labeling) well the products by clearly stating the type of fishing gear used, with dates and the source of the fish (fishing grounds). This is key in attracting more markets and increase sales volume. Once the products are well labeled and use of eco-friendly fishing gears used it will be easy to market the fish products from Lamu since the branding strategy reflects the sensitivity of Lamu people on environment. Show casing during fishing competition and other exhibitions locally, nationally and internationally will attract more investors and attract international market. Use of radio, television

and print media to advertise the products available and their prices is an avenue that can be used to market the fish and fish products. In addition, contemporary information and communication technologies provides an important platform for marketing fish and fishery products.

Recommended policy measures: Lamu County requires a policy on the establishment of co-management areas for the sake of protecting marine fisheries and establishment of locally protected areas. The County also needs to formulate a policy on the establishment of mariculture projects within the Lamu waters for the sake of reducing pressure on the marine environment caused by capture fisheries. The County only has a spatial plan for the terrestrial environment, but it lacks a spatial plan on marine environment. The marine spatial plan is very important for the marine demarcation which helps separate areas for mariculture from areas of maritime transport, offshore oil & gas exploration activities among many others.

Recommended areas of research: The Fisheries sector in Lamu County is still lacking data on different aspects of fisheries. Therefore, the sector in Lamu County is still in need of research on mariculture of different species in our waters such as sea cucumber, seaweeds, octopus, milkfish and other species and farming techniques such as the use of submerged, semi-submerged and floating cages and intertidal ponds among many others. If research could be done on the above subjects and fishers are privileged to use those alternative means of livelihoods, the fisheries sector will advance and the local economy will boom.

Environmental challenges: Fishing is an important source of food, income and employment (Ogada et al., 2017). However, the sector faces different challenges. The challenges include, but not limited to population increase which lead to more pressure being exerted on capture fisheries due to high demand of fish and high rate of unemployment, use of inappropriate and destructive fishing gear such as monofilament (1,134) and beach seins (64), weak regulated and Illegal, Unreported and Unregulated (IUU) fishing and siltation of oxbow lakes and pollution from marine litter, the sustainability of fishing in the County may be uncertain. Overharvesting of mangrove forest is also a factor leading to the decline of fish stock because mangroves act as both foraging grounds and habitats for different fisheries resources such as fish and crabs. Encroachment of beaches threatens breeding of sea turtles, and pollution especially from the excavation and ocean dredging activities at the Lamu port area and from the ballast water also pose a challenge in the marine fisheries sector. Ballast water may lead to the introduction of non-native species which can be harmful to the marine environment and to the native species.

Solutions to the identified environmental challenges: The sector recommends diversification of livelihoods which may include the introduction of mariculture in Lamu County and introducing fishers to alternative and complementary livelihood activities. This will reduce the rate of capture fisheries hence reducing pressure on the artisanal fisheries. The sector also recommends gear exchange program that will ensure exchange of destructive gears with more environment friendly fishing gears. Enforcement of existing fisheries laws by Kenya Coast Guards, Kenya Fisheries Service and the County Department of Fisheries needs to be enhanced. The Forest department in collaboration with Community Forest Associations need to put Forest Management Plans in place in order to protect and sustainably utilize our mangrove forests for the benefit of the current and future fishers and the entire coastal communities who majorly depend on fish for livelihood and as the cheapest source of protein. Encroachment of beaches is a threat to our oceans and other species like sea turtles. Therefore, National management Authority needs to stay firm in rejecting any development project which is not 30 meters away from the high tide of our Indian ocean. Dredging activities at Lamu Port needs to be checked and done with environmental mind-set in order to avoid any environmental perturbation which is harmful to the entire marine ecosystem. Ballast water needs to be released at a distance of about 200 NM away from the port. Furthermore, all the precautious measures proposed by the International Convention for the Control and Management of

Ships' Ballast Water and Sediments, 2004 which came to effect in 2017 needs to be adhered to for the benefit of our fisheries resources in specific and the marine ecosystem at large.

3.10 Settlement, Urbanization and transportation

The population settlement and distribution in the County is influenced by a number of factors including access to economic opportunities such as agriculture, livestock keeping, fishing and trade (Lamu County Government, 2018). The situation is such that over 50 percent of the County population lives in Amu and Mpeketoni in Lamu West Constituency, whereas Lamu East Constituency accounts for 17 percent of the County population and Witu which is predominately a livestock zone is occupied mainly by the Orma community (Lamu County Government, 2018). Mpeketoni, Hindi and some parts of Witu are settlement schemes and are predominantly agricultural cosmopolitan areas whereas apart from Lamu, the other islands comprising Pate, Kizingitini, Ndau and Siyu are mainly occupied by the Bajuni community and Kiunga by the Boni and Bajunis communities (Lamu County Government, 2018). Kizingitini Division which is the smallest division as at 2018 had the highest population density of 622 persons per Km^2 followed by Amu and Faza Divisions with 295 and 119 persons per Km^2 while Kiunga and Hindi divisions had low population densities of three and eight persons per Km^2 respectively (Lamu County Government, 2018). These population densities have implications on environmental conservation as the higher the population density, the higher the likelihood of high pressure on natural resources such as forests among others.

The key County urban centres are at Lamu Island, Mokowe which is now the administrative capital of the County. Other towns in the County include; Witu, Muhamarani, Mkunumbi, Hindi and Kiunga (Lamu County Government, 2018). Previously, urbanization in the County was concentrated at the Lamu Island but following the implementation of the devolved governance and opening of the County through expansion of the road network, more urban centres are emerging. The Lamu port project which is nearly completed is also expected to lead to major urban growth around the port once operational.

The key forms of transportation in the County comprise of sea, air and road transport. The total length of all classified roads in the County is 688.6Km with bitumen surface covering 6Km, gravel surface 161.1Km and earth surface 521.5Km (Lamu County Government, 2018). The most important trunk road in Lamu County is the Malindi-Garsen-Mokowe Class C road which constitutes a high accessibility development corridor. Other important National roads in the County include the Hindi-Bodhei road that connects the County to Garissa County and extends to Milimani Road up to the border with Somalia through Basuba and Kiunga (Lamu County Government, 2018). Sea transport is another important form of transport in the County and dates back a very long time and is very important because it links Lamu with other port Cities in/and outside Kenya. The upcoming LAPSET project is expected to boost the sea transport of the County immensely. There are several jetties but the most important ones are the customs (Kenya Ports Authority) jetties on Lamu Island and the Mokowe jetty on the mainland with other jetties operating at Mkunumbi, Kizuka, Magogoni, Kizingitini, Mtangawanda, Siyu, Matondoni among others (Lamu County Government, 2018). There is currently one airport located on Manda Island (Manda Airport), and 12 airstrips in the County found in Mokowe, Witu, Mkunumbi, Pate, Siyu, Tenewi, Mangai, Kizingitini, Kiwayuu, Mkokoni, Kiunga as well as in Mararani and apart from Manda airport, all the other airstrips do not have regular flights (Lamu County Government, 2018).

3.11 Energy, Mining, Industry and trade

Lamu is supplied with electricity from the main grid and there is also use of solar power at household level. The County has high potential for renewable energy particularly solar energy and some residents of the County are tapping solar energy (Lamu County Government, 2018). Previously, there has been plans for Coal powered energy generation under the Amu power project and a wind power project to be set-up at Kiongwe, Bahari Ward - Mpeketoni (Lamu County Government, 2018). The use of wood fuel for cooking and kerosene for lighting is still common particularly at the rural areas (Lamu County Government, 2018; NEMA, 2018). The common use of wood fuel at the rural areas present a concern for de-vegetation of the remaining County forests and woodlands which require to be addressed through innovation of cheap energy saving technologies. More so, the coal power plan as has previously been noted, may present some environmental concerns related to air pollution and climate change and may require a detailed reflection.

Studies by Simiyu (1989) on well logs have shown that the area has good source of reservoir and cap rocks that could combine very well with the closed highs to accumulate oil and gas pools. As a result, the County has previously been subject to several oil and gas explorations. Among those who have made oil and gas bioprospecting previously include; shell and Zarara oil and gas limited (ESF Consultants, 2016). In industry and trade, the County processing facilities are inadequate and have continued to constrain marketability of particularly perishable goods such as fruits and vegetables and there is only one known processing unit, the outdated Mpeketoni ginnery that has left farmers to sell their crop produce in raw form (Lamu County Government, 2018). The County has two main markets, namely Lamu Town and Mpeketoni Central. Lamu Town which is the main urban centre is famous for its rich cultural activities and a world heritage site while Mpeketoni Central is famous for trading and agricultural activities. There are several other trading centres located along the road which include the following; Mokowe, Hindi, Hongwe, Bomani, Majembeni, Kiongwe, Baharini, Mapenya, Mkunumbi, Uziwa, Faza, Kizingitini, Pate, Siyu, Kiunga, Mkokoni, Mhamarani, Katsakairu, Witu and Moa (Lamu County Government, 2018).

3.12 Health sanitation and waste

Lamu County lacks a sewerage system for connecting the effluent discharge and commonly the communities use pit latrines which cover only about 65% of the County (Lamu County Government, 2018). Thus the effluent from the various facilities flow to the Indian Ocean (ESF Consultant, 2016). The lack of a sewerage system from an environmental perspective poses a major pollution concern to the ground water and other water resources such as the marine ecosystem. The County has only 2 secured disposal sites in Amu and Shella with the remaining towns lacking disposal sites and the waste at the dumpsites is managed by open burning (ESF Consultants, 2016; Lamu County Government, 2018). According to Lamu County Government (2018), the County lacks waste management policy, which is necessary for effective operation of solid waste management and even consolidated structure on solid wastes management and also the department responsible for solid waste management is challenged with human resource shortage including street orderlies. Inadequate solid waste management may also result in environment pollution. Generally, the level of population with access to improved sanitation in the County has been provided at 38 per cent and the population having access to solid waste services has been placed at 26% (NEMA, 2018).

Health facilities in the County also lack incinerators for effective disposal of medical wastes. This calls for regular monitoring of medical waste management as it can cause serious environmental and health risks to the community neighbouring the health facilities across the Counties.

3.13 Environmental Hazards and Disasters

Lamu County experiences several disasters mainly associated with effects of climate change. The key disasters include severe droughts, flooding and previously tsunami that result in rise in sea levels along the coastal zone. Intrusion of salt waters upstream at the Tana Delta and drying of Lake Kenyatta previously results in disasters. Loss of biodiversity, degradation of rangelands through soil erosion particularly on farm lands, pollution of wetlands and marine ecosystems and destruction of forest habitats along river basins, and mangroves are also environmental threats that are approaching environmental hazards and disasters if not managed. Invasive species especially *Prosopis juliflora* (Mathenge) threatens natural ecosystems, biodiversity and local livelihoods especially livestock keeping.

3.14 Research, technology and innovation

Lamu County has been subject to research for several years with many focused on discovery of the biodiversity of the County and geological studies for oil and gas bioprospecting some dating decades before devolution. Some of the research work undertaken at the County include those of Simiyu (1989), Kairo (2002), Ogada et al. (2017), Musina et al., (2015) and Stokes, et al., (2016). Following the rollout of the devolved governance, the County Government has continued to promote research, technology and innovation to generate information for application in advancing the County socio-economic development while mainstreaming environmental interests. The County Government therefore partners with a range of researchers and innovators in driving research, technology and innovation in the County. Among key collaborators are the Kenya Marine and Fisheries Institute (KEMFRI) on marine research and blue economy. The County though does not host a university or research institute that can serve as a research, technology and innovation incubation hub. Thus the County requires to strengthen collaboration with national and external research and innovation incubation hubs outside the County for accelerating technological and innovations development to guide policy development and implementation.

3.15 Environmental Education, Information and communication

Environmental education, information and communication is vital for promotion of sustainable environment conservation and management. The Lamu County has a Department for Environment steered by A County Executive Committee Member and spearheads matters of environment conservation in the County in collaboration with public and private stakeholders. Environmental education, information and communication comprise part of the key strategies the Department employs to promote environment conservation in the County. Several schools have environment or wildlife clubs that contribute in increasing environmental education, information and communication. The inventory of the school environment/wildlife clubs though require to be undertaken to assess their capabilities for strengthening as vehicles for advancing environmental education, information and communication in the County. Several National agencies like the National Environment Management Authority, Kenya Wildlife Services and Kenyan Forest Service including a range of Public Benefits Organization such as Nature Kenya also complement the County Government in offering environmental education, information and communication while implementing their mandate. Some of the environmental education, information and

communication is done through organized forums, meetings, local radio, Television channels and social media.

3.16 Environmental Governance, compliance and enforcement

The Constitution of Kenya 2010 in part 2 of the fourth schedule as read together with Articles 185(2) 186(1) and 187(2) of the Constitution provide for a range of devolved environmental functions. As stipulated in Part 2 of the Fourth Schedule, the devolved environmental functions include agriculture; control of air and noise pollution, solid waste management and other public nuisances; County planning and development; implementation of specific National Government policies on natural resources and environmental conservation, which include soil and water conservation as well as forestry; and County public works and services. Therefore, the Constitution of Kenya 2010 provides for County Governments to play a central role in matters of environmental governance, compliance and enforcement.

The Environmental Management and Coordination Act (revised 2015), 1999 in recognizing the role of County Governments in Environmental Governance provided for the establishment of the County Environment Committee (CEC) gazetted by the County Governor under section 29. The functions of the County Environment Committees (CECs) are provided under section 30 of the Act. The key function of the CECs is to ensure proper management of the environment within the County. The County Environment Committee comprise members from both National and County Government as well as private sector stakeholders and in so doing provide the best platform for Environmental Governance in the County. Lamu County Government is in the process of gazetting the County Environment Committee chaired by the CEC member in charge of environment and with NEMA County Director of Environment as the secretary. The CEC has however not been trained on its roles. The CEC will therefore require training on its roles and functions in order to effectively discharge is mandate as soon as it is gazetted. Moreover, discharging the CEC functions will require support from the County Government and other stakeholders.

Section 47(3) of the Forest Conservation and Management Act requires County Government to prepare management strategies and plans with respect to forests in the County. Pursuant to this requirement the County Government of Lamu working jointly with relevant stakeholders is finalising preparation of Lamu County Forest Policy. Once in place the policy will provide a framework for sound management and conservation of forest resources in the County. Preparation of management plans by the County Government of Lamu is imperative to implement the Forest Policy once in place.

Other laws, policies and plans the County Government of Lamu is working to put in place in order to effectively discharge its functions as contemplated under Part 2 of the Fourth Schedule include: ongoing preparation of Lamu County Climate Change Policy; preparation of Lamu County Climate Bill; preparation of Forest Land Restoration Action; and Waste Management Policy for Lamu Municipality. Once in place these legal frameworks will go a long way in helping the County Government to strengthen environmental governance, compliance and enforcement. Continuous assessment of areas that require legislations and provision of bills for enactment to support implementation of all the devolved environmental functions is imperative. Moreover, allocation of adequate resources (human and financial) to implement the plans and policies will be key in realizing effective Environmental Governance in the County.

3.17 People, Environment, Economy and Development

According to Kenya population census survey of 2019, Lamu County has a population of 143, 920 comprising of 76,103 males and 67,813 females (KNBS, 2019). According to the County Integrated Development Plan (CIDP), the County population is expected to have an increase of 17.7% between 2018 and 2022 (Lamu County Government, 2018). The County with 62.2% of the population living in absolute poverty, and with the population growth rate of 2.8 per cent, the projected increase in population has a major and direct impact on the basic needs such as food, water and other natural resources such as wood fuel and building material. The population distribution in the County is influenced by a number of factors including access to economic opportunities such as agriculture, livestock keeping, fishing and trade. In the water sector, the expectation is that the available water sources of river Tana will have to be tapped to increase the volume of clean water for consumption affecting the ecological conditions of the river system. According to the County Integrated Development Plan (CIDP) the County has a life expectancy of 53.8 years compared to the national life expectancy of 57.9 years while adult literacy rate of the County is 33.9 per cent compared to national adult literacy rate of 87.38 per cent which are key factors that determine the County human development index (Lamu County Government, 2018). Whereas the County demographic dividend is under transition, the demographic window will be achieved when those aged below 15 years in the County are less than 30% of the total population and those aged 65 years and above in the County are less than 15% of the population and this is expected to be achieved by 2064 (Lamu County Government, 2018). The concerns with the current status of human development index and demographic dividend indicate concerns for the County population socio-economy, development and subsequently environmental conservation, economy and overall development. Therefore, the County requires to provide policy interventions for promoting the County human development index and demographic dividend.

3.18 Environment and climate change finance

The climate change Act, 2016 provide the legal framework for the management of climate change in Kenya by both National and County Governments. Section 19 of the Act mainstreams the climate change actions into County Government functions and provides that; A County Government shall, in performance of its functions, integrate and mainstream climate change actions, interventions and duties set out in the Act and the National Climate Change Action Plan into various sectors. Secondly a County Government shall play a role in the development, updating and approval of the County Integrated Development Plan and the County Sectoral Plans shall mainstream the implementation of the National Climate Change Action Plan, taking into account national and County priorities. Thirdly, the Governor of a County shall designate a County Executive Committee Member to coordinate climate change affairs and a County Government may enact legislation that further defines implementation of its obligations under this Act, or other climate change functions relevant to the County or such other related purposes. Under the climate change Act section 19 (4), the counties in making legislations can make provisions of climate change finance such as establishment of Lamu County Climate Change Fund to mobilize resources from public and private sectors to support climate change management actions.

In responding to the climate change Act, 2016, Lamu County through the County Integrated Development Plan (2018-2022) has prioritized for strengthening of climate change finance for the County through legislation and targeted resource mobilization in collaboration with stakeholders.

3.2 Summary of Environmental challenges in Lamu County

The table below provides a summary of some of the prioritized environmental issues, problems and challenges identified at the County level through consultation with various stakeholders including the sector departments. These environmental issues have resulted from the analysis presented in the County environmental profile and Outlook.

SNAPSHOT OF COUNTY ENVIRONMENTAL CHALLENGES	
Environmental Component	**Environmental issues/challenges**
Land and soils	Soil erosion
	Soil pollution from agro-chemicals
	Decline in soil fertility due to erosion and unsustainable utilization
	Land degradation due to communal land ownership challenges
Climate change and variability	Extreme weather events that result in erratic rainfall and changes in average minimum and maximum temperature day and night temperatures
	Severe droughts that affect biodiversity, ecosystems and people livelihoods
	Enhanced rainfall leading to floods that affect the natural landscapes
Water resources and pollution	Declining water level from major water sources i.e. Lake Kenyatta and other wetlands during severe droughts
	Destruction of water catchments i.e. sand-dunes and forests
	Intrusion of sea water specially at the delta affecting the wetland and biodiversity
	Freshwater pollution by agro-chemicals and marine litter like plastics
Wildlife, Biodiversity and Tourism	Decline in species populations and shift distributions patterns due to habitats loss and degradation
	Spread of invasive species i.e. *Prosopis multiflora*
	Human - wildlife conflicts
	Poaching

	Limited availability and access to data on biodiversity
Coastal Marine and Wetlands	Encroachment and destruction of riparian lands
	Declining water levels at the wetlands
	Pollution by agro-chemicals and litter
	Siltation in riverbeds, oxbow lakes and the delta
Forests and woodlands	Deforestation due to illegal harvesting of building materials and clearance for settlement and farming.
	Spread of invasive species i.e. *Prosopis multiflora*
Agriculture, Livestock and fisheries	Destruction of native forests and wetlands through unsustainable agriculture
	Agro-chemicals pollution on soils
	Overfishing
	Overgrazing
Settlement and urbanization	Solid waste accumulation and pollution
	Waste water effluents pollution
	Intensification of settlement and development projects altering natural landscapes i.e. at Lamu Island
	Increase in unplanned settlements i.e. in Lamu Island
Energy, Mining, industry and trade	Indoor air pollution from high dependency on wood fuel and paraffin
	Destruction of habitats through mining explorations
Health, sanitation and waste	Lack of sewerage system
	Lack of sanitary landfills
	Lack of appropriate incinerators for medical wastes
Environmental Education, Information and Communication	Limited awareness on environment conservation
	Limited capacities for environmental education, information and communication promotion
Research, technology and	Limited environmental scientific data

innovation	Limited access to scientific environmental data
	Limited capacity for environmental research, technological and innovations development
Environmental Governance, Compliance and Enforcement	Limited resources (Budget) for Governance and compliance enforcement
	Lack of gazzeted County Environment Committee
People, Environment, Economy and Development	Concerns on demographic dividend and human development index which have implications on poverty, literacy and subsequently environment conservation.
Environment and Climate Finance	Lack of County legislation to promote climate financing
	Limited implementation of Climate change Act, 2016

CHAPTER FOUR

4.0 THE ENVIRONMENTAL ACTION PLAN FOR ADDRESSING THE CHALLENGES WITH IMPLEMENTATION AND INVESTMENT PLAN

The Lamu County Environment Action Plan (2022-2026) is built around a design of strategic actions addressing the environmental challenges determined. This was compiled into an implementation and investment matrix considering implementation timelines, actors and the budget for implementation of the actions building on the strategic goal and objectives designed around the theory of change logic. The Department of Environment County Executive Committee Member in charge of matters environment shall coordinate the partners in the implementation of the CEAP as the County awaits gazzettment of the County Environment Committee (CEC). There are considerable capacity challenges on the part of staff at the Department responsible for matters environment and in this regard, further capacity building will be instrumental for the staff of the Department and to the County Environment Committee for smooth implementation of the CEAP. The CEAP implementation requires substantial amount of financial resources which may be beyond the capability of the County Government to support all the strategic actions provided. In this regard, resource mobilization to complement the County support will comprise a major part of the CEAP implementation arrangements. Therefore, building bankable proposals is critical and the Department responsible for matters environment and the County Environment Committee once gazetted will either build their capacity for developing bankable proposals or engage consultancy services of reputable resource mobilization experts. Further, stakeholders, partners and community groups are encouraged to develop and market relevant proposals for implementation of the Environmental Action Plan.

TABLE 1. THE LAMU CEAP IMPLEMENTATION AND INVESTMENNT PLAN

Environmental Challenge	Strategic Actions (Solutions)	Activities	Time frame		Budget (Ksh in millions)	Actor/s
			Short -term (2yrs)	Long-term (5yrs)		
Land and soils						
Soil erosion	Promote soil conservation programmes	• Rehabilitation of gullies • Reafforestation of degraded ecosystems • Manage livestock overstocking to avoid overgrazing	√	√	150	County Government, KFS, NEMA, NGOs and other partners
Soil pollution from agro-chemical from farms applications	Management of Agro-chemicals application	• Enforce Agro-chemicals application guidelines • Monitor Agro-chemicals accumulation in soils		√	15	County Government – Ministry of Agriculture & Pest Control Board, Research institutions
Decline in soil fertility due to erosion and unsustainable utilization	Promote soil conservation and sustainable land use practices	• Reafforestation of degraded ecosystems • Adopt conservation and smart agriculture	√	√	100	County Government – Ministry of Agriculture, NGOs and Partners
Land tenure - Land degradation due to communal land ownership challenges	Support Community Lands Adjudication	• Land adjudicated for titling completion	√	√	150	County Government, National Land Commission and Ministry of Lands
Climate change and variability						
Extreme weather events that result in erratic rainfall and changes in average minimum and maximum temperature day and night	Promote climate change mitigation measures	• Afforestation and reafforestation activities in selected areas	√	√	100	County Government, KFS, NEMA, WRA, NWHSA, NGOs and other

temperatures						stakeholders
Severe droughts that affect biodiversity, ecosystems and people livelihoods	Promote climate change mitigation, adaptation and coping mechanisms Restoration of degraded ecosystems	• Afforestation and reafforestation activities • Deploy conservation and smart agriculture • Rainwater water harvesting				
Enhanced rainfall leading to floods that affect the natural landscapes	Promotion of floods control in vulnerable areas	• Development of floods infrastructure to control impacts of floods on environment and people		√	150	County Government and Stakeholders
Water resources and pollution						
Declining water level from major water sources i.e. Lake Kenyatta and other wetlands during severe droughts	Promote sustainable water use	• Adopt efficient water use technologies particularly on irrigation near wetlands • Prepare water management plans for specific water sources and catchments • Control siltation	√	√	100	County Government, WRA, WRUAs and Ministry of Water, NGOs
	Promote water catchments and riparian lands conservation	• Prepare and implement water catchments management plans • Restore degraded water catchments	√	√	50	County Government and Ministry of Water, WRA, WRUAs KFS and KWTA
Destruction of water catchments i.e. sand-dunes and forests	Promote conservation of water catchments	• Prepare and implement water catchments management plans • Restore degraded water catchments				
Intrusion of sea water especially at the delta affecting the wetland and biodiversity	Promote conservation of the delta ecosystem	• Conservation of mangroves ecosystem and further afforestation activities at the delta • Control of soil erosion and siltation from land based sources	√	√	60	County Government & KFS and NGOs
Freshwater pollution by agro-chemicals and marine litter like plastics	Monitoring water quality and promote safe use of agro-chemicals and wastes	• Research on patterns of water pollution • Awareness on safe use of chemicals	√	√	60	County Government, NEMA, WRA, WRUAS, PCB

	management	on farmlands and waste disposal in gazetted disposal sites • Conservation of riparian lands to filter chemicals to rivers and other water sources				KEMFRI, Universities and NGOs
Wildlife, Biodiversity and Tourism						
Spread of invasive species i.e. *Prosopis multiflora*	Control invasive species	• Map the spread of invasive species i.e. Prosopis multiflora • Establish and encourage invasive species utilization activities i.e. charcoal burning from Prosopis multiflora • Support invasive species control activities i.e. clearing of Prosopis multiflora	√	√	50	County Government, KFS, KEFRI, NEMA, NGOs
Human - wildlife conflicts	Promote co-existence	• Map wildlife territories/corridors • Initiate eco-tourism investments • Undertake wildlife conservation awareness programmes	√	√	30	KWS, County Government, KTB & NGOs
Decline in species populations and shift distributions patterns due to habitats loss and degradation	Foster habitats conservation and control poaching	• Increase patrol and surveillance activities to tame poaching • Strengthen habitats conservation initiatives • Restore degraded habitats • Develop and implement specific species and habitats management plans • Apply research data for conservation of species and habitats		√	50	County Government, KWS, KFS & NEMA & NGOs
Poaching	Poaching control	• Increase patrol and surveillance activities to tame poaching • Collaborate with KWS to control	√	√	50	County Government, KWS & KFS

		poaching				
Limited data and access on biodiversity	Promote of environmental/biodiversity research	• Establish research collaborations • Undertake environmental data generation/research • Establish research information resource centres • Mobilize funding for environmental/biodiversity research	√	√	50	County Government, KEMFRI, KEFRI, Universities, NEMA
Coastal Marine and Wetlands						
Encroachment and destruction of riparian lands	Enhance riparian lands conservation	• Enforce relevant laws on protection of riparian lands • Rehabilitate and conserve riparian lands	√	√	25	County Government, NEMA & KFS
Declining water levels at the wetlands	Promote Conservation of wetlands	• Undertake wetlands conservation and rehabilitation activities		√	50	County Government, KWS, NEMA, WRUA, WRUAs and NGOs
Pollution by agro-chemicals and litter	Control marine and wetlands pollution	• Map patterns of pollution on wetlands and marine environment • Create awareness on safe use of agro-chemicals	√	√	30	County Government, NEMA, Pest Control Board & NGOs
Siltation in riverbeds, oxbow lakes and the delta	Control siltation in wetlands and marine environments	• Undertake soil erosion control activities in terrestrial landscapes • Rehabilitate and conserve riparian lands	√	√	50	County Government, Ministry of Agriculture, WRA & NEMA
Forests and woodlands						
Deforestation due to illegal harvesting of building material and clearance for settlement and farming.	Control deforestation and promote forests and woodlands conservation and restoration	• Increase surveillance (enforcement) to deter illegal activities • Strengthen capacity of County officials in forest management • Undertake afforestation and	√	√	150	KFS, KWS, NEMA, NGOs and County Government

		reforestation activities to strengthen forests and woodlands in the County • Develop alternative sources livelihoods to ease dependency on forests and woodlands products • Create ward nurseries to support restoration initiatives • Increase funding to afforestation and reafforestation programmes • Develop management plans for gazetted forest • Strengthen CFAs to sustainably manage forests and woodlands • Create urban green parks and arboretums • Identify and gazette Ecologically Sensitive Areas (ESAs)				
Spread of invasive species i.e. *Prosopis multiflora*	Control of invasive species (*Prosopis multiflora*)	• Map the spread of invasive species i.e. Prosopis multiflora • Establish and encourage invasive species utilization activities i.e. charcoal burning from Prosopis multiflora • Support invasive destruction activities i.e. clearing of Prosopis multiflora	√	√	20	County Government, KFS, KEFRI & NGOs
Agriculture, Livestock and Fisheries						
Destruction of native forests and wetlands through unsustainable agriculture	Promote sustainable Agriculture	• Implement the County spatial plan • Adopt conservation and smart agriculture • Practice crop rotation	√	√	100	Ministry of Agriculture, County Government, NGOs and KFS

		• Mainstream agroforestry in farming				
Pollution of soils by Agro-chemicals	Control of Agro-chemicals pollution	• Enforce agro-chemicals application guidelines • Monitor agro-chemicals accumulation in soils • Introduce Integrated Pest Management (IPM)	√	√	50	Ministry of Agriculture, County Government, NGOs and PCB
Overfishing	Promotion of Maximum sustainable fishing yields and promotion of freshwater and marine habitats	• Enforcement of compliance with fisheries laws to avoid overfishing i.e use of appropriate fishing gear and practices • Undertake fishery research and implement the recommendations • Undertake measures to protect fish breeding sites • Strengthen Beach Management Units to manage fishing activities • Support establishment of fish ponds and hatcheries to ease pressure on natural freshwater and marine fisheries • Undertake advocacy on best fishing practices	√	√	50	County Government, Kenya Fisheries Service and NGOs
Overgrazing	Control of overgrazing	• Introduce improved methods and breeds of livestock for high returns • Hold regular livestock field schools/days to educate and sensitize farmers to avoid overstocking • Establish optimal livestock for free-ranging farmers • Introduce and support adoption of alternative livelihoods i.e apiculture	√	√	100	County Government, KARLO, ILRI and other NGOs

		and sericulture • Invent pasture propagation and bulking/storage programmes • Establishment and training of grazing management committees to control overgrazing • Strengthening ranches/conservancies • Implement recommendations of the Tana delta Land use plan on livestock management				
Settlement and urbanization						
Solid waste accumulation and pollution	Enhance solid waste management	• Identify a dumpsite for gazettment in-line with EMCA waste management regulations of 2006 • Domesticate and implement National Solid Waste Management Strategy • Enforce Waste Management regulations of 2006 • Establish sustainable waste collection and disposal system	√	√	25	County Government, NEMA
Waste water effluents pollution	Enhance waste water treatment and disposal	• Establish sewerage systems for the urban centres • Enforce EMCA water quality regulations of 2006 • Clean drainages	√	√	500	County Government, NEMA & NGOs
Intensification of settlement and development projects altering natural landscapes	Promote development in line with County spatial plan	• Prepare and implement the developed County spatial plan • Implement Tana River Delta Land-Use Plan and others plan such as Tana Delta Wetlands Management Plan • Enforce Environmental Impact	√	√	50	County Government, NEMA, WRA, KFS, KWS and NGOs

		Assessment and Audit Regulations of 2003				
Increase of informal settlement	Implement County spatial plan and integrated urban spatial plans	• Prepare and implement County spatial plan and Integrated Urban Spatial Plans.	√		30	County Government
Energy, Mining, industry and trade						
Indoor air pollution from high dependency on wood fuel and paraffin	Promote clean energy	• Supply electricity to residents • Support access to affordable clean energy stoves and other equipment		√	500	County Government, Ministry of Energy, KENTRACO
Destruction of habitats through mining explorations	Promote sustainable development/utilization of natural resources	• Enforce EMCA Environmental Impact and Audit Regulations of 2003 in development and exploitation of natural resources	√	√	5	County Government and NEMA
Health, sanitation and waste						
Lack of sewerage system	Promote waste water treatment and disposal	• Establish sewerage systems for the urban centres • Enforce EMCA water quality regulations of 2006 • Clean drainages	√	√	5	County Government, NGOs and NEMA
Lack of sanitary landfills and gazetted dumpsites	Promote solid waste management	• Gazette the dumpsites in-line with EMCA waste management regulation of 2006 • Domesticate and implement National Solid Waste Management Strategy • Enforce Waste Management regulation of 2006 • Establish sustainable waste collection and disposal system	√	√	Covered above	County Government & NEMA
Environmental Education, Information and Communication						
Limited awareness on environment conservation	Promote awareness on environment conservation	• Undertake awareness on environment conservation to the	√	√	25	County Government, KWS, KFS, NEMA

		public • Partner with ministry of education to mainstream environmental education and awareness in co-curriculum • Support establishment and work of schools environmental/wildlife clubs • Support formation of lobby groups to champion advocacy of special ecosystems i.e. friends of Tana Delta and marine ecosystem among others				& NGOs
Limited capacities for environmental education, information and communication	Strengthen capacity for environmental education, information and communication	• Forge partnership for environmental education, information and communication with relevant stakeholders • Increase funding and staff for environmental education, information and communication	√	√	25	County Government, KFS, KWS, NGOs & NEMA
Research, technology and innovation						
Limited environmental data	Promote environmental data mobilization	• Forge research collaborations • Undertake environmental research projects to increase data	√	√	50	KEMFRI, KEFRI, Universities, KWS, KFS and NEMA
Limited access to environmental scientific data	Promote environmental data access	• Establish environmental data centre • Establish County environmental data portal	√	√	50	County Government
Limited capacity for environmental research, technological and innovations development	Promote research capacity	• Employ qualified research scientists under the department responsible for environment • Acquire research equipment	√	√		County Government and Research Institutions
Environmental Governance, Compliance and Enforcement						
Limited resources (Budget) for Governance and	Strengthen funding for environment and natural	• Increase budgetary allocation for environment and natural resources	√	√	-	County Government & Development

compliance enforcement	resources	environment Governance, Compliance and Enforcement • Mobilize funding from development partners for supporting environment Governance, Compliance and Enforcement				Partners
Lack of County Environmental Committee	Establish County Environment Committee	• Gazette County Environment Committee	√	√	-	County Government
People, Environment, Economy and Development						
Concerns on demographic dividend and human development index which have implication on poverty, literacy and subsequently environment conservation.	Improve County demographic dividend and human development index	• Reduce poverty index and illiteracy • Control population explosion	√	√	200	County Government and Development Partners
Environment and Climate Finance						
Lack of County legislation to promote climate financing	Strengthen climate change finance legal framework	• Establish enabling County climate financing legislation	√		50	County Government and County Assembly
Limited implementation of Climate change Act, 2016	Strengthen implementation of climate change Act, 2016	• Operationalize County provisions of climate change, 2016.		√	50	County Government and Ministry of Environment and Forestry

CHAPTER FIVE

5.0 MONITORING AND EVALUATION PLAN

The implementation of the CEAP will take the form of a project or programme which will run through a complete project cycle and therefore will require a monitoring and evaluation plan to provide progress on the CEAP implementation.

Section 41B (1) of the Environmental Management and Coordination Act (revised 2015), 1999 empowers NEMA to monitor the implementation of the County and National Environment Action Plan. The Monitoring and Evaluation of this CEAP will embrace a conventional M&E approach which clearly provides for inputs and activities at the implementation level and output/outcomes regime as well as impacts at the results level as illustrated in the figure 2 below. The monitoring plan provides for the objectively verifiable indicators (OVI) and Means of Verification (MOV).
Monitoring outputs/outcomes and impacts would provide an indication on whether there is improvement or deterioration of the environment and provide information for state of Environment reporting in line with Section 9 (2) (P) of EMCA (revised 2015), 1999.

Figure 2. Project program cycle flow that the CEAP will flow and provide for monitoring and evaluation.

Implementation Plan Phase	Results phase – M& E Plan Phase

TABLE 2. THE LAMU CEAP MONITORING AND EVALUATION PLAN

Environmental Challenge	Strategic Actions (Solutions)	Activities	Objectively Verifiable Indicator (OVI)	Means of Verification (MOV)	Timeframe (Mid-term Monitoring and End-term Evaluation)	Budget (Ksh in Millions)
Land and soils						
Soil erosion	Promote soil conservation programmes	Rehabilitation gullies	No. of gullies rehabilitated and size of the area	Field monitoring missions and reports	Mid-term monitoring 2 years and end term at 5 years	0.2
		Reafforestation of degraded ecosystems	Hectares reafforestated			
		Manage livestock overstocking to avoid overgrazing	No of pastoralist managing optimal levels of livestock			
Soil pollution from agro-chemical from farms applications	Management of Agro-chemicals application	Enforce Agro-chemicals application guidelines	No. field inspections	Field monitoring missions and reports	Mid-term monitoring 2 years and end term at 5 years	0.2
		Monitor Agro-chemicals accumulation in soils	Levels of Agro-chemicals in soil			
Decline in soil fertility due to erosion and unsustainable utilization	Promote soil conservation and sustainable land use practices	Reafforestation of degraded ecosystems	No. of hectares reafforested	Field mission and reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.2
		Adopt conservation and smart agriculture	No of farmers adopting smart agriculture	Field mission monitoring and report		
Decline in soil fertility due to erosion and	Promote soil conservation and	• Land adjudicated for titling	Status of land adjudication/titling	Land adjudication report	Mid-term monitoring at 2 years and end-term evaluation at	0.1

unsustainable utilization	sustainable land use practices				5years	
Climate change and variability						
Extreme weather events that result in erratic rainfall and changes in average minimum and maximum temperature day and night temperatures	Promote climate change mitigation measures	Afforestation and reafforestation activities in selected areas	Hectares afforested and reafforested	Field monitoring missions and reports	Mid-term monitoring at 3 years and end-term evaluation at 5 years	0.2
Severe droughts that affect biodiversity, ecosystems and people livelihoods	Promote climate change mitigation, adaptation and coping mechanisms	Afforestation and reafforestation activities	Hectares afforested and reafforested			
		Deploy conservation and smart agriculture	No. of farmers adopting conservation and smart agriculture			
		Rainwater water harvesting	Cubic meters of rainwater harvested and No. of households harvesting rainwater			
Enhanced rainfall leading to floods that affect the natural landscapes	Promotion of floods control in vulnerable areas	Development of floods infrastructure to control impacts of floods on environment and people	No. of floods control infrastructure constructed	Field missions and reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.2

Water Resources and Pollution						
Declining water level from water major sources i.e. Lake Kenyatta and other wetlands during severe droughts	Promote sustainable water use	Adopt efficient water use technologies	No. of water use technologies adopted	Field mission and reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.1
		Prepare water management plans for specific water sources and catchments	No. of water management plans prepared	Management plans		
		Control siltation	No of siltation control projects undertaken	Field missions and reports		
	Promote conservation of water catchments and riparian lands	Prepare and implement water catchments management plans	No. of management plans	Management plans developed	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.1
		Restore degraded water catchments	Hectares of water catchments restored	Field missions and reports		
Destruction of water catchments i.e. sand-dunes and forests	Promote conservation of water catchments	Prepare and implement water catchments management plans	No. of management plans	Management plans developed		
		Restore degraded water catchments	Hectares of water catchment restored	Field missions and reports		
Intrusion of sea water especially at the delta affecting the wetland and biodiversity	Promote conservation of the delta ecosystem	Conservation of mangroves ecosystem and further afforestation activities at the delta	No. of mangroves conservation activities undertaken and hectares afforested	Field missions and reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.1
		Control of soil erosion and siltation from land based sources	No .of soil erosion initiatives			

Freshwater pollution by agro-chemicals and marine litter like plastics	Monitoring water quality and promote safe use of agro-chemicals and wastes management	Research on patterns of water pollution	No. of research reports	Field missions and reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.1
		Awareness on safe use of chemicals on farmlands and waste disposal in gazetted disposal sites	No. awareness initiatives undertaken			
		Conservation of riparian lands to filter chemicals from entering rivers and other water sources	No .of riparian lands conservation activities			
Wildlife, Biodiversity and Tourism						
Spread of invasive species i.e. *Prosobis multiflora*	Control invasive species	Map the spread of invasive species i.e. *Prosobis multiflora*	Map of invasive species distribution	Map developed and field mission and reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.2
		Establish and encourage invasive species utilization activities i.e. charcoal burning from *Prosobis multiflora*	No. of invasive utilization initiatives			
		Support invasive destruction activities i.e. clearing of *Prosobis multiflora*	Hectares of invasive species cleared			
Human - wildlife conflicts	Promote co-existence	Map wildlife territories/corridors	Map/s	Map/s developed and field missions	Mid-term monitoring at 2 years and end-	0.1

		Initiate ecotourism investments	No. of ecotourism initiatives	and reports	term evaluation at 5years	
		Undertake wildlife conservation awareness programmes	No .of wildlife awareness programmes			
Decline in species populations and shift distributions patterns due to habitats loss and degradation	Foster habitats conservation and control poaching	Increase patrol and surveillance activities to tame poaching	No .of patrols and surveillance undertaken	Field mission and reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.1
		Strengthen habitats conservation initiatives	No. of habitats conservation initiatives			
		Restore degraded habitats	Hectares of habitats restored			
		Develop and implement specific species and ecosystems management plans	No. of species management plans developed			
		Apply research data for conservation of species and habitats	No. of research recommendations			
Poaching	Poaching control	Increase patrol and surveillance activities to tame poaching	No. of patrols and surveillance activities	MoUs and reports	Mid-term monitoring at 2 years and end-term evaluation at	0.2

		Collaborate with KWS to control poaching	No. of MoUs and Joint activities		5years	
Limited data and access on biodiversity	Promote environmental /biodiversity research	Establish research collaborations	No. collaborative research	MoUs, Research reports, information resource centre and amounts of money awarded	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.1
		Undertake environmental data generation/research	No. of research projects undertaken			
		Establish research information resource centre	A research information resource centre			
		Mobilize funding for environmental/biodiversity research	Amount of resources mobilized in Kenya Shillings			
Coastal Marine and Wetlands						
Encroachment and destruction of riparian lands	Enhance riparian lands conservation	Enforce relevant laws on protection of riparian lands	No. of inspections to wetlands on compliance with riparian laws	Field Missions and reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.2
		Rehabilitate and conserve riparian lands	Hectares rehabilitated and conserved			
Declining water levels at the wetlands	Promote Conservation of wetlands	Undertake wetlands conservation activities	No. of wetlands conservation initiatives	Field missions and reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.1

Siltation in riverbeds, oxbow lakes and the delta	Control wetlands and marine environments siltation	Map patterns of pollution in wetlands and marine environment	No. of report on patterns of pollution in wetlands and marine ecosystems	Reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.1
		Create awareness on safe use of organic and inorganic chemicals i.e. pesticide and other chemicals	No. of awareness activities			
Siltation in riverbeds, oxbow lakes and the delta	Control wetlands and marine environments siltation	Undertake soil erosion control activities in terrestrial landscapes	No. of solid erosion control initiatives	Field mission and reports	Mid-term monitoring at 2 years and end-term evaluation at 5years	0.1
		Rehabilitate and conserve riparian lands	Hectares of riparian lands rehabilitated and conserved			
Forests and woodlands						
Deforestation due to illegal harvesting of building material and clearance for settlement and farming.	Control deforestation and promote forests and woodlands conservation and	Increase surveillance (enforcement) to deter illegal activities	No. of patrol/surveillance activities undertaken	Field missions and reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
		Strengthen capacity of County officials in forest management	No. of County officials trained on relevant aspects of forestry			

	restorations	Undertake afforestation and reforestation activities to strengthen forests and woodlands cover in the County	% forest cover increase			
		Develop alternative sources of livelihoods to ease dependency on forests and woodlands products	No. of alternative sources of livelihoods initiated			
		Create ward nurseries to support restoration initiatives	No. of nurseries created			
		Increase funding to afforestation and reafforestation programmes	Amount of financial resources for afforestation and reafforestation			
		Develop management plans for gazetted forests	No. of management plan			
		Strengthen CFAs to sustainably manage forests and woodlands	No. of CFAs supported			
		Create urban green parks an arboretums	No. of urban green parks and arboretums created			

Spread of invasive species i.e. *Prosobis multiflora*	Control of invasive species (*Prosobis multiflora*)	Map the spread of invasive species i.e. *Prosobis multiflora*	Map on invasive species distribution	Field mission and reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
		Establish and encourage invasive species utilization activities i.e. charcoal burning from *Prosobis multiflora*	No. of invasive species utilization initiatives			
		Support invasive destruction activities i.e. clearing of *Prosobis multiflora*	Hectares of invasive species cleared			
Agriculture, Livestock and Fisheries						
Destruction of native forests and wetlands through unsustainable agriculture	Promote sustainable Agriculture	Implement the County spatial plan	Status of the implementation of the County spatial plan	Field mission and reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
		Adopt conservation and smart agriculture	No. of conservation/smart agriculture programmes adopted			
		Practice crop rotation	No of farmers practicing crop rotation			
		Mainstream agroforestry in farming	No. of farmers on agroforestry and hectares on agroforestry			

Agro-chemicals pollution on soils	Control of Agro-chemicals pollution	Enforce Agro-chemicals application guidelines	No. of surveillance to monitor compliance with the guidelines	Field missions and reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
		Monitor Agro-chemicals accumulation in soils	No. of monitoring reports			
		Introduce Integrated Pest Management (IPM)	No. of farmers adopted IPM			
Overfishing	Promotion of Maximum sustainable fishing yields and promotion of freshwater and marine habitats	Enforcement of compliance with fisheries laws to avoid overfishing i.e. use of appropriate fishing gear and practices	No. of patrols to enforce fisheries laws	Field missions and reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
		Undertake fishery research and implement the recommendations	No. of research on recommendations adopted			
		Undertake measures to protect fish breeding sites	No. of conservation initiatives for fish breeding sites			
		Strengthen Beach Management Units to manage fishing activities	No. of Beach Management Units supported			
		Support establishment of fish ponds and hatcheries to ease pressure on natural freshwater and marine fisheries	No of fish ponds established and rehabilitated			

		Undertake advocacy on best fishing practices	No of fishing best practices advocacy undertaken			
Overgrazing	Control of overgrazing	Introduce improved methods and breeds of livestock for high returns	No of farmers practicing improved methods of livestock breeding	Field mission and reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.2
		Hold regular livestock field schools/days to educate and sensitize farmers to avoid overstocking	No. of livestock field days held			
		Establish optimal livestock for free-ranging farmers	Report determining optimal levels of livestock for pastoralists			
		Introduce and support adoption alternative livelihoods i.e apiculture and sericulture	No of farmers adopted apiculture and sericulture			
		Invent pasture propagation and bulking/storage programmes	No. of farmers practicing pasture propagation and bulking			
		Establishment and training of grazing management committees to control overgrazing	No. of grazing committees established and trained			
		Strengthen conservancies	No. of conservancies supported			

Settlement and urbanization						
Solid waste accumulation and pollution	Enhance solid waste management	Identify dumpsites for gazettment in-line with EMCA waste management regulation of 2006	Solid waste dumpsite sited and gazetted	Gazetted solid waste dumpsite, field mission and reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
		Domesticate and implement National Solid Waste Management Strategy	County solid waste management strategy			
		Enforce Waste Management regulation of 2006	No. of monitoring inspections on compliance with waste management regulations, 2006			
		Establish sustainable waste collection and disposal system	Waste collection systems in place (County or private collectors system)			
		Enforce EMCA water quality regulations of 2006	No. of inspections on waste water management in urban centres			
		Clean drainages	No. of clean-up events			
Waste water effluents pollution	Enhance waste water treatment and disposal	Establish sewerage systems for the urban centres	Status of the sewerage development	Field mission and report	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1

Intensification of settlement and development projects altering natural landscapes	Promote development and County spatial plan	Implement the County spatial plan	County spatial plan implementation and integrated urban development plan development status	County spatial plan implementation status and integrated urban development plan document development status	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
		Implement Tana River Delta Land-Use Plan and others plan such as Tana Delta Wetlands Management Plan	Status of the implementation of the Land-use plan of 2012 and others			
		Enforce Environmental Impact Assessment and Audit Regulations of 2003	% of development with EIA license			
Increase of informal settlement	Implement County spatial plan and integrated urban spatial plans	• Implement County spatial plan and Integrated Urban Spatial Plans.	Status of the County spatial plans and integrated urban spatial plans implementation status	County spatial plans and integrated urban spatial plans documents implementation reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
Energy, Mining, Industry and Trade						
Indoor air pollution from high dependency on wood fuel and paraffin	Promote clean energy	Supply electricity to County residents	No. of household connected to electricity	Field missions and reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.2
		Support access to affordable of clean energy stoves and other equipment	No. of household with energy saving stoves/solar			
Destruction of habitats through mining explorations	Promote sustainable development and natural	Enforce Environmental Impact and Audit Regulations of 2003 in development and natural	% of mining activities with EIA	Field inspections and reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1

	resources	resources exploitations projects				
Health, sanitation and waste						
Lack of sewerage system	Promote waste water treatment and disposal	Establish sewerage systems for the urban centres	Status of the County sewerage system	Field mission and reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	-
		Enforce EMCA water quality regulations of 2006	No of facilities with effluent discharge license			-
		Clean drainages	No of clean-up events			0.1
Lack of sanitary landfills and gazetted dumpsites	Promote solid waste management	Identify a dumpsite for gazettment in-line with EMCA waste management regulation of 2006	Dumpsite sited and gazette	Gazetted dumpsite, County solid waste strategy and effluent discharge licenses inspection reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	Covered above
		Domesticate and implement National Solid Waste Management Strategy	County solid waste management strategy document			
		Enforce Waste Management regulation of 2006	No. of effluent discharge licenses			
Environmental Education, Information and Communication						
Limited awareness on environment conservation	Promote awareness on environment conservation	Undertake awareness on environment conservation to the public	No. of awareness initiatives	Reports	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.2

		Partner with ministry of education to mainstream environmental education and awareness in co-curriculum	No. of collaborative initiatives undertaken			
		Support establishment and work of schools environmental/wildlife clubs	No. of schools environmental/wildlife clubs supported			
		Support formation of lobby groups to champion advocacy of special ecosystems i.e. friends of Tana Delta among others	No. of lobby group established and supported			
Limited capacities for environmental education, information and communication	Strengthen capacity for environmental education, information and communication	Forge partnership for environmental education, information and communication with relevant stakeholders	No. of partnerships engagements	Reports on partnership, financial resources and staff	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
		Increase funding and staff for environmental education, information and communication	Amount financial resources and staff allocated to environmental education, information and communication			
Research, technology and innovation						
Limited environmental	Promote environmental	Forge research collaborations	No. of collaboration initiated	Reports	Mid-term monitoring at 2 years and end-	0.1

data	data mobilization	Undertake environmental research projects to increase data	No of research reports		term evaluation at 5 years	
Limited access to environmental scientific data	Promote environmental data access	Establish environmental data resource centre	No. environmental data/information center established	Physical resource centre and data portal	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
		Establish County environmental data portal	County environmental data/information portal			
Limited capacity for environmental research, technological and innovations development	Promote research capacity	Employ qualified research scientists under the department responsible for environment	No. of environmental researchers employed	Staff employed and equipment acquired	Mid-term monitoring at 2 years and end-term evaluation at 5 years	-
		Acquire research equipment	No. of research equipment acquired			
Environmental Governance, Compliance and Enforcement						
Limited resources (Budget) for Governance and compliance enforcement by County Environment Committee	Strengthen funding for environment and natural resources	Increase budgetary allocation for environment and natural resources Governance, compliance and enforcement	Amount of funding allocated to County Environment Committee from County budgeting process	Amounts of financial resources allocated and mobilized from donors	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.2
		Mobilize funding from development partners for supporting environment Governance, compliance and enforcement	Amount mobilized from donors towards strengthening work of County Environment Committee			-

Lack of gazette County Environment Committee	Establish County Environment Committee	Gazette County Environment Committee	County environment committees gazetted	Gazette on County environment committee	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
People, Environment, Economy and Development						
Concerns on demographic dividend and human development index which have implications on poverty, literacy and subsequently environment conservation.	Promotion of County demographic dividend and human development index	Reduce poverty index and illiteracy	Poverty and literacy index Population growth statistics	Population report from economic survey	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.1
Environment and Climate Finance						
Lack of County legislation to promote climate financing	Strengthen climate change finance legal framework	Establish enabling County climate financing legislation	Status on the bill/legislation	Bill/legislation	Mid-term monitoring at 1 year and end-term evaluation at 2 years	0.2
Limited implementation of Climate change Act, 2016	Strengthen climate change, 2016	Operationalize provisions of climate change, 2016 section 19.	Report on implementations of climate change Act, 2016, section 19	Report	Mid-term monitoring at 2 years and end-term evaluation at 5 years	0.2

LIST OF INDIVIDUALS AND INSTITUTIONS THAT PARTICIPATED IN THE CEAP DEVELOPMENT PROCESS

The County Government of Lamu acknowledges the following individuals and institutions for their participation in the CEAP development process.

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