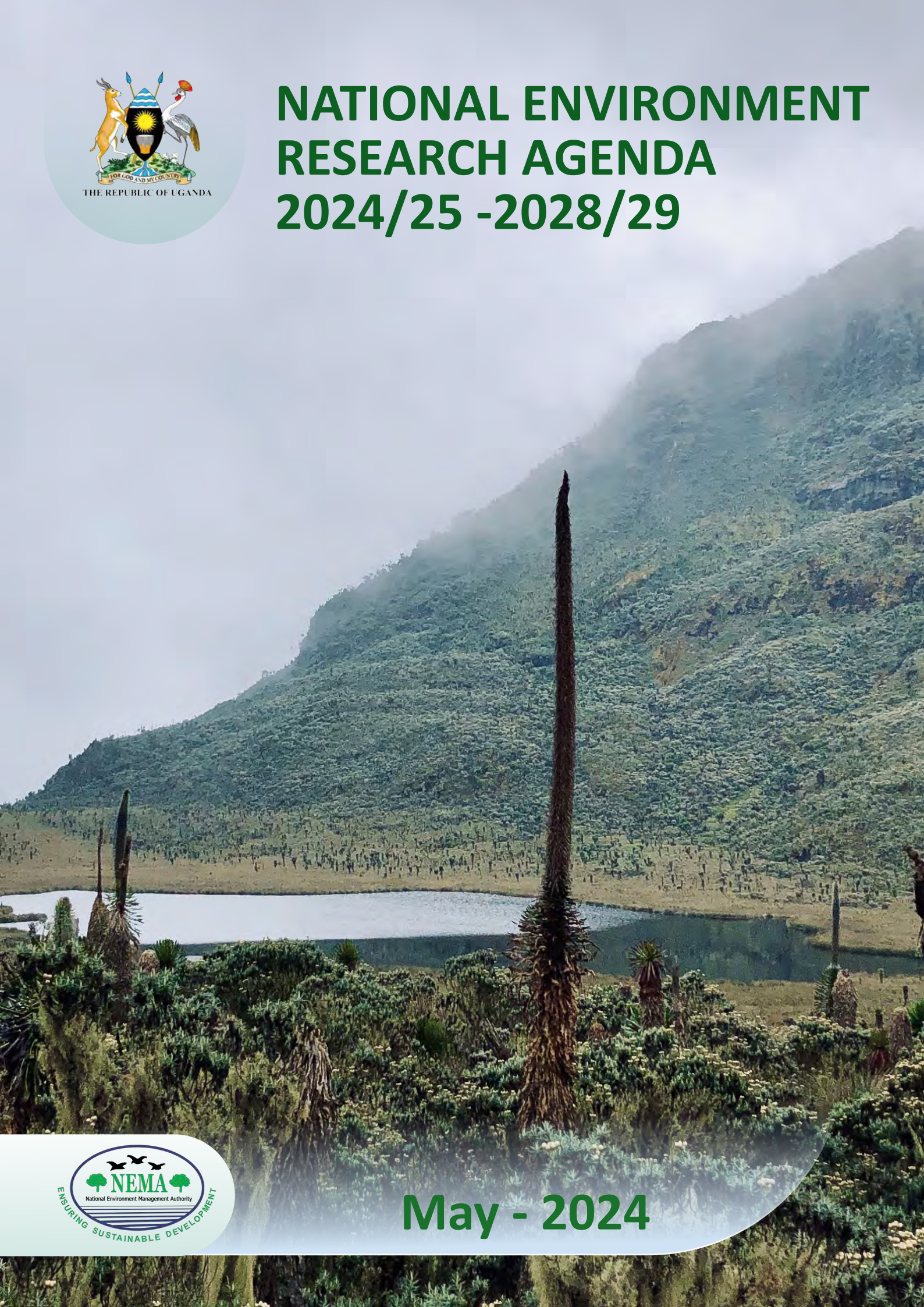
THE REPUBLIC OF UGANDA

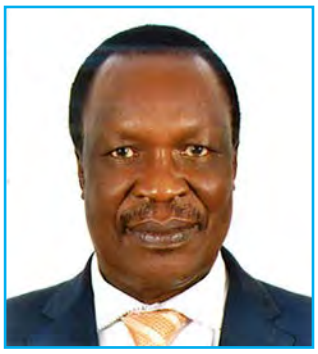
NATIONAL ENVIRONMENT RESEARCH AGENDA 2024/25 -2028/29



NEMA
National Environment Management Authority
ENSURING SUSTAINABLE DEVELOPMENT

May - 2024

Foreword



The National Environment Management Authority (NEMA), through wide stakeholder consultation, developed the National Environment Research Agenda. This initiative stands as a beacon of hope, guiding us toward a future with environmental conservation and sustainable development. As we navigate the path of socio-economic development we find ourselves at a critical juncture where the decisions we make today will echo throughout history, shaping the legacy we leave for future generations.

Uganda's natural beauty and biodiversity are unparalleled, forming the foundation of our economic prosperity and the well-being of our people and yet in the conservation and protection of this splendour, we face significant threats and challenges including but not limited to land degradation, deforestation, pollution, climate change and biodiversity loss which threaten to disrupt the delicate balance between development and ecological sustainability. In response, Government in her commitment to fostering environmental sustainability in the country has embarked on a transformative journey voyage, firmly committed to environmental sustainability by harnessing research as a tool for effective decision-making.

Therefore, I am thrilled to unveil the five-year National Environmental Research Agenda (2024/25-2028/29) as a testament to our commitment and resolve to take the lead in confronting the environmental threats and challenges that we are facing nationally, regionally, and globally. Consequently, the alignment of this research agenda to the pivotal national, regional, and global strategic development frameworks, including Uganda Vision 2040, East African Community Vision 2050, and United Nations Sustainable Development Goals (2030) underscores our holistic approach to addressing environmental issues. By considering the aspirations of these strategic frameworks, we ensure that our research efforts will be locally relevant to Uganda's development goals and contribute significantly to the broader regional and global environmental sustainability objectives.

The insights from this Research Agenda will serve as foundational pillars upon which we will construct our policies, strategies, and investments. Grounding our decisions in robust scientific evidence, we amplify the effectiveness and efficiency of our actions, driving us closer to the realization of our long-term vision for national development.

I extend my heartfelt commendations to NEMA for their exemplary leadership and foresight in championing the development of National Environmental Research Agenda . I am confident that the outcomes of this initiative will catalyze transformative change, empower communities, and safeguard our environment for both present and future generations. Together, through concerted collective action, we can surmount the challenges ahead and forge a pathway towards a greener, cleaner, more productive, and prosperous and sustainable future for Uganda.

For God and my country

Hon. Sam Mangusho Cheptoris
MINISTER OF WATER AND ENVIRONMENT

Message from Chairperson NEMA Board

As an organization mandated to be custodian of Uganda's environmental heritage, the National Environmental Management Authority (NEMA) bears a sacred responsibility of protecting the country's natural environment for the benefit of the current and future generations. This solemn responsibility guides our every action, highlighting the gravity of our role in preserving our precious ecosystem.

The National Environment Research Agenda 2024/25-2028/29 is significant milestone. It forms the basis for carrying research that will inform decision making in the field of environment management. As we embark on this research-led environmental responsiveness journey, I urge each of you to embrace the spirit of collaboration and innovation. Let us rise with courage and determination to face the challenge that is before us, recognizing that the future of Uganda – and indeed, the world – depends on how well we take care of the environment.

We are all stewards of Uganda's environmental heritage, entrusted with the solemn duty to protect and preserve it for generations to come. Together, let us build a future where development and conservation go hand in hand, ensuring a better, brighter tomorrow for all.

For God and my country

Prof. James Okot-Okumu
CHAIRMAN BOARD OF DIRECTORS
NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

Message from the Executive Director NEMA

Uganda is blessed with a rich natural resources, from its vast water bodies and lush wetlands to its diverse biodiversity and mineral wealth. As we set our sights on the achieving the Vision 2040, it is essential to acknowledge the pivotal role that our environment plays in shaping both our economic prosperity and the well-being of our people. However, amidst this vision of progress, we are confronted by formidable challenges such as environmental degradation, resource conflicts, and the looming spectre of climate change. In response, Uganda has embarked on a transformative journey that is firmly committed to environmental sustainability. The National Environment Management Authority (NEMA) is the forefront through its mandate of coordinating, monitoring, regulating, and supervise all activities in the field of environment management in the country.

One of the core functions of NEMA is undertake and support research in innovations, new technologies and emerging issues on environment. It is within this context that the National Environment Research Agenda has been developed. National Environmental Research Agenda serves as a dynamic blueprint, guiding research endeavours in all sectors. It provides a framework for evidence-based pathways for environmental policy formulation and strategic planning. By discerning priority research domains and fostering synergistic alliances among stakeholders, the National Environmental Research Agenda charts a course for a more informed and proactive approach to environmental management.

Through the diligent execution of the National Environmental Research Agenda and concerted action by all stakeholders, Uganda is poised to surmount the environmental challenges of our time and cultivate a future that shines with the promise of ecological abundance and prosperity for generations to come.

For God and my country

Barirega Akankwasah, PhD
EXECUTIVE DIRECTOR
NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

Executive Summary

Uganda is endowed with rich natural resources, including water, wetlands, biodiversity, land, forests, fisheries, minerals, and petroleum resources which are of economic and cultural value to the country and its people. However, critical environmental concerns like land degradation, deforestation, the deterioration of aquatic and terrestrial habitats, loss of wildlife and biodiversity, lack of access to quality water, and environmental pollution stand out as pressing environmental issues that demand immediate attention. Therefore, appropriate environmental management is a crucial aspect in the sustainable utilization of the natural resources for economic development of the country. The National Environment Management Authority (NEMA) established by the National Environment Act Cap 181 is mandated to Coordinate, Monitor, Regulate, and Supervise all activities relating to the environment.

The five-year National Environment Research Agenda (2024/25-2028/29) is strategically aligned with national and international frameworks and addresses the environmental challenges of Uganda while intertwining sustainability with aspirations of utilization of natural resources of the country for poverty alleviation. The National Environment Act Cap 181 underscores the need for empirical information derived through research and has inspired the development of the National Environmental Research Agenda to fill existing gaps in environmental information to enhance decision-making and empower policy formulation. The priority research areas for the next five years of the National Environmental Research Agenda encompass the Water-Food-Energy Nexus and Climate Change, Pollution and Waste Management, Gender, Culture and Environment, Ecosystem, biodiversity, and Genetic Resources, Land Use, Soil Management, and Mineral Resources.

The vision of National Environmental Research Agenda is “sustainable environment management to support the economic development of Uganda”. The Mission is “to research, develop, and provide innovative solutions to pressing environmental challenges for sustainable development in Uganda in 5 years”. The goal is “to promote sustainable development through research and innovative approaches to address environmental issues”. For successful implementation, the National Environmental Research Agenda relies on a robust framework that harmonizes legal mandates, collaboration mechanisms, and financial strategies. The framework prioritizes guideline development, collaboration fostering, and securing diversified funding sources with a budget estimate of UGX 37,500,000,000 (Thirty-Seven Billion Five Hundred Million Shillings). The resource mobilization strategy for the National Environmental Research Agenda implementation incorporates Public-Private partnerships, internal resource generation, institutional collaborations, and targeted fundraising as well as active engagement with development partners and participation in research grant proposal writing in response to grant calls.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

List of Acronyms

CBD	Convention on Biological Diversity
CBOs	Community-Based Organizations
CPOL	Convention on the Protection of the Ozone Layer
ICCD	International Convention to Combat Desertification
IWRM	Integrated Water Resource Management
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MDAs	Ministries Departments and Agencies
MWE	Ministry of Water and Environment
NARO	National Agricultural Research Organization
NDP	Uganda National Development Plan
NEA	National Environment Act
NGOs	Non-Governmental Organizations
NEMA	National Environment Management Authority
NEMP	National Environment Management Policy
NFA	National Forestry Authority
SDGs	UN Sustainable Development Goals
SWOT	Strengths, Weaknesses, Opportunities, and Threats
UBOS	Uganda Bureau of Statistics
UN	United Nations
UNCST	Uganda National Council of Science and Technology
UNMA	Uganda National Metrological Authority
UWA	Uganda Wildlife Authority

Chapter One

1.0 INTRODUCTION

1.1. BACKGROUND

Uganda is endowed with rich natural resources including water, wetlands, biodiversity, land, forests, fisheries, and minerals; more recently, Uganda started to explore its petroleum resources. The country's natural resources support the livelihoods of its people and constitute a bedrock for the country's socio-economic development. With that hindsight, environmental management is crucial in the country's quest for sustainable economic development, as Uganda envisions a future marked by a green, productive, and clean environment, free from the shackles of water, land, and air pollution. Therefore, commitment to the conservation of the flora and fauna, with a dedicated effort to various ecosystem restoration and enhancement is core to Uganda's economic development.

There is a linkage between environmental issues, natural resource utlization conflicts, and socio-economic well-being; this is acknowledged by the vulnerability of the poor communities in Uganda to the detrimental impacts of climate change, climate variability land degradation, and infrastructure development. While the poor populations heavily rely on natural resources to sustain their livelihoods, unsustainable practices, such as soil erosion, deforestation, and the depletion of water retention in the soils, further exacerbate their vulnerability. Therefore, addressing these environmental challenges and ensuring that environmental sustainability takes center stage is important in Uganda's development agenda. Moreover, Uganda's strategic development agenda aimed at alleviating poverty and attainment of prosperity for all as enshrined in the Uganda Vision 2040 and the National Development Plan III underscores the need to address the escalating environmental challenges and conflicts. Consequently, this national environment research agenda is developed to facilitate the development of the national knowledge base that will guide the utilization and management of the country's natural resources to ensure environmental sustainability.

At the forefront of this national research agenda is the National Environment Management Authority (NEMA), a semi-autonomous body established by the National Environment Act of 1995 and entrusted with a legal mandate of coordinating, monitoring, regulating, and supervising all activities relating to the environment in the country. In the execution of its mandate, NEMA diligently adheres to the stipulations of the National Environment Management Policy (NEMP) of 2017, and the revised National Environment Act (NEA) No.5 of 2019 which empowers NEMA to undertake and support research and innovations, fostering the development of new technologies and addressing emerging environmental issues for sustainable human health and the environment. Furthermore, the NEMA strategic plan 2020/2021-2024/2025 positions NEMA as the central hub for environmental management, research, and information dissemination. This underscores the proactive role NEMA plays in staying abreast of scientific knowledge and advancements.

In shaping this research agenda, NEMA draws inspiration from international treaties aimed at protecting human health and the environment to which the Republic of Uganda is a party. These attendant treaties

stand as pillars guiding Uganda's commitment to global environmental governance include the United Nations Convention on Biological Diversity (CBD) and its subsequent Cartagena Protocol on Biosafety, United Nations Framework Convention on Climate Change and its subsequent Kyoto Protocol, and the United Nations Convention to Combat Desertification, the International Convention on Oil Pollution Preparedness, Response, and Cooperation, the Rotterdam Convention on Trade of Hazardous Chemicals and Pesticides, the Basel Convention on Trans-Boundary Movement of Hazardous Wastes, and the Stockholm Convention on Persistent Organic Pollutants. Uganda actively participates in conventions such as the Convention on Biological Diversity (CBD), the Convention on the Protection of the Ozone Layer (CPOL), the International Convention to Combat Desertification (ICCD), the Kyoto Convention on the Reduction of Carbon Emissions, and the Ramsar Convention on Wetlands of International Importance. These international affiliations emphasize Uganda's commitment to collaborative efforts in addressing global environmental challenges while safeguarding its unique ecological assets.

The five-year National Environmental Research Agenda (2024/25-2028/29) strategically aligns with various national plans, policies, and laws, including the Uganda National Development Plan (NDP III) (2020/2021-2024/2025), NEMP (2017), NEA No. 5 (2019), the Uganda Green Growth Development Strategy (2017/18-2030/31), National Climate Change Policy (2015), and sector-specific policies such as the National Wetlands Management Policy(2017), National Water Policy (revised 2021), Uganda Wildlife Policy(2014), National Fisheries and Aquaculture Policy(2017), Uganda Forestry Policy (2001), and National Land Use Policy(2006) among others. Additionally, National Environmental Research Agenda is seamlessly aligned to Uganda's Vision 2040, the constitutional framework of the Republic of Uganda, the East African Community Vision (2050), and UN Sustainable Development Goals (SDGs) 2030. Furthermore, it is important to note that all stakeholders play an active role in safeguarding the environment through collective efforts, especially at this time when the country is experiencing challenges of climate change, resource depletion, and environmental degradation. Therefore, addressing these environmental challenges requires scientific knowledge of the possible causes to develop knowledge-based solutions for effective environmental management. This underscores the relevance of this National Environment Research Agenda developed by NEMA in consultation with various stakeholders.

1.2. JUSTIFICATION

Uganda’s rich natural resources provide the livelihood needs of the people; however, these resources are faced with an escalating array of environmental threats that pose challenges in balancing development and ecological preservation. The National Environment Act 181 identifies the critical environmental concerns that Uganda grapples with – namely land degradation, deforestation, deterioration of aquatic and terrestrial habitats, loss of wildlife and biodiversity, lack of access to quality water, and environmental pollution - as pressing issues that demand immediate attention. While NEMA has made commendable strides in enhancing and rehabilitating the deteriorated environment, there remains a necessity for further coordinated endeavours to effectively tackle the prevailing challenges.

A significant hindrance to effective environmental management in Uganda is the insufficient empirical knowledge that could guide in devising targeted strategies to address the identified environmental concerns. Additionally, the limited dissemination of available environmental research findings to stakeholders and the subsequent lack of its absorption by policymakers in the policy-making process exacerbates the challenges.

Moreover, the weak coordination and collaboration within NEMA and Government Ministries, Departments, and Agencies (MDAs), and insufficient and erratic allocation of funds to environmental research has been pointed out as hindrances to the effective conduct and dissemination of environmental research results thus contributing to the perpetuation of the national environmental challenges. Recognition of these critical environmental management gaps is imperative for the development of the National Environmental Research Agenda that establishes priority areas for engagement in environmental research that addresses local challenges and the creation of institutional linkages for effective monitoring and management of environmental research activities in the country as well as effective resource allocation for environmental research. Consequently, a clear National Environmental Research Agenda will facilitate the generation of sufficient research-based information that will be a guiding tool for decision-making in policy formulation, regulation, and enforcement at various levels.

The National Environmental Research Agenda serves as a dynamic framework designed to guide collaboration with stakeholders in environmental research projects aimed towards nurturing a circular and green environment for the achievement of sustainable development in Uganda. Besides offering a strategic roadmap for national environmental research, the National Environmental Research Agenda also provides opportunities for well-informed decision-making and empowers policymakers to develop policies and strategies that mitigate environmental challenges. Through the diligent implementation of the National Environmental Research Agenda, Uganda can navigate the complex landscape of utilization of the national natural resources while alleviating environmental challenges thus ensuring that the legacy of its rich natural and cultural heritage endures for generations to come.

Chapter Two

2.0. METHODOLOGY

The development of the National Environment Research Agenda was initiated and undertaken through a transparent, consultative, and participatory process led by the Research and Innovations Unit in the Department of Environment Planning and Coordination at the National Environment Management Authority. The Research and Innovations Unit of NEMA conducted a situation analysis through a literature review (desk study) followed by stakeholder consultations. A review of existing literature on environmental legislation was conducted to identify their impacts and prevailing gaps in the aspects of the Water-Food-Energy Nexus and climate change, pollution and waste management, gender, culture, environment, ecosystem, biodiversity, and genetic resources, land use, soil management, and mineral resources.

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To ensure comprehensiveness and depth, the developed National Environment Research Agenda was subjected to a rigorous consultative review process with representatives from the Ministry of Water and Environment (MWE), Uganda National Meteorological Authority (UNMA), the Uganda Bureau of Statistics (UBOS), and Science, Technology and Innovations Secretariat - Office of the President, Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), Natural Chemotherapeutics Research Institute (NCRI), National Forestry Authority (NFA), Uganda Wildlife Authority (UWA), National Agricultural Research Organization (NARO), academic institutions, Non-Governmental Organizations (NGOs), private sector, and Community-Based Organizations (CBOs). Subsequently, the draft National Environmental Research Agenda was presented to stakeholders in a meeting for validation, feedback, and ultimate ownership, and the final approval of the National Environmental Research Agenda was done by the Management of the National Environment Management Authority (NEMA).

Chapter Three

3.0. SITUATIONAL ANALYSIS

3.1. OVERVIEW

A general analysis of the role of the National Environment Management Authority (NEMA) as mandated by the National Environment Act (NEA) No. 5 of 2019 indicates that NEMA is the key government agency responsible for environment management in the country and should be responsible for coordination of the National Environment Research Agenda. However, NEMA is cognisant of the fact that various national organizations, such as academia and government parastatals also perform related environmental research in line with their mandates. Over time, this has resulted in pockets of similar or related research outputs being scattered across various national repositories and not being made available to inform policies for community and national development. Furthermore, generation and monitoring of access to environmental research information, and sharing of benefits derived from research on natural and other environmental resources nationwide has been a challenging task.

Despite the political will to create coherence among communities, the generation and utilization of environmental research information by policymakers, government agencies, and private sector entities remains difficult due to the lack of coordination of environmental research activities in the country. Therefore, the National Environmental Research Agenda provides NEMA with leverage to coordinate and collaborate with all stakeholders to bring national coherence in addressing environmental research and related development concerns.

Although there is fragmented environmental knowledge generated through research activities of different government and non-government institutions in the country, the overall contribution of natural resources to the national economic and fiscal trends in terms of the Gross Domestic Product (GDP) and general support to household subsistence is difficult to ascertain due to a lack of unified consistent environmental information.

Despite the availability of well-researched environmental knowledge in many dissertations in tertiary institutions in the country, this information often remains inaccessible to other socio-economic structures and policymakers which hinders its utilization for community and national development. Consequently, the lack of awareness of proper environmental management practices is exemplified by the rampant improper disposal of harmful waste products in the open environment, like plastic bags (kaveera), used waste oil, electronic waste, and the occupation of key environmental habitats such as wetlands by human households and industrial activities. Moreover, the existing gap in environmental knowledge is also evident in the poor state of locally made products such as natural medicines and indigenous and local foods that are sold in community markets. Therefore, the National Environmental Research Agenda offers a valuable opportunity to bridge the existing gaps in the generation and utilization of environmental knowledge for sustainable national development. NEMA manages the Clearing-House Mechanism (CHM), which makes the coordination and implementation of National Environmental Research Agenda achievable.

Uganda is a party to many international treaties that support strategic research in solving environmental issues, concerns, and conflicts; and the national policy and legal frameworks allow for private and public partnerships and collaborations at the national level. Many Memorandums of Understanding (MOUs) and other successful agreements and contracts have been implemented across different sectors, including the natural resource sector. It is against this backdrop that the National Environmental Research Agenda, implemented and coordinated by NEMA, is envisaged to achieve the long-sought national coherence in the utilization of research information in environmental management decision-making.

3.2 SWOT ANALYSIS

The incorporation of a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis (***Table 1***) in the development of this National Environment Research Agenda is pivotal in providing a strategic framework for comprehensively assessing internal and external factors shaping the research agenda. Identification of strengths allows the research agenda to optimize the utilization of existing resources for research and identified weaknesses facilitate the development of proactive measures for improved effectiveness. Furthermore, the identified opportunities guide the research agenda towards untapped areas of potential impact while understanding the threats enables the formulation of a risk management plan constituted of mitigation and adaptation strategies. In essence, the SWOT analysis functions as a diagnostic tool, fostering a nuanced understanding of the research context and empowering the National Environment Research Agenda to navigate challenges, capitalize on opportunities, and ensure resilience and relevance in alignment with Uganda's national development priorities.

Table 1: The SWOT analysis for National Environmental Research Agenda

STRENGTHS	**WEAKNESSES**
• Existing Research and Innovations Unit in the NEMA structure • NEA Cap 181 Provision for Research Execution • Existing Linkages with National Institutions • Support Research • Resource/Project mobilization committee • Network of donors for Research Support • Mini Laboratory and Equipment • Gender parity • Coordination role for stakeholder engagement • Multidisciplinary professionals • Hosts multilateral environmental agreements • Competencies within NEMA and other partner institutions • Trained and Experienced Specialists • Overlapping Research Agendas	i. Inadequate Resources (Funding, HR, Equipment, Safety Gears) ii. Translating Research into Action iii. Limited Coordination Among Stakeholders iv. Limited Access to Data v. Data Quality (Completeness, Coverage, Data Gaps) vi. Limited Flexibility in Adopting Emerging Data Sources vii. Lack of modern Technologies for Research viii. Fragmented Research Landscape ix. Permission to Undertake Research in Sensitive Sectors x. Use of Rudimentary Methods in the Data Production Cycle xi. Limited Capacity for Qualitative and Quantitative Analysis

OPPORTUNITIES	THREATS
i. Existing Government Think Tanks for Resource Mobilization ii. Political Will iii. Established research Institutions in the country. iv. Partnerships (MDAs, International) v. Funding Opportunities (e.g., GOU, Internal/ External Grants) vi. Favourable Government Policy Supporting Research and Innovations. vii. Human resource Capacity (Active/Retired Scientists, Graduate Students) viii. Emergent Demands Requiring Research and Innovations. ix. Research and Development Requirements by Funders x. Global interest in Climate Change Mitigation and Adaptation Strategies xi. Technological Advancements (ICT, GIS, Machine Learning) xii. Data Sharing from Various Database Sources xiii. Evolving Research Methodologies xiv. Requirements to Report on Development Frameworks Ratified by Uganda xv. Addressing Global Environmental Challenges	i. Non-alignment of Research Agendas from other Institutions ii. Institutions Working in Silos iii. Institutional Restructuring and Mandate Restrictions iv. Limited Funding Allocated to Research v. Misalignment of Research Priorities across Sectors vi. Limited Involvement of Private Sector in Research vii. Security Concerns with Cloud-stored Research Information viii. Infrastructural Developments ix. Low Commitment of Development Partners to Environmental Research x. Environmental Climate Change Challenges xi. Changing Regulatory Frameworks xii. Duplication of Interventions

Chapter Four

4.0 RESEARCH AGENDA

This chapter outlines the National Environmental Research Agenda vision, mission, goal, strategic objectives, core values, and a description of the priority areas of environment research that were identified and collectively endorsed by stakeholders for this National Environment Research Agenda. Each priority area is accompanied by potential or suggestive themes that are described in Appendices 1-5; it is crucial to note that the execution of this research agenda may extend beyond the outlined priority research areas and themes.

4.1 VISION

Sustainable environment management supporting socio-economic transformation and sustainable environment in Uganda.

4.2 MISSION

To undertake research and provide innovative solutions to environmental challenges for sustainable development in Uganda.

4.3 GOAL

To promote sustainable development through research and innovative approaches to address environmental issues.

4. 4 STRATEGIC OBJECTIVES AND PERFORMANCE INDICATORS

4.4.1 Strategic Objectives

The National Environmental Research Agenda is to be implemented to achieve the following five strategic objectives:

1. Develop an integrated national environment management database for the Water-Food-Energy Nexus for enhanced resource utilization and climate resilience.
2. Establish a robust waste management strategy that minimizes pollution and enhances a circular economy for sustainable resource utilization.
3. Develop research and policy frameworks that integrate community-led adaptation strategies, indigenous knowledge systems, and gender considerations into environmental initiatives.
4. Create protocols for the protection and enhancement of ecosystems, biodiversity, and genetic resources.
5. Provide guidelines that promote sustainable land and mineral resource management practices for sustainable environmental management.

4.4.2 Performance Indicators

For each strategic objective, the strategy identifies the required output and corresponding Performance indicators for easy implementation as presented in ***Table 2.***

Table 2: Detailed outputs and performance indicators for each of the strategic objectives.

Strategic Objectives	Outputs	Performance Indicators
Develop integrated management frameworks for the Water-Food-Energy Nexus for enhanced resource utilization and climate resilience.	Comprehensive Water-Food-Energy Nexus management framework.	The number of frameworks developed and implemented.
	Training programs for stakeholders on integrated resource management.	Number of training sessions conducted, and participants trained.
	Pilot projects demonstrating integrated management practices.	Number of pilot projects initiated and their outcomes.
Establish a robust waste management strategy to minimize pollution and emphasize a circular economy for sustainable resource utilization.	Waste management strategy document emphasizing circular economy.	Reduction in pollution levels and increase in resource recycling rates.
	Development of recycling and waste reduction facilities.	The number of new facilities established and operational.
	Public awareness campaigns on waste management and recycling.	Reach and impact of awareness campaigns.
Develop research and policy frameworks that integrate community-led adaptation strategies, indigenous knowledge systems, and gender considerations into environmental initiatives.	Research and policy frameworks incorporating community-led adaptation, indigenous knowledge, and gender considerations.	Number of policies and frameworks developed and adopted.
	Case studies and reports on successful community-led adaptation strategies.	Number of case studies published and disseminated.
	Workshops and consultations with community leaders and stakeholders.	Number of workshops held and stakeholder engagement levels.
Safeguard and enhance ecosystems, biodiversity, and genetic resources.	Conservation programs and initiatives to protect ecosystems, biodiversity, and genetic resources.	Number of conservation programs implemented, and species protected.
	Restoration projects for degraded ecosystems.	Area of land restored and health improvements in ecosystems.
	Biodiversity monitoring and assessment reports.	Frequency and comprehensiveness of monitoring reports.

Promote sustainable land and mineral resource management practices for sustainable environmental development.	Sustainable land and mineral resource management practices and guidelines.	Number of sustainable practices adopted and decrease in land degradation.
	Training programs for land and resource managers on sustainable practices.	Number of training programs conducted, and participants trained.
	Research studies on the impact of sustainable practices on land and mineral resources.	Number of research studies published, and their findings utilized.

4.5 CORE VALUES

In implementing this Research Agenda, the following values will be upheld.

1. Integrity
2. Creativity and innovations
3. Collaboration
4. Accountability
5. inclusivity

4.6 PRIORITY RESEARCH AREAS

For the five years (2024/25- 2028/29) of implementation of this National Environment Research Agenda coordinated by the NEMA, the environmental research ecosystem in Uganda will focus on the following priority areas.

1. Water-Food-Energy Nexus and Climate Change
2. Pollution and waste management
3. Gender, Culture, and Environment
4. Ecosystem, biodiversity, and Genetic Resources
5. Land use, Soil Management and Mineral Resources

4.6.1 Water-Food-Energy Nexus and Climate Change

The Water-Food-Energy Nexus represents an interdependent relationship between the water, food, and energy resources that are essential for human survival and economic development. Often, actions in one domain can significantly impact the other two, necessitating a holistic and integrated approach to resource management. It has been observed that understanding and optimizing the interconnections between water, food, and energy is vital now as the global population grows and urbanizes amidst the pressing challenges of climate change. Water is indispensable for both food production and energy generation. In food production, agriculture consumes approximately 70% of the world's freshwater for crop irrigation and livestock sustenance. On the other hand,

A farmer using River Rwizi as one of the rivers in Uganda for Irrigation to enhance Agricultural productivity.Photo Credit Isaac Tindyebwa (NEMA)

water is crucial for various energy production processes, including hydropower, cooling in thermal power plants, and biofuel cultivation. Moreover, the production of food itself is a significant consumer of energy as energy is needed to extract, treat, and distribute water, as well as to power agricultural machinery, irrigation systems, and food processing and distribution networks. Also, energy is used in the manufacture of fertilizers and fuel required for transportation.

The global concern of climate change and climate variability demands a comprehensive approach encompassing both mitigation and adaptation strategies. Climate change mitigation involves actions aimed at reducing or preventing the emission of greenhouse gases into the atmosphere, such as transitioning to renewable energy sources, enhancing energy efficiency, afforestation initiatives, and sustainable land use practices. Adaptation strategies focus on building resilience by adapting to the inevitable impacts that are already occurring or expected to occur in the future, including building climate-resilient infrastructure, implementing sustainable water management practices, and developing strategies to cope with extreme weather events. The synergistic approach of combining mitigation and adaptation strategies recognizes the urgency to address the root causes of climate change while protecting societal and environmental systems against its impacts. Research and innovations play key roles in these efforts by informing evidence-based policies that foster the development of new improved technologies and adaptive strategies. The Water-Food-Energy Nexus in the face of climate change and climate variability poses significant risks to water availability, food security, and energy stability. Extreme weather events, shifting precipitation patterns, and rising temperatures can disrupt the delicate balance of this nexus leading to resource scarcity and heightened competition between the water, food, and energy sectors.

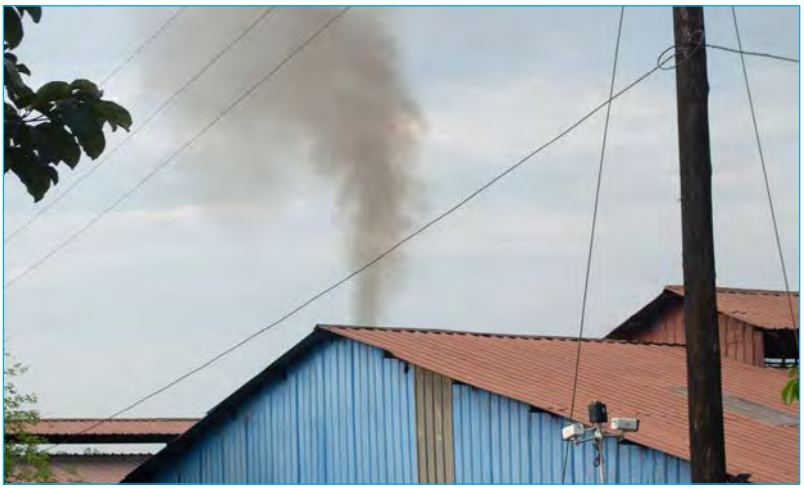
Solar panels for renewable energy 4MW PV Power station connected to the National Grid at Busitema,Tororo District . Photo Credit Isaac Tindyebwa (NEMA)

The Water-Food-Energy Nexus approach aims to identify synergies and trade-offs between the water, food, and energy sectors to promote sustainable development. Advances in technology, such as precision irrigation systems can enhance water efficiency in agriculture and reduce the energy required for water pumping and treatment. Renewable energy sources such as solar and wind can be leveraged to power agricultural operations thus decreasing dependence on fossil fuels and reducing greenhouse gas emissions. Similarly, sustainable agricultural practices can be employed to mitigate environmental impacts and contribute to the resilience of water and energy systems. Therefore, incorporating a nexus perspective into National Environmental Research Agenda is essential for achieving the United Nations Sustainable Development Goals (SDGs) related to clean water and sanitation (SDG 6), affordable and clean energy (SDG 7), and zero hunger (SDG 2).

The key thematic areas to be addressed in the water-food-energy nexus include:

i. Management of Water-Food-Energy Resources and Environmental Considerations

ii. Water-Food-Energy Nexus and Sustainable Agricultural Practices
iii. Climate change detection and attribution
iv. Climate change and adaptation mechanisms
v. Climate change and Biodiversity
vi. Climate change mitigation measures
vii. Climate change, water availability and quality
viii. Carbon capture and technology
ix. Community vulnerability and resilience to climate change
x. Greenhouse gas fluxes and Ozone depletion
xi. Renewable energy (hydro, wind, biomass among others) and resource efficiency.



Air pollution from an industry along Masaka road in Mpigi District .Photo Credit Isaac Tindyebwa (NEMA)

4.6.2 Pollution and Waste Management

Pollution and waste management stand as pivotal domains in environmental sustainability. The challenges of air, water, and/or soil pollution require concerted efforts in research and innovation. As societies grapple with the repercussions of industrialization, agriculture, and urbanization, there is an urgency to develop proactive strategies that not only curb pollution but also optimize the management of generated waste. Therefore, research plays a central role in understanding the intricacies surrounding pollution sources, pathways, and impacts. It provides the foundation for the creation of innovative technologies and methodologies aimed at efficient pollution control and waste management. The quest for cleaner and greener environments relies heavily on the outcomes of dedicated research efforts and the application of innovative solutions to address the challenges of environmental pollution and waste.

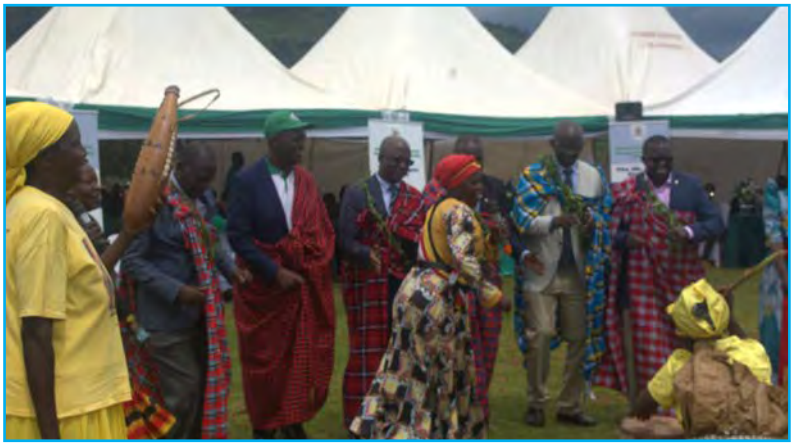
Solid waste management at Kitezi land fill Kampala District. Photo Credit Isaac Tindyebwa (NEMA)

The key thematic areas to be addressed in pollution and waste management are.

i. Agrochemical pollution including herbicides, fertilizers, pesticides, and veterinary drugs.
ii. Air quality assessment and management
iii. Circular economy strategies (Zero waste)
iv. Liquid waste management (Oil spillage, chemicals)
v. Plastic waste reduction and alternatives
vi. Solid waste management (Domestic waste, plastic, electronic and radioactive waste)
vii. Noise pollution
viii. Waste-to-energy technologies.

4.6.3 Gender, Culture and Environment

The intricate interplay between gender, culture, and the environment can significantly influence the sustainable development agenda. Understanding the relationships among these three elements is essential for formulating inclusive and effective strategies that address environmental challenges while respecting diverse cultural perspectives and acknowledging gender dynamics. Gender roles and cultural norms often shape individuals' interactions with the environment, influencing resource utilization, conservation practices, and vulnerability to environmental changes. In many societies, women, for instance, may play key roles in natural resource management and conservation, yet their contributions are sometimes overlooked or undervalued. Cultural beliefs and practices also play a pivotal role in shaping environmental attitudes and behaviours. Indigenous knowledge, embedded in cultural contexts, offers valuable insights into sustainable practices and biodiversity conservation. At the same time, certain cultural norms may contribute to environmental degradation, necessitating a careful examination of these dynamics.



Sabeni cultural display during the celebration of the International day of Biodiversity in Kapchorwa District. Photo Credit Isaac Tindyebwa (NEMA)

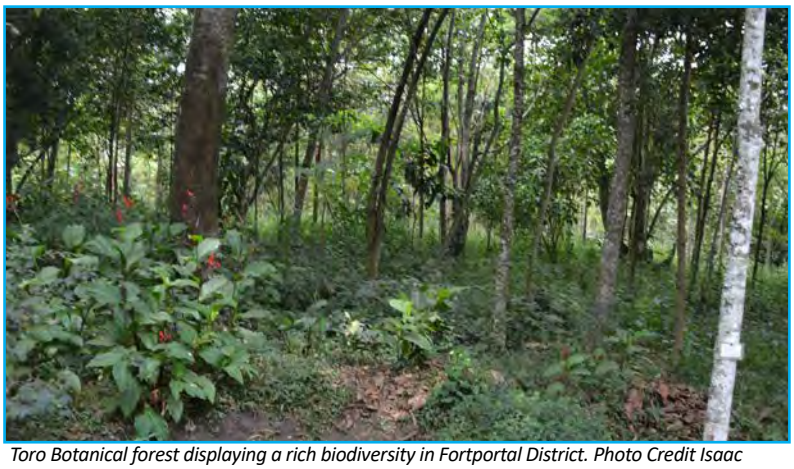
Research and initiatives in the intersection of gender, culture, and the environment are imperative for creating comprehensive and equitable environmental policies. Investigating the different impacts of environmental issues on diverse gender groups and cultural communities is vital. Moreover, recognizing and amplifying the role of women and local communities, integrating traditional knowledge, and fostering gender-sensitive and culturally responsive environmental practices are essential components of a holistic approach. This priority area delves into the complex relationships between gender, culture, and the environment, emphasizing the need for research and innovations that embrace diversity and promote sustainable practices.

This priority area will be addressed through the exploration of the following research themes:

i. Community mitigation and adaptation to environmental changes
ii. Gender considerations in the environment.
iii. Impacts of human interactions with the environment
iv. Relations between the environment and people's beliefs and cultures
v. Indigenous and Traditional Knowledge Systems in Environmental Research
vi. Indigenous peoples and local communities and Environmental Research

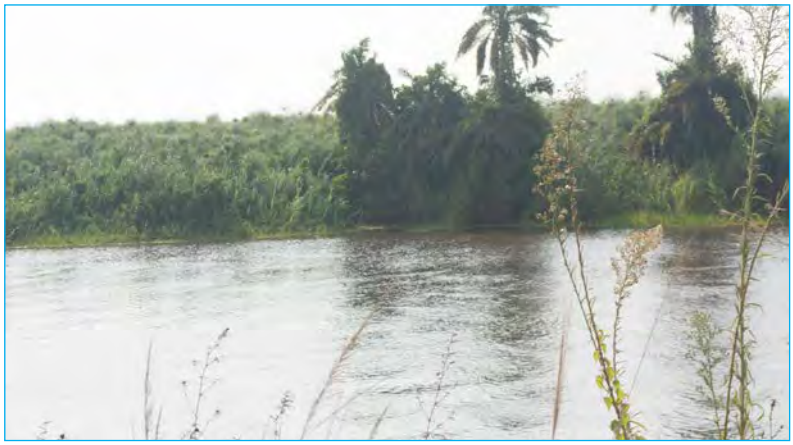
4.6.4. Ecosystem, Biodiversity, and Genetic Resources

Terrestrial and aquatic ecosystems are integral components of Earth's biodiversity, each supporting a range of interconnected life forms. These ecosystems form complex networks of flora and fauna, playing a pivotal role in maintaining ecological balance, providing ecosystem services, and contributing to food security and the overall health of the planet. Additionally, they are crucial repositories of genetic resources that are vital for adaptation, resilience, and the continued evolution of species. Terrestrial ecosystems encompassing forests, grasslands, and woodlands are important for biodiversity and genetic resources conservation.



Toro Botanical forest displaying a rich biodiversity in Fortportal District. Photo Credit Isaac Tindyebwa (NEMA)

These ecosystems host diverse species with complex interactions essential for ecological stability. The genetic diversity found in terrestrial ecosystems is fundamental for the adaptability and resilience of species to environmental changes. For instance, genetic variation in forest trees can enhance their resistance to pests and diseases, while diverse plant genetics contribute to soil health and fertility. However, terrestrial ecosystems face significant threats, including deforestation, habitat fragmentation, climate change, and the introduction of invasive and alien species. These threats lead to a reduction in genetic diversity, making species more vulnerable to extinction. Human activities, notably urbanization and unsustainable land use practices, further exacerbate the degradation of these habitats and the resultant loss of biodiversity and genetic resources.



River Katonga an aquatic ecosystems in Uganda along Masaka road In Mpigi District. Photo Credit Isaac Tindyebwa (NEMA)

Aquatic ecosystems, comprising streams, rivers, lakes, and wetlands, are vital to Earth's biodiversity and genetic resources. These ecosystems provide habitats, breeding grounds, and sustenance for a vast array of flora and fauna. The genetic diversity within aquatic species is crucial for the resilience of ecosystems, enabling species to adapt to changing environmental conditions and resist diseases. Aquatic biodiversity is not only essential for the health of these ecosystems but also for global food security, as numerous communities depend on fisheries and aquaculture for their livelihoods. However, aquatic ecosystems are under threat from overfishing, habitat destruction, pollution, climate change, and invasive species. These threats diminish genetic diversity, impairing the ability of species to adapt and survive. They are prone to being endangered once not protected or conserved.

Preserving and enhancing biodiversity and genetic resources in terrestrial and aquatic ecosystems is crucial.

Shearnut tree seedling the Endangered specie being grown in nurseries by National Forestry Authority for conservation, and restoration in Gulu District. Photo Credit Isaac Tindyebwa (NEMA)

It ensures the resilience of ecosystems amidst environmental changes, contributes to the stability of global climate patterns, and sustains essential resources for human societies, including food, medicine, and raw materials derived from diverse genetic pools. The conservation of aquatic and terrestrial biodiversity and genetic resources requires comprehensive efforts in research, sustainable management, and policy implementation. Scientific research is essential to understanding

the complex dynamics in ecosystems, the interconnections among species, and the impacts of human activities. Conservation strategies and sustainable practices are necessary to mitigate the adverse effects of these threats and ensure the long-term health and productivity of these ecosystems.

This priority area will be addressed through the exploration of the following research themes:

i. Physiochemical Aquatic Ecosystem, Biodiversity, standards, quality control and assurance
ii. Endangered species, conservation, and restoration
iii. Biodiversity genetic mapping, preservation, and control
iv. Wildlife disease management
v. Environmental and social safeguards
vi. Human impacts on the aquatic and terrestrial ecosystems and controls
vii. Invasive and alien species and ecosystem health
viii. Keystone ecosystems and biodiversity
ix. Loss and stability of aquatic and terrestrial biodiversity
x. Natural resources capital accounting (Aquatic and terrestrial Population dynamics)
xi. Aquatic and terrestrial Environment DNA (eDNA)
xii. Biodiversity and human health
xiii. Bioprospecting
xiv. Terrestrial, aquatic species and genetic preservation and conservations

4.6.5. Land Use, Soil Management, and Mineral Resources

Land use and soil management play key roles in shaping the environmental and agricultural landscapes, influencing the health of ecosystems, food production, and overall sustainability. The utilization of land and the practices applied to manage soil have direct impacts on biodiversity, water quality, and climate resilience. Land use encompasses a wide spectrum of activities, from urban development, infrastructural and industrial development, mining, and agriculture to conservation and forestry. As populations grow, striking a balance between meeting human needs and preserving natural ecosystems becomes increasingly challenging. Additionally, infrastructural development encompasses a broad spectrum, including transportation networks, energy systems, water supply, and urban facilities. It therefore becomes imperative to assess and mitigate the potential environmental impacts.

Water Pipes being constructed in an environmently conscience manner along the Gulu road wetland ecosystem to Gulu City. Photo Credit Isaac Tindyebwa (NEMA)

Sustainable industrial development and environmental preservation stand at the forefront of global environmental challenges and opportunities. As industries continue to play a pivotal role in economic growth, there is a growing imperative to align industrial practices with ecological sustainability. This necessitates a paradigm shift towards innovative approaches that harmonize industrial processes with environmental well-being. For instance, mining contributes significantly to global economic development and energy security, but its activities often pose challenges to the environment. The transition towards sustainable mining and

energy practices involves adopting cleaner technologies, improving energy efficiency, and integrating environmental considerations into the planning and execution of projects.

Sustainable land use practices involve minimizing habitat loss, protecting biodiversity hotspots, and optimizing the allocation of land for various purposes. The relationship between development and land management necessitates an integrated and forward-thinking perspective in shaping a sustainable future. Soil management is closely linked with land use and is essential for maintaining soil structure and soil fertility, preventing erosion, and mitigating the impact of agricultural activities. Good Agricultural Practices (GAP) contribute to sustainable soil management by enhancing soil structure, reducing nutrient runoff, and promoting long-term productivity. Moreover, environmentally conscious practices in infrastructure and industrial development and mining minimize soil disturbances, promote soil health, reduce soil contamination, and rehabilitate reclaimed land. Research in land use and soil management is vital for developing evidence-based practices that address environmental challenges paving the way for a sustainable and resilient future for generations to come.

This priority area will be addressed through the exploration of the following research themes.

i. Degradation, restoration, and conservation.
ii. Sustainable solutions for drainage management and flood control
iii. Population dynamics and land resource management.
iv. Oil and gas and environmental management.
v. Mining and extraction technologies.
vi. Mining, industrial, and infrastructural development, and human health
vii. Land use, land cover, and biodiversity.
viii. Physical, chemical, and biological composition of soil.
ix. Infrastructural development and environmental management.
x. Policy formulation for infrastructure, industrial, mining, and environment

4.6.6 Cross-cutting issues

Throughout the consultation process, several issues emerged as crucial and with broad-reaching implications, necessitating their inclusion across all priority areas of environmental research. These cross-cutting issues encompass the following:

i. Gender perspectives on environmental initiatives
ii. Transboundary environmental concerns.
iii. Information and Communications Technology (ICT) in environment research.
iv. Innovations and technological transfers in environment research. This may include biotechnology, genetically modified organisms, bioremediation, phytoremediation, biosafety, and biosecurity.
v. Demography and the environment.
vi. Environmental governance, planning, monitoring, and assessment practices.
vii. Environmental education, mindset change, and effective information management
viii. Emerging issues within the different priority areas.
ix. Scenario of modelling and environmental analysis.

5.0. IMPLEMENTATION FRAMEWORK

5.1. INTRODUCTION

The National Environmental Research Agenda serves as the blueprint for translating aspirations of environment research into tangible actions to achieve its mission. It also creates a dynamic and inclusive research environment through prioritizing the development of guidelines and policies, fostering collaborations with stakeholders, and securing funding sources. The incorporation of a scientific committee, expansion of research facilities, and periodic reviews underscore the commitment to high-quality, and adaptable research initiatives. Additionally, active engagement with communities, political advocacy, and a robust monitoring and evaluation system further enhance the framework's capacity to drive impactful environmental research, aligning efforts with the overarching goals of sustainability and conservation as summarized in **Figure 1**.

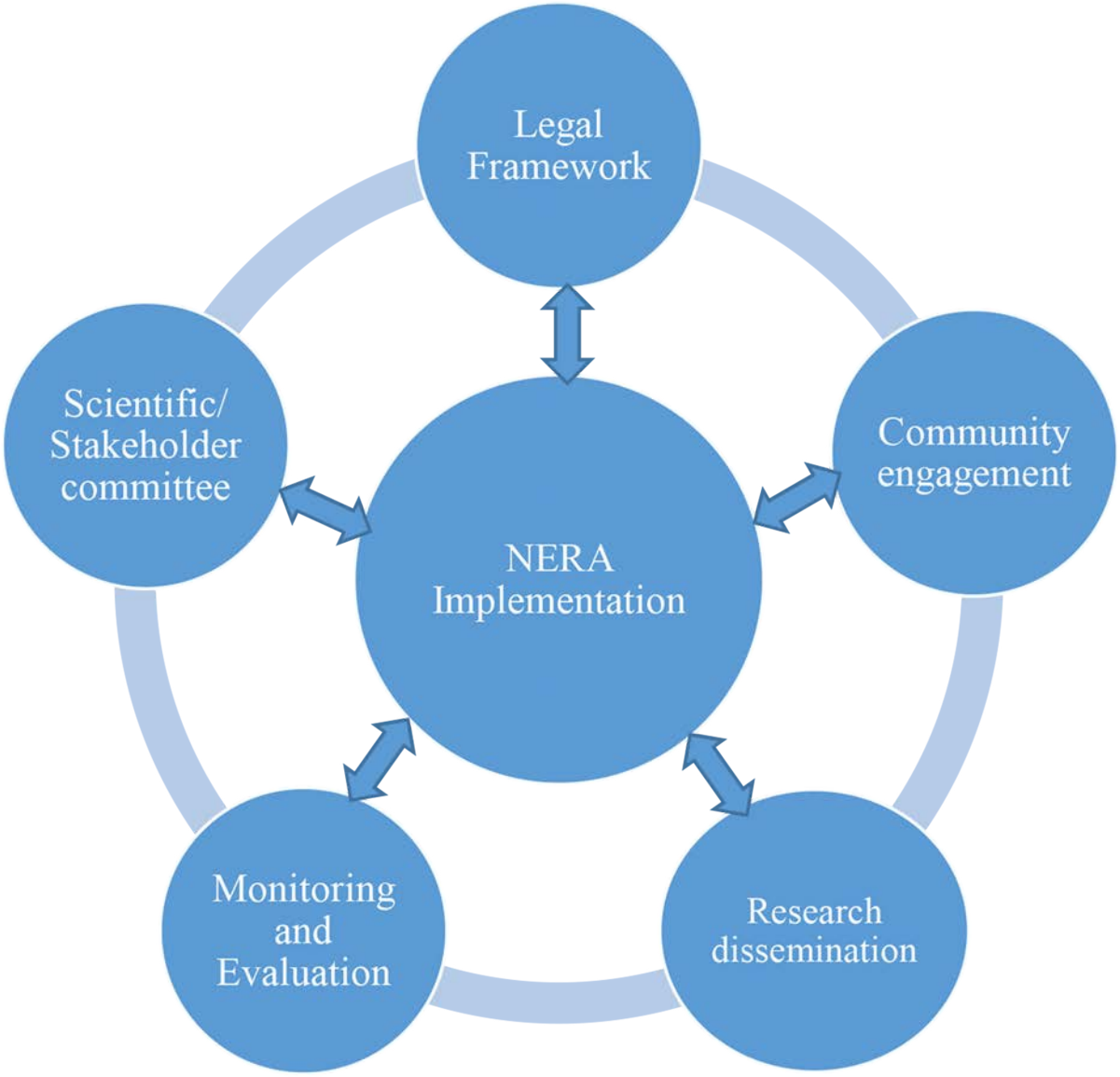


Figure 1: National Environmental Research Agenda implementation framework.

5.2 LEGAL FRAMEWORK

This research agenda is to be executed and carried out within the existing policies, legal, and institutional frameworks, which include the 1995 Constitution of the Republic of Uganda, NEA Cap 181. Additionally, it aligns with the Uganda Wildlife Act, 2019, the National Climate Change Policy, 2018, the National Oil and Gas

Policy for Uganda, 2008, the Mining Act, 2003, the National Forestry and Tree Planting Act, 2003, the Water Act, Cap. 152, the Universities and Other Tertiary Institutions Act of 2001, and the guidelines of the Uganda National Council of Science and Technology (UNCST) among others. The Minister of Water and Environment will provide overall guidance while NEMA management will offer strategic policy oversight.

5.3 STAKEHOLDERS ENGAGEMENT

The effective delivery of the National Environmental Research Agenda will require the engagement of the different government MDAs including the Ministry of Finance And Economic Planning, Ministry of Water And Environment, Ministry of Gender, Labour and Social Development, Ministry of Agriculture, Animal Industry and Fisheries, Ministry of Energy and Mineral Development, Ministry of Lands, Housing and Urban Development, Ministry of Health, Ministry of Tourism, Wildlife and Antiquities, Office of The Prime Minister, Academic Institutions and the private sector.

Furthermore, international, and regional cooperation plays a crucial role in environmental research; Uganda, as a signatory and ratifier of numerous international and regional environmental treaties, benefits from the provisions in such agreements which often assist countries in fulfilling their obligations. Environmental research underscores the necessity of regional and international collaboration; therefore, collaboration with regional and international institutions will be vital as part of implementing the National Environmental Research Agenda.

5.4 MONITORING AND EVALUATION (M&E)

Aligned with the 2011 National Policy on Public Sector Monitoring and Evaluation, the execution of the National Environmental Research Agenda will undergo scrutiny at national, regional, district, and community tiers. Vigilant efforts will be invested in monitoring outcomes and the broader impact of research on environmental management and sustainability. NEMA in collaboration with the stakeholders will oversee the comprehensive implementation of this research agenda and will actively engage in the monitoring, evaluation, reporting, and review of each of the research projects to be implemented. The format in Appendix 6 will be used during the monitoring and evaluation process. The Monitoring and Evaluation (M&E) will be conducted at every stage of the project implementation to ensure a thorough assessment of the research agenda's effectiveness and its contributions to sustainable environmental practices in the country.

5.5 REVIEW OF THE RESEARCH AGENDA

To maintain relevance and delivery excellence, the National Environment Research Agenda will undergo a formal review after every five years of implementation. However, the review process may be made earlier based on factors such as satisfaction levels derived from M&E reports and the need to address emerging critical issues. The review process will be conducted by NEMA in collaboration with stakeholders. This structured approach will ensure a continuous improvement cycle, aligning the Research Agenda with evolving challenges and stakeholder expectations.

5.6 RESEARCH COORDINATION AND DISSEMINATION FRAMEWORK

The coordination meetings between NEMA and stakeholders will occur on a bi-annual basis, offering a platform to assess research agenda implementation progress and address emerging environmental issues. Furthermore, NEMA will take the lead in disseminating environmental research findings across the country. This will primarily be accomplished through annual scientific conferences and the facilitation of research

findings' publication in peer-reviewed books, scientific journals, websites, and various communication channels such as radio, television programs, magazines, leaflets, newsletters, and policy briefs. The objective is to enhance visibility and ensure a systematic and regular exchange of information, fostering a widespread understanding of environmental issues and contributing to informed decision-making at both national and community levels.

5.7 RESEARCH FUNDING AND SUPERVISION

NEMA in collaboration with other stakeholders will support selected projects as per the outlined priority areas in this research agenda. Selection of the environmental-related projects for funding will be conducted every year via a call for proposals and vetting of the proposals received from the respective researchers by a select committee. The selected lead research projects will be supervised by both NEMA and the collaborating institution. If the NEMA co-funds the research projects undertaken at a collaborating institution, NEMA should be acknowledged in the research reports, dissertations, theses, and scientific journal publications co-authored by both institutions.

5.8 THE SELECTION CRITERION OF THE RESEARCH PROJECTS

The NEMA Executive Director (ED) will establish a committee of five (5) technical persons chaired by the designated Head of the Research and Innovations Unit at NEMA to coordinate and spearhead all research and innovation projects under this research agenda. The operations of the committee will be guided by the given terms of reference. The chosen projects will be forwarded to the Board of Directors of NEMA through the Executive Director for approval.

5.9 FINANCING OF THE RESEARCH AGENDA

The cost of implementing this research agenda over five (5) years is estimated at UGX. 37,500,000,000 (Thirty-Seven Billion, Five Hundred Million Uganda Shillings); the detailed budget items are presented in Table 3. The fund for implementation of this research agenda will be sourced from the Government of Uganda and partner organizations.

Table 3: Estimated costs of implementing the National Environmental Research Agenda over the five years.

Priority area	Estimated Cost in Uganda Shillings
Water-Food-Energy Nexus and Climate Change	
Management of Water-Food-Energy resources and environmental considerations.	650,000,000
Water-Food-Energy Nexus and sustainable agricultural practices.	500,000,000
Sustainable solutions for drainage management and flood control.	700,000,000
Climate change detection and attribution	450,000,000
Climate change and adaption mechanisms	525,000,000
Climate change and Biodiversity	525,000,000
Climate change mitigation measures	575,000,000
Climate change, water availability and quality	550,000,000
Carbon capture and technology	500,000,000
Community vulnerability and resilience to climate change	400,000,000

Greenhouse gas fluxes and ozone depletion	500,000,000
Renewable energy (Hydro, wind, biomass among others) and Resource Efficiency	450,000,000
Sub-total	**6,325,000,000**
Pollution and waste management	
Agrochemical pollution including herbicides, fertilizers, pesticides, and veterinary drugs	600,000,000
Air quality assessment and management	875,000,000
Circular economy strategies (Zero waste)	750,000,000
Liquid waste management (Oil spillage, chemicals)	600,000,000
Plastic waste reduction and alternatives	1,100,000,000
Solid waste management (Domestic waste, plastic, electronic and radioactive waste).	700,000,000
Noise pollution.	550,000,000
Waste-to-energy technologies.	975,000,000
Sub-total	**6,150,000,000**
Gender, Culture, and Environment	
Community mitigation and adaptation strategies for impacts of environmental changes	650,000,000
Gender considerations in environmental studies	625,000,000
Impacts of human interactions with the environment	700,000,000
Relations between the environment and people's beliefs and cultures	550,000,000
Indigenous and Traditional knowledge systems in Environmental research	525,000,000
Indigenous peoples and local communities and Environmental Research	525,000,000
Sub-total	**3,575,000,000**
Ecosystem, Biodiversity, and Genetic resources	
Physiochemical Aquatic Ecosystem, Biodiversity, standards, quality control, and assurance	350,000,000
Endangered Species, Conservation and Restoration	775,000,000
Biodiversity genetic mapping, preservation, and control	450,000,000
Wildlife Disease management	650,000,000
Environmental and social safeguards	425,000,000
Human impacts on aquatic resources and controls	475,000,000
Invasive and alien species and ecosystem health	400,000,000
Keystone ecosystems and biodiversity	425,000,000
Loss and stability of aquatic and terrestrial biodiversity	425,000,000
Natural resources capital accounting	375,000,000
Aquatic and terrestrial Environment DNA (eDNA)	425,000,000
Biodiversity and human health	750,000,000
Bioprospecting	425,000,000
Terrestrial, aquatic species and genetic preservation and conservations	425,000,000
Sub-total	**6,775,000,000**
Land use, Soil management, and Mineral Resources	
Degradation, restoration, and conservation.	1,250,000,000
Population dynamics and land resource management	475,000,000
Sustainable solutions for drainage management and flood control	1,500,000,000

Land use, land cover, and Biodiversity	650,000,000
Physical, chemical, and biological composition of soil.	550,000,000
Oil and gas and environmental management	850,000,000
Mining and extraction technologies	650,000,000
Mining, industrial and infrastructure development, and human health	1,500,000,000
Infrastructural development and environmental management	650,000,000
Policy formulation for infrastructure, industrial, mining, and environment	350,000,000
Sub-total	**8,425,000,000**
Cross-cutting issues	
Gender perspectives on environmental initiatives	550,000,000
Trans-boundary environmental concerns	450,000,000
ICT in environmental research	500,000,000
Innovations and technological transfers in environmental research	2,800,000,000
Demography on the Environment	375,000,000
Environmental governance, planning, monitoring, and assessment practices	350,000,000
Environmental education and effective information management	425,000,000
Scenario of modelling and environmental analysis	300,000,000
Emerging issues within the different priority areas	500,000,000
Sub-total	**6,250,000,000**
GRAND TOTAL	**37,500,000,000**

5.10 RESOURCE MOBILIZATION AND SUSTAINABILITY

The resource mobilization strategy for National Environmental Research Agenda implementation is hinged on a well-rounded and diverse approach that encompasses funding from the Government of Uganda and collaborative efforts in sourcing funding including leveraging on private-public partnerships. Institutional collaborations, both nationally and internationally, are sought to generate funding for this research agenda. Additionally, securing a dedicated budget within the institutional framework provides consistent and predictable funding for ongoing projects, showcasing NEMA's and stakeholders' commitment to this research agenda. Public-private partnerships targeted fundraising campaigns and collaboration with NGOs, regional bodies, and international organizations will contribute to financial support and on-the-ground expertise. Active participation in research grant proposal writing responding to research grant calls and exploring funds from basket funds managed by the Ministry of Finance, Planning and Economic Development offer additional avenues for research funding support for this research agenda. Collaboration with public universities through their Research and Innovation Funds enhances access to academic expertise and facilities. Furthermore, engaging in consultancy services and participating in symposiums and conferences not only provides financial support but also opportunities for networking and collaboration.

Sustainability efforts include internships, research mentorships, adherence to legal frameworks, and signing of a Memorandum of Understandings to ensure the long-term impact of National Environmental Research Agenda on environmental sustainability at both national and global levels. Through this comprehensive National Environment Research Agenda, the NEMA aims to contribute significantly to the environmental database that will inform development decisions and ensure sustainability.

APPENDICES

Appendix 1: Priority Research Area of Water-Food-Energy Nexus and Climate Change.

Sub-themes	Possible research areas	Outputs	Indicators	Outcomes
i. Climate change detection and attribution	Carbon reduction policies and strategies	Implementation of climate policies	Reduction in carbon emissions	Mitigated climate change impacts
	Climate-resilient infrastructure	Implementation of adaptive infrastructure	Resistance to climate-related impacts	Enhanced community resilience
	Ecosystem-based adaptation	Conservation and restoration of ecosystems	Biodiversity indices	Improved ecosystem resilience
ii. Management of Water-Food-Energy Resources and Environmental Considerations	Integrated Water Resource Management (IWRM)	Guidelines for IWRM practices, improved water management policies	Water usage efficiency, water quality, availability of water resources	Sustainable water resource utilization, improved water quality, reduced water scarcity
	Renewable Energy Integration	Research papers, new renewable energy technologies, policy frameworks	Percentage of renewable energy usage, energy efficiency, carbon emissions	Increased renewable energy adoption, reduced carbon footprint, enhanced energy security
	Water-Energy Efficiency in Industrial Processes	Industrial best practice guidelines, innovative technologies, efficiency improvement plans	Water and energy consumption in industries, waste generation	Reduced industrial water and energy usage, minimized waste generation, cost savings for industries
iii. Water-Food Energy Nexus and Sustainable Agricultural Practices	Sustainable Agricultural Practices	Best practice manuals, new agricultural technologies, policy recommendations	Crop yield, water usage in agriculture, soil health, use of agrochemicals	Increased agricultural productivity, reduced water usage, improved soil health, reduced environmental impact
	Efficient Water Use in Agriculture	Guidelines for Efficient Water Use Practices	- Crop yield per unit of water used	Enhanced agricultural productivity per unit of water

iv. Climate change and adaption mechanisms	Early warning systems for extreme events	Development and implementation of early warning systems	Timely response to climate-related disasters	Reduced human and economic losses
	Adaptive agricultural practices	Implementation of climate-smart agriculture	Crop yields and resilience to climate variability	Increased food security
	Climate-resilient urban planning	Adoption of sustainable urban planning	Urban resilience indicators	Improved urban infrastructure and planning
v. Climate change and Biodiversity	Biodiversity conservation strategies	Protected area expansion and management	Species richness and abundance	Preserved biodiversity and ecosystems.
	Impact of climate change on species	Monitoring and assessment of species response to climate change	Changes in species distribution and behaviour	Informed conservation measures
	Restoration of critical habitats	Restoration projects for key habitats	Habitat quality metrics	Recovered biodiversity populations
vi. Climate change mitigation technologies	Renewable energy technologies	Adoption of solar, wind, and biogas technologies	Increased share of renewable energy in the energy mix	Reduced dependence on fossil fuels
	Carbon capture and storage (CCS)	Implementation of CCS technologies	Captured and stored carbon dioxide indicators	Mitigated greenhouse gas emissions
	Afforestation and reforestation	Implementation of tree planting projects	Increased forest cover and carbon sequestration	Improved carbon balance and biodiversity
vii. Climate change, water availability and quality	Water resource management strategies	Adoption of sustainable water management	Water quality indices	Improved water availability and quality
	Impact of climate change on water resources	Modelling and assessment of water resource changes	Changes in water availability and flow patterns	Informed water resource management
	Climate-resilient water infrastructure	Implementation of climate-resilient water infrastructure	Resistance to extreme weather events	Enhanced water supply resilience

viii. Carbon capture and technology	Carbon capture and utilization (CCU)	Implementation of CCU technologies	Utilization efficiency of captured carbon	Reduced atmospheric carbon concentrations
	Environmental and economic assessments	Evaluation of CCU projects' environmental and economic impacts	Environmental and economic indicators	Sustainable carbon management
	Social acceptance and governance of CCU	Integration of public opinions and governance in CCU projects	Public support and regulatory compliance	Ethical and transparent carbon management
ix. Community vulnerability to climate change	Vulnerability assessments	Identification of vulnerable communities	Vulnerability indices	Informed community adaptation strategies
	Community-based adaptation projects	Implementation of locally tailored projects	Community resilience indicators	Increased community resilience to climate change
	Social and economic impacts of climate change	Assessment of climate-induced social and economic changes	Changes in key social and economic indicators	Informed policies and interventions
x. Greenhouse gas fluxes and Ozone depletion	Greenhouse gas monitoring systems	Implementation of monitoring technologies	Greenhouse gas concentration levels	Informed climate policies and actions
	Identification of emission sources	Mapping and analysis of emission sources	Source-specific emission data	Targeted emission reduction strategies
	Verification of emission reduction efforts	Assessment of the effectiveness of emission reduction projects	Reduction in emissions from targeted sources	Improved accountability and mitigation efforts
	Identification of ozone-depleting substances (ODS) sources		Reduction in ODS emissions	Preserved stratospheric ozone layer
	Public awareness and compliance	Education and communication campaigns	Awareness levels of ODS alternatives	Reduced use of ozone-depleting substances
xi. Renewable energy (Hydro, wind, biomass among others) and Resource Efficiency	Solar energy efficiency improvements	Adoption of advanced solar technologies	Increased solar energy conversion efficiency	Enhanced solar energy utilization
	Biomass utilization	Implementation of biomass projects	Volume of biogas, bio-oil and bio char produced	Reduced dependence on fossil fuels
	Wind energy optimization.	Integration of advanced wind technologies	Improved wind energy capture efficiency	Increased contribution of wind energy

Appendix 2: Priority research area of Pollution and waste management.

Sub-themes	Possible research areas	Outputs	Indicators	Outcomes
i. Environmental impacts of industrial processes and remediation (a focus on industries like textile, leather, cement, and paint among others)	Pollution control technologies	Implementation of pollution control	Reduction in emissions and effluents	Improved environmental quality
	Industrial waste management	Efficient waste treatment processes	Decrease in industrial waste generation	Reduced environmental pollution
	Remediation techniques	Successful implementation of remediation	Soil and water quality improvement	Ecosystem restoration
ii. Industrial strategies for sustainable environmental management	Circular economy practices	Implementation of waste-to-resource	Resource efficiency	Reduced environmental footprint
	Green supply chain management	Adoption of sustainable supply chains	Reduction in environmental impact of supply chain	Enhanced sustainability in production
	Eco-friendly technologies	Integration of green technologies	Reduction in carbon footprint	Improved industrial environmental performance
iii. Socio-economic development: A nexus between industry, environment, and health	Socio-economic impact assessments	Comprehensive impact assessments	Socio-economic indicators	Informed policy and development decisions
	Health and environment linkages	Improved occupational health programs	Health and environmental quality indicators	Enhanced well-being of communities
	Sustainable community development	Implementation of community projects	Community development indices	Balanced socio-economic growth
iv. Agrochemical's pollution including herbicides, fertilizers, pesticides, and veterinary drugs	Sustainable farming practices	Adoption of organic farming techniques	Reduction in agrochemical usage	Minimized agrochemical pollution
	Alternative pest control	Development of non-chemical pest control	Decrease in pesticide usage	Reduced environmental contamination
	Soil health management	Implementation of soil conservation	Improvement in soil quality	Enhanced agricultural sustainability

v. Air quality assessment and management	Air quality monitoring systems	Establishment of air quality monitoring	Air quality indices	Improved air quality
	Emission reduction strategies	Implementation of emission controls	Reduction in air pollutants	Healthier ecosystems and communities
	Urban planning for air quality	Implementation of green urban planning	Air pollution levels in urban areas	Sustainable urban development
vi. Circular economy strategies (Zero waste)	Resource recovery technologies	Adoption of resource recovery systems	Reduction in resource consumption	Minimized waste and environmental impact
	Eco-design and product lifecycle	Integration of sustainable product design	Product life cycle assessments	Reduced environmental footprint
	Circular supply chain management	Implementation of circular supply chains	Reduction in waste along the supply chain	Enhanced sustainability in production
vii. Liquid waste management (Oil spillage, chemicals)	Oil spill response technologies.	Development of oil spill response systems	Timely containment and cleanup of spills	Minimized impact on aquatic ecosystems.
	Chemical waste treatment methods	Implementation of efficient treatment	Reduction in hazardous chemical discharges	Improved water quality
	Regulatory frameworks	Establishment of stringent regulations	Compliance with waste disposal regulations	Reduced environmental contamination
viii. Plastic waste reduction and alternatives	Plastic alternatives research	Development of alternative materials	Reduction in plastic production and usage	Decreased plastic pollution
	Waste separation and recycling	Implementation of effective recycling	Increase in plastic recycling rates	Reduced plastic waste in landfills
	Public awareness campaigns	Increased public awareness	Reduction in single-use plastic consumption	Shift towards sustainable practices

ix. Solid waste management (Domestic waste, plastic, electronic and radioactive waste)	Efficient waste collection	Implementation of waste collection systems	Improved waste collection rates	Cleaner and healthier urban environments
	E-waste recycling technologies	Adoption of electronic waste recycling	Reduction in electronic waste accumulation	Minimized environmental impact
	Radioactive waste disposal	Safe and secure radioactive waste disposal	Compliance with radiation safety standards	Reduced risk of radioactive contamination
x. Noise pollution	Noise reduction technologies	Implementation of noise reduction tech	Reduction in ambient noise levels	Improved public health and well-being
	Urban planning for noise control	Integration of noise control in planning	Compliance with noise regulations	Enhanced quality of life in urban areas
xi. Waste-to-energy technologies.	Energy recovery from waste	Implementation of waste-to-energy tech	Increased energy production from waste	Renewable energy sources
	Emission control in energy generation	Adoption of clean energy technologies	Reduction in greenhouse gas emissions	Sustainable and cleaner energy production

Appendix 3: Priority Research Area of Gender, Culture, and Environment

Sub-themes	Possible research areas	Outputs	Indicators	Outcomes
i. Community mitigation and adaptation to environmental changes	Climate change adaptation strategies	Implementation of adaptive measures	Reduction in vulnerability to climate impacts	Increased resilience to environmental changes
	Mitigation policies and practices	Adoption of sustainable mitigation actions	Greenhouse gas emission reductions	Minimized environmental impact
	Integrated resource management	Implementation of sustainable resource use	Resource use efficiency	Enhanced ecosystem and community sustainability
ii. Gender considerations in environmental studies	Gender-inclusive environmental policies	Implementation of gender-sensitive policies	Gender-disaggregated data collection	Improved gender equity in environmental decision-making
	Women's participation in conservation	Involvement of women in conservation projects	Increased representation of women in environmental roles	Enhanced community engagement and sustainability
	Gender-responsive environmental education	Integration of gender perspectives in education	Improved gender awareness and inclusivity in environmental programs	Empowered and informed communities
iii. Impacts of human interactions with the environment	Urbanization and environmental impacts	Urban planning guidelines for sustainability	Urban environmental quality indicators	Balanced urban development
	Industrialization and environmental consequences	Adoption of sustainable industrial practices	Reduction in industrial environmental footprint	Improved environmental quality
	Agriculture and sustainable practices	Adoption of eco-friendly agricultural methods	Soil and water quality indices	Enhanced agricultural sustainability.
iv. Relations between the environment and people's beliefs and cultures	Cultural heritage preservation	Integration of environmental considerations in cultural preservation	Cultural diversity indices	Sustainable preservation of cultural heritage
	Ethnobotanical studies	Documentation of traditional plant knowledge	Conservation of traditional medicinal plants	Improved understanding of biodiversity
	Indigenous land management practices	Recognition and protection of Indigenous land rights	Sustainable land use and conservation	Enhanced environmental stewardship.

v. Indigenous and Traditional Knowledge Systems in Environmental Research	Documentation of Indigenous and traditional knowledge	Compilation of traditional ecological knowledge	Preservation of traditional knowledge systems	Enhanced biodiversity conservation
	Integration of Indigenous and traditional practices	Adoption of sustainable practices based on traditional knowledge	The success of traditional practices in a modern context	Improved environmental management.
	Collaborative research with Indigenous communities	Joint projects with local communities	Community involvement in research projects	Mutual learning and sustainable outcomes

Appendix 4: Priority Research Area of Ecosystem, biodiversity, and Genetic Resources

Sub-themes	Possible research areas	Outputs	Indicators	Outcomes
i. Endangered species, conservation, and restoration	Ecosystem health assessment	Monitoring and assessment of aquatic ecosystems	Biotic and abiotic indicators	Preserved and restored aquatic ecosystems
	Habitat protection and restoration	Implementation of ecosystem restoration projects	Improved habitat quality	Enhanced biodiversity and ecosystem services
	Sustainable management strategies	Adoption of sustainable fisheries and aquaculture practices	Sustainable resource use indicators	Improved aquatic biodiversity management
	Conservation breeding programs	Establishment of breeding programs for endangered aquatic species	Increased population size of endangered species	Recovery and preservation of endangered species
ii. Physiochemical Aquatic Ecosystem, Biodiversity, standards, quality control and assurance	Establishment of biodiversity standards	Development of standards for aquatic biodiversity	Adherence to biodiversity quality metrics	Conserved and improved aquatic biodiversity
	Quality control and assurance measures	Implementation of monitoring and quality control programs	Compliance with biodiversity standards	Enhanced biodiversity conservation
	Research on physiochemical and biodiversity indicators	Identification and validation of physiochemical biodiversity indicators	Integration of indicators in monitoring programs	Informed and effective conservation efforts
	Habitat protection and restoration	Implementation of projects for endangered species protection	Improved habitat conditions for endangered species	Recovery and preservation of endangered species
iii. Biodiversity genetic mapping, preservation, and control	Genetic mapping of aquatic species	Development of genetic maps for key aquatic species	Availability and quality of genetic mapping data	Improved understanding of genetic diversity
	Preservation of bio and genetic diversity	Implementation of biodiversity and genetic conservation programs	Maintenance of biodiversity genetic diversity indicators	Preserved biodiversity and genetic diversity of aquatic species
	Control of genetic pollution	Implementation of measures to prevent genetic pollution	Reduction in genetic pollution indicators	Protected genetic integrity of aquatic species

iv. Wildlife disease management	Disease prevention and control	Implementation of measures to prevent and control diseases in terrestrial ecosystems	Reduction in disease prevalence and impacts	Enhanced health and stability of terrestrial ecosystems
	Cost-effectiveness of strategies	Cost-effectiveness of strategies	- Policy briefs	Cost-efficient management practices
v. Aquatic and terrestrial Environment DNA (eDNA)	Molecular Ecology of Aquatic Communities:	Identification of gene flow patterns and genetic differentiation among populations	Genetic connectivity and population structure of aquatic organisms	insights into the drivers of population dynamics
	Genetic Diversity and Conservation	Genetic profiles of target species populations.	Genetic markers (e.g., microsatellites, SNPs) diversity within aquatic species	Improved understanding of genetic diversity patterns
vi. Environmental and social safeguards	Development of environmental safeguards	Integration of safeguards in development projects	Compliance with environmental safeguards	Minimized negative environmental and social impacts
	Social impact assessments	Assessment of social impacts of projects	Improved social indicators	Enhanced social well-being and equity
	Stakeholder engagement	Implementation of effective stakeholder engagement programs	Level of stakeholder satisfaction	Informed and inclusive decision-making

Appendix 5: Priority Research Area of Land Use, Soil Management, and Mineral Resources.

Sub-themes	Possible research areas	Outputs	Indicators	Outcomes
i. Degradation, restoration, and conservation	Assessment of degraded ecosystems	Identification and mapping of degraded ecosystems	Extent and severity of degradation	Informed restoration strategies
	Ecological restoration techniques	Implementation of restoration projects using various techniques	Changes in vegetation cover and ecosystem structure	Improved ecological health and functionality.
	Conservation strategies for biodiversity	Development of conservation plans for protecting vulnerable species	Changes in population sizes and health of targeted species	Enhanced biodiversity conservation
	Sustainable land management practices	Adoption of practices to prevent further degradation and promote sustainability.	Changes in land use patterns and ecosystem services	Enhanced resilience of ecosystems
ii. Sustainable solutions for drainage management and flood control	Low-impact development	Green infrastructure projects	Reduction in stormwater runoff	Sustainable urban development
	Climate-smart drainage systems	Improved flood forecasting systems	Timely response to flood events	Minimized flood damage
	Community-based flood management	Community resilience plans	Community awareness and preparedness.	Improved community response to floods
iii. Oil and Gas and environmental management	Environmental and social impacts of oil and gas exploration	Regulatory frameworks	Community well-being, biodiversity	Sustainable and responsible oil and gas practices
	Economic implications of oil and gas exploration	Local economic development	Employment rates, GDP growth	Balanced economic growth and environmental protection

iv. Mining and Extraction Technologies	Environmental impacts of mining and extraction	Mitigation strategies	Air, water, soil pollution, habitat destruction	Improved environmental regulations and practices
	Sustainable mining practices	Restoration success	Mine closure plans, ecosystem recovery	Enhanced environmental sustainability in mining
	Rehabilitation of mined areas	Ecosystem recovery	Soil fertility, vegetation growth	Improved land quality and community livelihoods
	Social and economic impacts of mine decommissioning	Livelihood sustainability	Employment opportunities, community well-being	Balanced restoration with positive social outcomes
	Evaluation of alternative energy sources and technologies	Feasibility studies	Energy output, cost-effectiveness	Diversified and sustainable energy portfolios
v. Physical, chemical, and biological composition of soil	Physical characteristics of ecosystems	Analysis of soil structure, topography, and water flow in an ecosystem	Changes in physical attributes of ecosystems	Improved understanding of ecosystem dynamics
	Chemical composition of ecosystems	Measurement of nutrient and pollutant levels in soil, water, and air	Changes in chemical composition indicators	Informed land and water management practices
	Biodiversity assessment and monitoring	Documentation of species diversity and abundance in ecosystems	Changes in biodiversity indicators	Enhanced conservation and management of biodiversity
vi. Mining, industrial, and infrastructural development, and human health	Rehabilitation of mined areas.	Ecosystem recovery.	Soil fertility, vegetation growth.	Improved land quality and community livelihoods.
	Social and economic impacts of mine decommissioning	Livelihood sustainability	Employment opportunities, community well-being	Balanced restoration with positive social outcomes
	Occupational Health and Safety	Rate of workplace injuries and illnesses	Safety guidelines and manuals	Safer working conditions

vii. Infrastructural development and environmental management.	Green infrastructure design.	Implementation of green spaces.	Increase in urban green cover	Improved air and water quality.
	Biodiversity-friendly planning.	Preservation of natural habitats.	Biodiversity indices.	Enhanced ecological resilience.
	Climate-resilient infrastructure	Resilient buildings and systems	Reduction in climate-related damage	Increased infrastructural sustainability
viii. Land use, land cover, and biodiversity.	Community Involvement in Land and Biodiversity Management.	Community engagement levels.	Community-based conservation models	Empowered communities with sustainable land use practices.
	Effects of Agricultural Practices on Biodiversity.	Crop diversity.	Policy recommendations.	Enhanced agro biodiversity
ix. Policy formulation for infrastructure, industrial, mining, and environment	Sustainable Infrastructure Development	Comprehensive policy recommendations for sustainable infrastructure	Number of green buildings constructed Reduction in carbon footprint of new projects	Increased adoption of eco-friendly construction practices Improved air quality and reduced environmental degradation
	Impact of Industrial Activities on Local Ecosystems	Detailed impact assessment reports and mitigation strategies	Frequency and severity of pollution incidents Biodiversity indices in industrial areas.	Enhanced ecosystem health and biodiversity Reduced industrial pollution levels
	Sustainable Mining Practices	Guidelines for implementing sustainable mining practices	Compliance rates with sustainable mining guidelines Number of mines adopting eco-friendly technologies	Minimized environmental damage from mining activities. Increased economic benefits from sustainable mining

Appendix 6: Monitoring and Evaluation Framework Plan Template.

Priority Research Area	Results (Outcomes/ outputs)	Indicators	Indicator Definitions	Baseline	Targets					Data Source	Data Collection Method	Frequency of data collection	Responsible person
					Y1	Y2	Y3	Y4	Y 5				
Infrastructural and industrial development and environmental management													
Pollution and waste management													
Gender, Culture, and Environment													
Climate Change mitigation and adaptation													
Aquatic ecosystems and Biodiversity													
Terrestrial Ecosystems and Biodiversity													
Mining, energy and environment													
Biotechnology and Environment													
Land use and soil management													
Cross-cutting issues													

Appendix 7: List of contributors to the National Environmental Research Agenda.

S/NO.	NAME	INSTITUTION
1.	DR. BARIREGA AKANKWASAH	NEMA
2.	Mr. FRANCIS SABINO OGWAL	NEMA
3.	DR. RICHARD KOMAKECH	NEMA
4.	DR. INNOCENT ACHAYE	NEMA
5.	Mr. STUART KASOZI	NEMA
6.	Mr. ADSON TUMWEBAZE	NEMA
7.	Mr. DENNIS TWINOMUJUNI	NEMA
8.	Mr. EDWIN BALUKU	NEMA
9.	DR. JEROME LUGUMIRA	NEMA
10.	Mr. GODWIN KAMUGISHA	NEMA
11.	Mr. NICKSON AHIMBISIBWE	NEMA
12.	Ms. ANNET BUKIRWA	NEMA
13.	Mr. ISAAC TINDYEBWA	NEMA
14.	Ms. JENIFFER KUTESAKWE	NEMA
15.	Mr. WILBERT IKILAI	NEMA
16.	Ms. SARAH TUMUHAIRWE	NEMA
17.	Ms. ANNE NAKAFEERO	NEMA
18.	DR. SAMSON GWALI	NATIONAL FORESTRY RESOURCES RESEARCH INSTITUTE
19.	DR. PETER OBUBU	MINISTRY OF WATER AND ENVIRONMENT
20.	DR. CATHERINE WANDERA	SCIENCE TECHNOLOGY & INNOVATION SECRETARIAT
21.	PROF. GERALD EILU	MAKERERE UNIVERSITY
22.	Mr. MICAH OKIROR	NATURAL CHEMOTHERAPEUTICS RESEARCH INSTITUTE
23.	Mr. OMONY WILLIAM GEORGE	UGANDA NATIONAL METEOROLOGICAL AUTHORITY
24.	DR. KATUURA ESTHER	MAKERERE UNIVERSITY
25.	DR. DENNIS OKELLO	KABALE UNIVERSITY
26.	DR. OMUJAL FRANCIS	NATURAL CHEMOTHERAPEUTICS RESEARCH INSTITUTE
27.	Ms. EVE KOMUTUNGA	NATIONAL AGRICULTURE RESEARCH ORGANISATION
28.	Mr. AGGREY RWETSIBA	UGANDA WILDLIFE AUTHORITY
29.	Mr. EMMANUEL OGWAL	NATIONAL AGRICULTURE RESEARCH ORGANISATION
30.	DR. BASSA SAMUEL	NATIONAL FISHERIES RESOURCES RESEARCH INSTITUTE
31.	Ms. SHALLON CHALLENGE	NATIONAL FORESTRY AUTHORITY
32.	Ms. BETTY NAWOOVA	UGANDA BUREAU OF STATISTICS
32.	Mr. OWONA JOEL	MINISTRY OF WATER AND ENVIRONMENT
33.	Mr. HAKIM SSERUNKUUMA	MINISTRY OF WATER AND ENVIRONMENT

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

NEMA HOUSE, Plot 17/19/21 Jinja Road, P.O.Box 22255 Kampala Uganda,

Tel: +256-414-25106820, +256-414-255695,+256-414-251068,

Fax: +256-414-257521/232680.

@nemaug. nemaug. www.nema.go.ug info@nema.go.ug.

NEMA
National Environment Management Authority
ENSURING SUSTAINABLE DEVELOPMENT