

RESEARCH REPORT

Enhancing Sustainable Community-Based Management and Climate Resilience in the Lake Opeta Wetland System

AUGUST 2026



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Executive Summary

INTRODUCTION

This study was undertaken to generate evidence for the development of community-based wetland management strategies that can strengthen climate resilience and biodiversity conservation in the Lake Opeta Wetland System. Lake Opeta and its surrounding swamps are located in north-eastern Uganda and extend across Nakapiripirit, Nabilatuk, Bulambuli, Katakwi, Kumi, and Bukedea, covering 68,912 hectares. The system is of high ecological and livelihood significance because it is recognised as a Ramsar Site and an Important Bird Area, while also supporting fisheries, grazing, domestic water supply, and wider ecosystem services for surrounding communities. The study was conducted under the Strengthening Environmental Accountability and Climate Action in West Nile and Karamoja (SEA-WNK) Project, funded by the Danish Ministry of Foreign Affairs through DANIDA.

METHODOLOGY

The assessment applied a mixed-methods design anchored in the DPSIR framework to analyse the drivers, pressures, ecological state, impacts, and response options for the wetland system. It combined literature review, remote sensing and GIS analysis, biodiversity and water quality assessment, household interviews, key informant interviews, and focus group discussions. Wetland use and cover change were assessed for 1996, 2006, 2016, and 2026. The socio-economic component covered 385 households across seven target subcounties and 14 focus group discussions, with findings further refined through a stakeholder validation workshop. This approach enabled the study to link ecological change with livelihoods, governance, and climate risks in a grounded and systematic way.

FINDINGS

Status and trend of the Lake Opeta Wetland System: The findings show clear and measurable wetland transformation. In 2026, the dominant wetland use and cover types were grasslands (42.8%), small-scale farmlands (28.0%), and papyrus and floating vegetation (25.1%). Intact wetlands declined from 2,672.3 km², equivalent to 93.2% of the wetland area, in 1996 to 2,017.1 km², equivalent to 70.3%, in 2026, representing a net loss of 655.2 km² over the assessment period. Degradation is spatially uneven, with the largest losses in intact wetland cover occurring in Bukedea (58.9%), Kumi (26.8%), and Katakwi (22.4%). By 2026, degraded wetlands covered 850.8 km² or 29.7% of the total wetland area, while intact wetlands covered 2,017.1 km² or 70.3%. Small-scale farmland expansion emerged as the dominant land-cover change, increasing from 50.2 km² in 1996 to 803.2 km² in 2026. These trends show that degradation is no longer isolated but a landscape-scale process largely driven by land conversion.

Drivers of degradation: Across the target districts, the leading reported drivers of wetland degradation were grazing from wetlands (17.1%), cultivation from wetlands (14.3%), limited awareness and poor knowledge about wetlands (10.4%), burning of wetland vegetation (9.9%), and over-harvesting of wetland resources (8.9%). These findings show that degradation is not the result of one dominant pressure alone. Rather, it reflects the interaction between livelihood dependence, weak awareness, and continued unsustainable resource use. The report therefore points to a wetland system under combined pressure from production needs, weak regulation, and inadequate stewardship.

Climate risks: The major reported climate shocks were drought (29.8%), floods (25.9%), extreme heat (20.7%), and strong winds (15.6%). The study found that these impacts are gendered, with women being more affected by several climate-related impacts in Katakwi, Kumi, Nabilatuk, and Nakapiripirit, while men bore a greater share of some livelihood losses in Bulambuli and parts of Bukedea. At the community level, the main barriers to climate adaptation were limited knowledge on climate risks and adaptation options (11.3%) and weak community organisation (10.8%). In response, respondents proposed practical resilience measures, especially sensitisation of communities (19.7%), planting of trees and creation of green spaces (12.1%). These results show that communities are aware of the risks, but also that women often carry a disproportionate share of climate impacts while adaptive capacity remains constrained by knowledge, organisation, and resource gaps.

Factors affecting wetland management: Wetland management is being weakened by governance and institutional constraints. The report identifies weak coordination among districts and actors, weak enforcement of wetland regulations, political and livelihood pressures on enforcement, limited inclusion in governance structures, and weak accountability mechanisms. A key indicator of this governance challenge is the high level of access to wetland resources across the study area, reported by 82.6% of respondents. Access was especially high in Nabilatuk (95.5%), Bukedea (89.1%), Katakwi (86.1%), and Kumi (85.2%), showing how deeply wetland use is embedded in local livelihood systems. Women are among the major users of wetland resources in Kumi, Nabilatuk, and Nakapiripirit because of their central role in collecting water, firewood, and construction materials, yet participation in restoration remains male-dominated, where men account for 60.9% of participation, compared to women (23.0%) and youth (11.3%). This points to a management system in which women and youth are important wetland users, but remain underrepresented in decision-making and restoration processes.

Socio-economic conditions and community practice: The six study districts have a combined population of approximately **1,288,045 people**, distributed across **275,570 households**, with an average household size of **4.6 persons**. The socio-economic profile of the study area reflects a strong dependence on natural resources, with household livelihoods predominantly centered on crop production (**38.9%**), livestock rearing (**15.8%**), casual labour (**14.9%**), and charcoal production (**10.8%**). This high level of dependence on natural resources underscores the critical role of wetland ecosystems in sustaining household incomes, food security, and access to essential resources.

Wetlands provide a wide range of goods and services to surrounding communities. Across the wider wetland system, the most reported benefits include **crop cultivation (19.2%)**, **firewood collection (15.9%)**, **livestock grazing (13.5%)**, and **water for domestic use (9.9%)**. Around Lake Opeta specifically, communities place the greatest value on the wetland for **food provision, particularly fish (27.6%)**, **domestic water supply (20.3%)**, and **water for productive activities (19.0%)**. These findings demonstrate the central importance of the wetland to local food security, household livelihoods, and day-to-day subsistence.

The use of wetland resources is, however, differentiated by gender and location. Women play a particularly prominent role in wetland resource use in **Kumi and Nabilatuk**, and remain significantly involved in **Nakapiripirit**. In contrast, men are more dominant in wetland use in **Bulambuli and Katakwi**, including areas around Lake Opeta in Katakwi District. These differences point to distinct gendered patterns of access to, use of, and dependence on wetland resources, which are important considerations for equitable and inclusive wetland management.

The findings also highlight the continued relevance of **traditional and community-based conservation practices**. The most commonly reported mechanisms include collective community action for wetland protection (**38.0%**), regulation and oversight by elders or clan leaders (**15.2%**), and the protection of sacred or culturally significant wetland sites (**10.2%**). These practices represent important sources of

local knowledge, social regulation, and community stewardship that can complement formal wetland governance and conservation systems.

Overall, the findings demonstrate that **Lake Opeta and the wider wetland system are fundamental to the socio-economic well-being and resilience of surrounding communities**. At the same time, patterns of resource use, access, benefits, and management responsibilities vary significantly across locations and between women and men. Future wetland management and conservation interventions should therefore adopt a **community-centered, gender-responsive, and socially inclusive approach** that recognises local livelihood realities while strengthening sustainable resource use and traditional stewardship practices.

CONCLUSION AND RECOMMENDATIONS

Conclusion: Lake Opeta remains a strategically important ecological and socio-economic asset, but it is under growing pressure from intersecting land use, livelihood, governance, and climate-related stresses. Wetland degradation has become a measurable landscape-scale process rather than a localised problem. The study also shows that Lake Opeta is as much a governance and development issue as it is an environmental one, because wetland use is deeply embedded in household livelihoods. Effective management will therefore depend on a coordinated approach that brings together biodiversity conservation, climate resilience, water resource protection, and livelihood transition within one integrated framework

Recommendations: The study points to several practical priorities. First, establish an inter-district Lake Opeta Wetland Management Coordination Framework to harmonise planning, enforcement, restoration, and monitoring across the six districts. Second, prioritise wetland boundary demarcation and legally backed zoning to clarify protection, use, and restoration areas. Third, strengthen and harmonise local by-laws and wetland use regulations. Fourth, integrate wetland management into district planning across agriculture, livestock, fisheries, energy, and climate resilience. Lastly, link protection measures with viable alternative livelihoods for wetland-dependent households. These actions provide a practical route for translating the study evidence into policy, advocacy, and programming.

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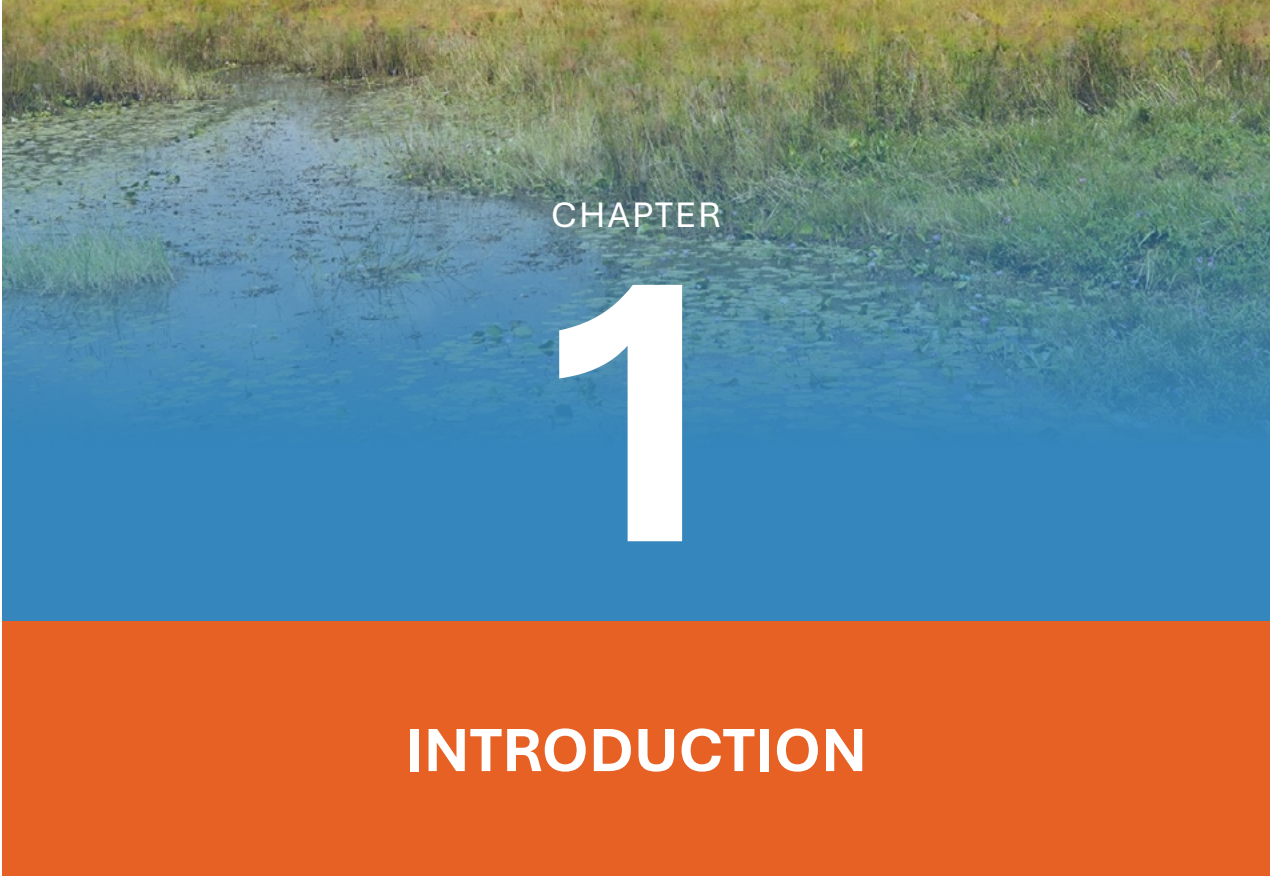
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LIST OF ACRONYMS

Acronym	Description
ACEMP	Africa Center for Energy and Mineral Policy
CAP	Chapter (reference number used in Ugandan laws)
CBD	Convention on Biological Diversity
DEO	District Environment Officer
DO	Dissolved Oxygen
DPSIR	Drivers, Pressures, State, Impact, Response
DRAW	District Rapid Appraisal of Wetlands
EA	Environmental Audit
EC	Electrical Conductivity
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FGD	Focus Group Discussion
GIS	Geographic Information System(s)
GPS	Global Positioning System
HDQRs	Headquarters
IBA	Important Bird Area
ISODATA	Iterative Self-Organising Data Analysis Technique (classification algorithm)
IUCN	International Union for Conservation of Nature
KII	Key Informant Interview
LC	Least Concern (IUCN category)
MFA	Danish Ministry of Foreign Affairs
MWE	Ministry of Water and Environment
NDP	National Development Plan
NEMA	National Environment Management Authority
NGOs	Non-Governmental Organization
SPACE	Sustainable Plan and Action for Community Empowerment
UNBS	Uganda National Bureau of Standards



CHAPTER

1

INTRODUCTION

1.1 Project background

The Strengthening Environmental Accountability and Climate Action in West Nile and Karamoja (SEA-WNK) project is a 41-month initiative (August 2024-December 2027) funded by the Danish Ministry of Foreign Affairs (MFA) through DANIDA. The project is implemented in the districts of Zombo, Madi Okollo, Obongi, Adjumani, Amudat and Nakapiripirit by a consortium of four national organizations: RICE West Nile (lead implementer), Friends of Zoka, Sustainable Plan and Action for Community Empowerment (SPACE) and Africa Center for Energy and Mineral Policy (ACEMP).

The goal of the project is improved protection and sustainable utilization of natural resources among the communities in West Nile and Karamoja Sub Region which will be achieved through; Increasing community awareness and action on environmental protection; Strengthening implementation of national and district-level policies, ordinances, regulatory frameworks for environmental protection and climate action; and Increasing opportunities for alternative livelihoods to reduce dependence on natural resources.

To achieve this, the project will conduct some studies on environmental degradation and climate change in the Karamoja Region, to generate evidence that will inform advocacy actions during implementation. It is against this background that ACEMP hired a consultant to conduct a study to inform the development of community-based wetland management strategies to build climate resilience and biodiversity conservation around and within the Lake Opeta wetland system.

1.2 Introduction

Lake Opeta and its surrounding wetlands are located in north-eastern Uganda, spanning six districts: Nakapiripirit, Nabilatuk, Bulambuli, Katakwi, Kumi, and Bukedea, and covering approximately 68,912 hectares. The lake is regarded as the ‘only true wetland’ within the Karamoja region and plays an important role in supporting pastoral livelihoods, particularly among the Karamojong and Pokot communities, who

use the area as a dry-season grazing reserve. It also serves as an important grazing area for livestock keepers from neighbouring districts in the Karamoja sub-region, notably Amudat and Moroto.

The wetlands surrounding Lake Opeta are of significant ecological importance, particularly for the conservation of bird species, and there have been increasing calls for strengthened protection and conservation of the area. The wetland system is currently designated as both a Ramsar Site and an Important Bird Area (IBA), encompassing the lake, extensive swamplands, and adjacent grasslands. Beyond its importance for avian biodiversity, the Lake Opeta wetland ecosystem provides a critical refuge for fish species that have become locally extinct or severely depleted in major water bodies such as Lakes Victoria and Kyoga.

However, Lake Opeta and its surrounding wetland ecosystem are increasingly threatened by environmental degradation, largely driven by human activities such as deforestation, expansion of agricultural activities, and conversion of wetland areas to other land uses. These pressures are contributing to the deterioration of water quality, loss of biodiversity, and degradation of ecosystem functions, with significant implications for the livelihoods and well-being of local communities that depend on the lake and its surrounding wetlands for their sustenance and economic activities.

1.3 Study Objectives

1.3.1 Main objective

To generate evidence-based information to guide the development of community-based wetland management strategies that strengthen climate resilience, enhance biodiversity conservation, and promote sustainable use of the Lake Opeta wetland system.

1.3.2 Specific objectives

The specific objectives were;

- i. To assess the status, trends, and drivers of wetland degradation and climate-related risks.
- ii. To analyse governance, institutional, and community-level factors affecting wetland management.
- iii. To generate evidence on socio-economic conditions and community practices.
- iv. To propose feasible, evidence-based recommendations to inform policy, advocacy, and programming.

1.4 Legal and Institutional Framework

Legal and Policy Frameworks

The international and national legal and policy frameworks governing wetland management, and their relevance to the Lake Opeta study, are summarised in **Table 1**.

Table 1: International and national legal and policy frameworks governing wetland management in Uganda

Framework	Wetland-relevant focus	Relevance to the Lake Opeta study
International Legal and Policy Frameworks		
Kunming-Montreal Global Biodiversity Framework (2022)	Global goals and targets for halting biodiversity loss, ecosystem restoration, and mainstreaming biodiversity in planning and finance.	Provides the overarching biodiversity outcomes that wetland restoration, threat reduction, and community-led governance measures can be aligned to (targets on ecosystem restoration and reducing pressures).
Transforming our world: the 2030 Agenda for Sustainable Development (A/RES/70/1) (2015)	Integrates wetlands across goals on water, climate action, ecosystems, livelihoods, and governance.	Strengthens results framing by linking wetland functions (water quality, flood control, livelihoods) to SDG targets and indicators for reporting and policy influence.
Paris Agreement (2015)	Climate adaptation and resilience agenda, including nature-based solutions and climate-risk reduction.	Anchors the climate resilience rationale, supports climate-risk-informed wetland management, and justifies adaptation-oriented by-laws and livelihood measures.
Sendai Framework for Disaster Risk Reduction 2015-2030 (2015)	Disaster risk reduction through risk understanding, governance, investment, and preparedness.	Supports flood risk and drought resilience components, including community readiness, early warning linkages, and risk-informed land-use controls around wetlands.
United Nations Convention to Combat Desertification (1994)	Sustainable land management and addressing land degradation drivers that affect hydrology and ecosystem services.	Helps frame catchment-level pressures (erosion, vegetation loss, siltation) that undermine wetland storage and purification functions.
Convention on Biological Diversity (1992)	Conservation, sustainable use, and equitable benefit sharing of biodiversity.	Provides a direct basis for biodiversity conservation measures, community participation, and benefit-sharing logic for livelihood options linked to conservation.
Convention on Wetlands of International Importance (Ramsar Convention) (1971)	Wise use of wetlands, conservation and sustainable utilisation principles.	Provides the globally recognised “wise use” framing that can be operationalised through local by-laws, and community management agreements.
National Legal and Policy Frameworks		
National Wetland Strategic Plan 2026-2036 (2026)	National direction for wetland protection, restoration and coordinated implementation over a 10-year period.	Serves as the highest-level national strategic anchor for the study’s community-based wetland management strategies, restoration options, and policy influence agenda (including alignment to national targets and implementation structures).
National Development Plan IV (NDP IV) (2025/26–2029/30)	National development priorities that mainstream environment, climate resilience, water security and sustainable livelihoods.	Positions wetland management as development-critical, strengthening justification for investments in restoration, enforcement, and climate-resilient livelihoods, and supports uptake by district and national planning processes.

Framework	Wetland-relevant focus	Relevance to the Lake Opeta study
National Biodiversity Strategy and Action Plan III (2025-2030)	National biodiversity targets, threats, and priority actions for ecosystems, species, and community participation.	Provides a ready-made biodiversity action structure for Lake Opeta, supporting prioritisation of threats, selection of restoration interventions, and framing of community-led conservation incentives.
National Climate Change Act, 2021 (2021)	Establishes the legal basis for climate response measures, planning and coordination mechanisms.	Strengthens the legal justification for climate-resilience actions in wetland governance, supports climate mainstreaming in district planning, and underpins the study's climate resilience objective.
National Environment (Environmental and Social Assessment) Regulations, 2020 (2020)	Sets requirements for environmental and social assessment, impact management and compliance.	Guides the study's safeguards logic where recommended livelihoods, ecotourism facilities, or restoration works may require screening and proportionate impact management.
National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 2020 (2020)	Controls effluent discharges and protects receiving waters from pollution loads.	Directly supports the objective on natural water purification by framing pollution control expectations relevant to communities, enterprises, and institutions affecting the wetland system.
National Environment Act, 2019 (2019)	Establishes the legal foundation for environmental governance, compliance, and enforcement tools.	Provides the national legal basis for regulating wetland use, supporting enforcement pathways for ordinances and by-laws, and legitimising institutional coordination arrangements.
Uganda National Climate Change Policy (2015)	Policy direction for adaptation and mitigation, mainstreaming climate across sectors including water and ecosystems.	Strengthens policy coherence for climate-resilient wetland management strategies and supports the study's climate vulnerability and adaptation framing.
Uganda National Land Policy (2013)	Land governance principles relevant to natural resources, tenure security, land-use planning, and conflict management.	Supports socio-economic analysis of wetland dependence and land-use drivers, and informs realistic by-law provisions that consider tenure dynamics and local incentives.
Physical Planning Act, 2010 (2010)	Provides for planning instruments and development control mechanisms applicable to sensitive ecosystems.	Enables land-use zoning and development controls around the wetland and riparian areas, supporting practical, enforceable spatial rules in community-based plans.
National Environment (Wetlands, River Banks and Lake Shores Management) Regulations, 2000 (2000)	Specific regulatory controls for wetland, riverbank and lakeshore management, including permitted and prohibited activities.	Provides the most direct regulatory backbone for diagnosing illegal or harmful practices, defining compliance expectations, and translating findings into enforceable local rules.
The Local Governments Act (1997)	Decentralisation and local governance powers that enable local rule-making and implementation structures.	Justifies the study's emphasis on community-based governance, and supports development of locally owned by-laws with defined enforcement and monitoring roles.
Constitution of the Republic of Uganda (1995)	Establishes the public interest basis for environmental protection and natural resource governance.	Provides the overarching legal foundation for protecting wetlands as critical natural assets, supporting rights-and-duties framing and legitimising community-led regulation.
National Policy for the Conservation and Management of Wetland Resources (1995)	National policy guidance for wetland conservation and sustainable use	Directly aligns with the study's objectives on threats assessment, mitigation, sustainable utilisation, and community-based management arrangements.

Framework	Wetland-relevant focus	Relevance to the Lake Opeta study
The Land Act (Cap. 227)	Land tenure and land management rules that influence wetland encroachment dynamics and enforcement feasibility.	Supports analysis of land tenure drivers, conflict risks, and practical enforceability of riparian and wetland land-use controls within community-based plans.

WETLAND USER GUIDELINES

- Guidelines for prioritizing wetlands in need of management measures in Uganda.
- A vision statement for wetland management in Uganda.
- Guidelines for smallholder paddy rice cultivation in seasonal wetlands.
- District Rapid Appraisal of Wetlands (DRAW).
- Wetlands and the law.
- General guidelines for wetland management.
- Guidelines for capture fisheries in wetlands.
- Guidelines for fish farming in wetlands.
- Guideline for sand and clay mining in wetlands and for the rehabilitation of sand and clay mining area.
- Guidelines for defining wetlands boundaries.
- Guidelines for wetland edge cultivation.
- Guidelines for reporting wetland abuse.
- A guideline for Rapid assessment of wetland ecosystems Uganda.
- Guidelines for the formulation of sub country and district wetland action plans.
- Guidelines for wetland restoration.
- Management planning guideline.
- Guidelines for Sustainable Harvesting of Papyrus, Typha and Miscanthus from Wetlands

Wetland Institutional Framework in Uganda

Effective wetland management is critical to safeguarding the ecological, economic, and social functions of wetlands and ensuring their conservation and wise use for present and future generations. In Uganda, wetland management is guided by a multi-institutional governance framework that brings together national and local government institutions, as well as other stakeholders, to promote the sustainable use, protection, and restoration of wetland ecosystems.

The Ministry of Water and Environment, through the Wetlands Management Department, has the primary mandate to coordinate and oversee the protection, conservation, restoration, and sustainable management of wetlands on behalf of the Government and people of Uganda. The Department works in collaboration with a range of institutions whose mandates and functions contribute to effective wetland governance. These include the National Environment Management Authority (NEMA), the Ministry of Lands, Housing and Urban Development, District Land Boards and Area Land Committees, District Environment Officers, and Local Government Councils. Collectively, these institutions play complementary roles in environmental regulation, land-use planning and management, enforcement, monitoring, community engagement, and the protection of wetland resources at national, district, and local levels (Table 2).

CHAPTER

2

METHODOLOGY

Uganda's commitment to wetland conservation is further strengthened by its obligations as a Contracting Party to the Ramsar Convention on Wetlands. The country has established an institutional framework to facilitate the implementation and operationalisation of the Convention at the national level. This framework includes the Ramsar Administrative Authority and the National Focal Point, supported by Communication, Education, Participation and Awareness (CEPA) focal persons representing both government and civil society, currently represented by Nature Uganda. It also includes Uganda's representative to the Scientific and Technical Review Panel (STRP).

Table 2: Mandates of key players in Wetland Management

Entity	Roles and responsibilities
Wetlands Management Department	a. Maintaining an up-to-date inventory for wetlands b. Promoting the wise use of wetlands c. Developing wetland policy, guidelines, standards and legislation; d. Sensitisation of the public on the importance of wetlands; e. Restoration and protection of wetlands. f. Technical backstopping and capacity building of local governments g. Monitoring and supervision h. Compliance monitoring and enforcement i. Reviewing environment and Social Impact Assessments (ESIAs) and Environment Audits (EAs) for projects in or around wetlands;
National Environment Management Authority	a. Review all ESIAs countrywide, including projects in wetlands; b. Issue (and revoke) wetland resource use permits to (of) applicants who (do not) satisfy conditions laid out in the Wetlands Regulations or specified by NEMA; c. Conduct periodic inspection and monitoring of wetlands and enforce compliance to the wetland legislation; d. Ensure the integration of environmental concerns in overall national planning through coordination with the relevant ministries, departments and agencies of government.

Entity	Roles and responsibilities
Ministry of Lands, Housing and Urban Development	- Issue all land titles countrywide and ensure none are issued in wetlands; - Cancel titles erroneously issued in wetlands; - Develop countrywide base maps indicating land available for titling, and that which is not, such as wetlands.
District Local Governments	- Conduct due diligence on applications for titles within the Local Government to ensure titles are not issued in known wetlands. - Assist District and Local Environment Committees to conserve wetlands within their locality and enforce legal compliance. - Ensure activities in the catchment area of wetlands do not affect the water level of the wetland. - Authorise research activities in a protected wetland. - Formulate by-laws, guidelines and directives for management of wetlands. - With approval of the District Environmental Officer (DEO), order an Environment and Social Impact Assessment (ESIA) for projects that involve the use of a wetland within ten metres of the edge of the wetland.

Source: Adopted from the Office of the Auditor General, 2018 report with changes

2.1 Introduction

The assessment employed a mixed-methods approach, integrating qualitative and quantitative methods to provide a comprehensive understanding of climate risks, status of wetlands, drivers of wetland degradation, and measures to restore and manage Lake Opeta wetland system in the host districts. Data was collected through literature review, household surveys, Key Informant Interviews (KIIs), and Focus Group Discussions (FGDs). Triangulation across these data sources enhanced validity and reliability.

2.2 Description of the study area

Location: The study covered Lake Opeta, its surrounding swamps and communities in Katakwi district (Magoro subcounty), Nabilatuk district (Lolachat subcounty), Nakapiripirit district (Namalu subcounty), Bulambuli district (Bunambutye subcounty), Bukedea district (Malera and Kolir subcounties), and Kumi district (Ongino subcounty) (**Figure 1**). These subcounties exhibited comparatively higher levels of degradation. The study districts are located in Karamoja, Teso, and Bugisu subregions. The study districts collectively cover a total area of 9,428.5 Km², comprising Bukedea (1,049.7 Km²), Bulambuli (693.6 Km²), Katakwi (2,427.9 Km²), Kumi (1,074.1 Km²), Nabilatuk (1,804.5 Km²), and Nakapiripirit (2,378.8 Km²).

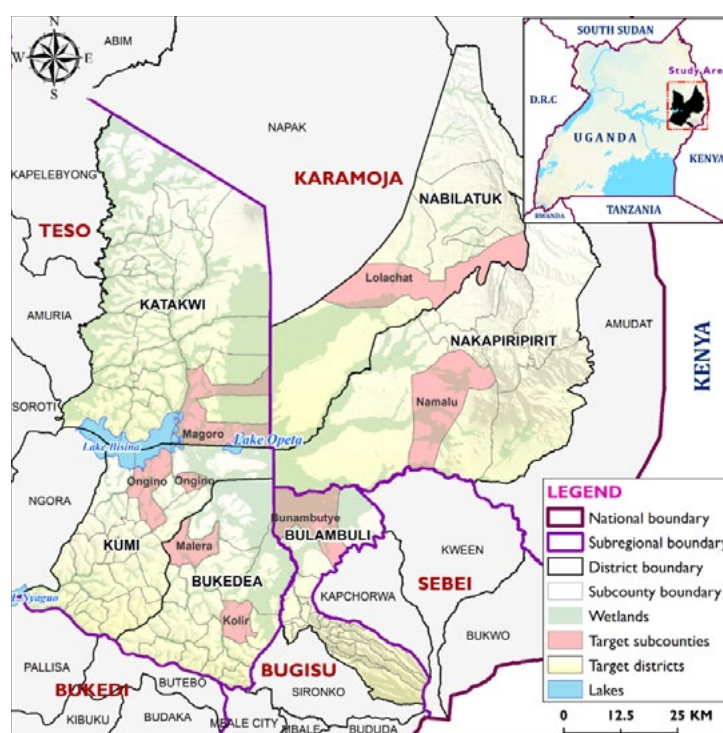


Figure 1: Target sub counties and districts for the study in Karamoja, Teso, and Bugisu subregions

Topography: The study area exhibits a diverse topography ranging from low-lying plains to high mountainous terrain, with elevations spanning approximately 1,021 m to over 4,208 m above sea level (**Figure 2**). Much of Katakwi, Kumi, Bukedea, and parts of Bulambuli lie within relatively flat to gently undulating lowlands. In contrast, the eastern and south-eastern parts of the study area, particularly in Nakapiripirit and southern Bulambuli, rise sharply into rugged highlands and mountainous zones associated with the Mounts Kadam and Elgon landscapes, marked by steep slopes, escarpments, and deeply incised valleys. Nabilatuk occupies an intermediate elevation zone, transitioning from plains to rolling hills. Overall, the topography reflects a gradual west-east increase in elevation, with significant implications for drainage patterns, land use, climate variability, and vulnerability to hazards such as flooding in low-lying areas and erosion or landslides in the high-altitude zones.

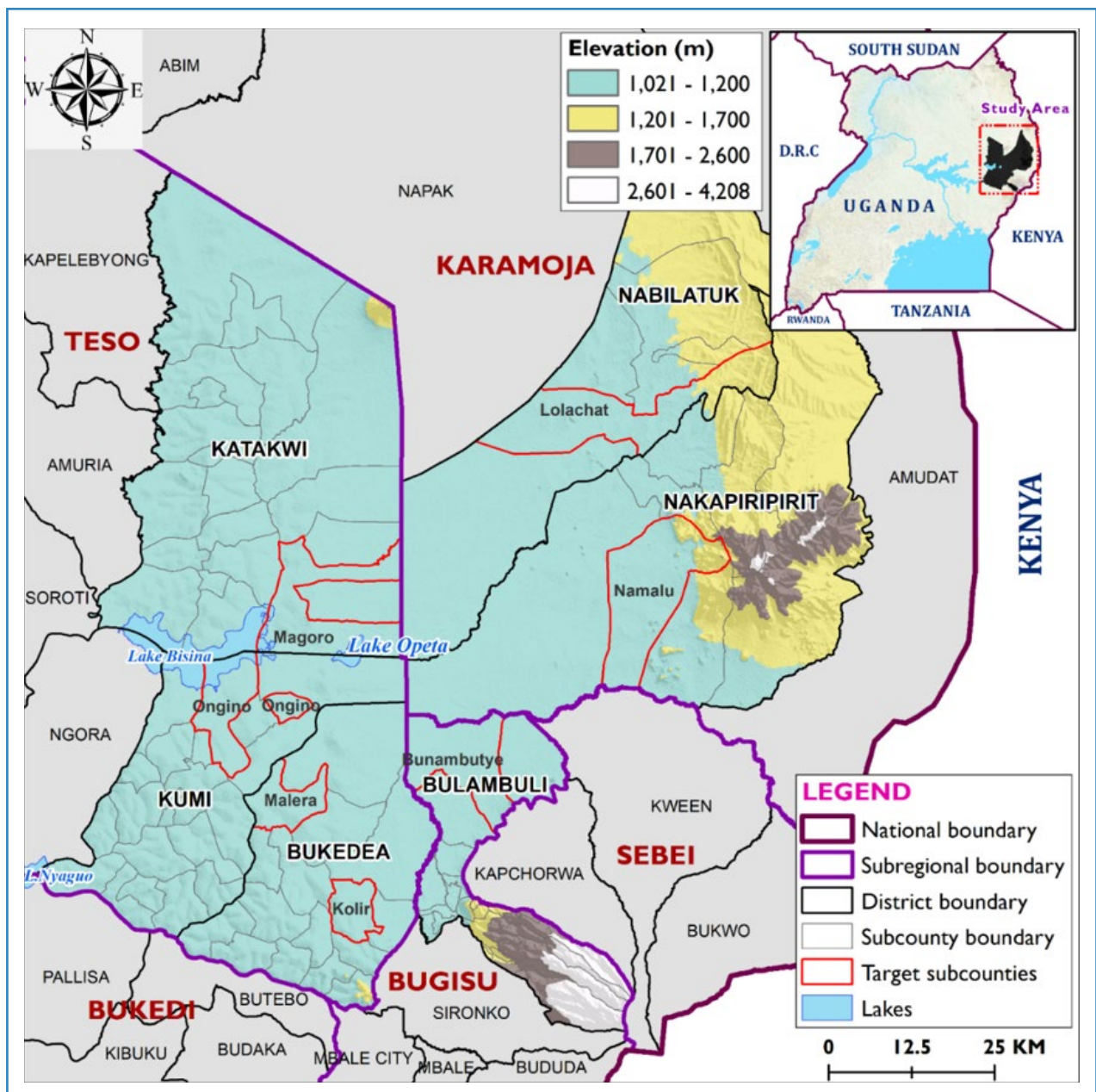


Figure 2: Topography of the study districts

Climate: Katakwi, Kumi, Bukedea, and Bulambuli districts experience a bi-modal rainfall pattern, with two rainy seasons running from March to May (MAM) and September to November (SON) (Egeru, 2012). On the other hand, the Karamoja districts (Nabilatuk and Nakapiripirit) experience a unimodal rainfall regime with a peak period occurring between April and August (Egeru et al., 2015). Between 1994 and 2024, annual rainfall in the study districts ranged from about 900 mm to over 1,800 mm, with higher annual totals in Bukedea, Kumi and Katakwi and lower but more variable amounts in Nabilatuk and Nakapiripirit. Minimum temperatures generally range from about 18°C to 21°C, while maximum temperatures typically lie between 29 °C and 33°C.

2.3 Approach to the assignment

The assignment applied the **DPSIR (Drivers, Pressures, State, Impacts and Responses) analytical framework** (Figure 3) to provide a systematic, evidence-based assessment of the Lake Opeta wetland ecosystem and to inform the development of practical, community-responsive management strategies. The framework enabled the assessment to move beyond documenting the visible symptoms of wetland degradation to examining the underlying factors driving environmental change and identifying appropriate and sustainable responses.

Under the **Drivers** component, the assessment examined the underlying socio-economic, demographic, livelihood, institutional, and governance factors influencing the use and management of the wetland. The **Pressures** component focused on the direct pressures resulting from these drivers, including land-use change and wetland conversion, overgrazing, unsustainable fishing practices, deforestation, and climate-related stresses. The **State** of the wetland was then assessed through ecological surveys, spatial analysis, field observations, and community-generated evidence to establish the condition of biodiversity, habitats, water resources, and overall ecosystem integrity.

The assessment subsequently examined the **Impacts** of these changes on ecosystem functions and services, biodiversity, local livelihoods, and the resilience of communities and the wetland system to climate-related shocks. Finally, the **Response** component focused on identifying realistic and context-specific measures to address the identified drivers and pressures. Through participatory engagement with local communities, district authorities, and traditional institutions, the assessment supported the co-development of management measures, restoration priorities, improved resource-use practices, and alternative livelihood options.

The application of the DPSIR framework therefore provided a coherent basis for linking the **underlying causes of wetland degradation to the pressures they generate, the resulting changes in ecosystem condition, their impacts on people and the environment, and the responses required to address them**. This ensured that the proposed management interventions were grounded in evidence, responsive to community priorities, and oriented towards addressing root causes while strengthening the long-term ecological integrity, resilience, and sustainable use of the Lake Opeta wetland system.

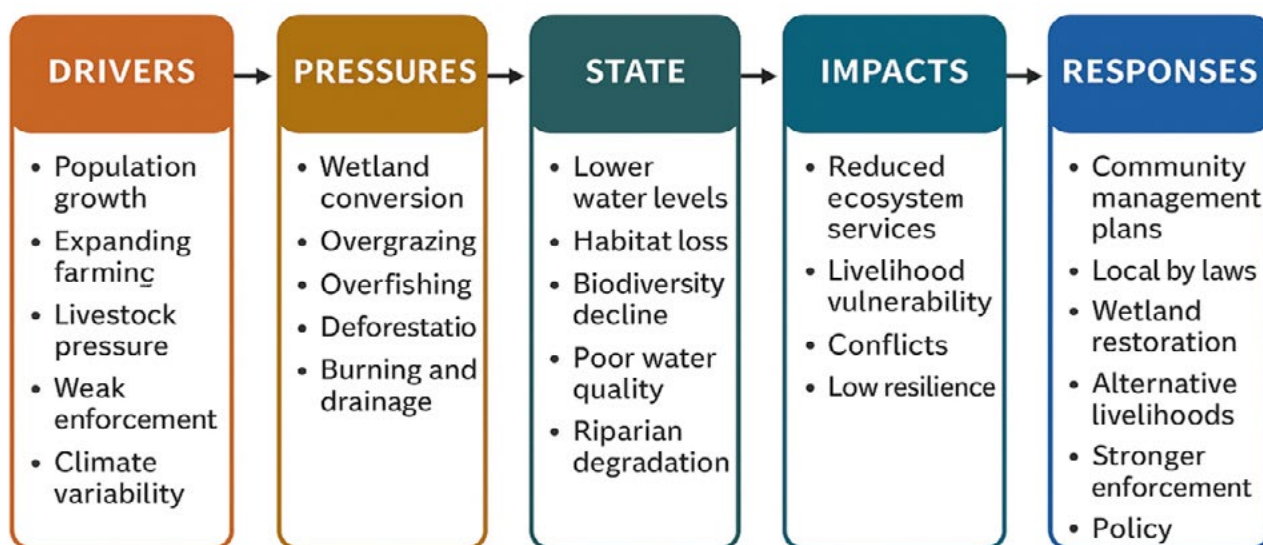


Figure 3: DPSIR framework to be adopted for the study

2.4 Socio-economic data collection and analysis

Research design and sampling procedure: The research design adopted a mixed method, cross sectional approach to generate a comprehensive understanding of the ecological, socio economic and institutional dynamics shaping the Lake Opeta wetland system. It integrated biophysical assessments, spatial analyses, socio economic surveys, knowledge, attitude and practice inquiries, ecological observations and institutional reviews to produce a holistic evidence base. Quantitative methods characterized wetland conditions, resource use patterns and ecological changes, while qualitative techniques such as key informant interviews, focus group discussions and participatory mapping provided deeper insights into community experiences, governance practices and drivers of degradation, resilience and resource management. This combination of approaches ensured that the study captures both the measurable environmental changes and the lived realities of wetland dependent communities.

The sampling strategy was purposive and stratified to ensure balanced representation of the diverse wetland user groups and geographical areas surrounding Lake Opeta. Key informants were purposively selected from district technical teams, traditional leaders, community resource management institutions, fisheries authorities, pastoralist representatives and non-state actors with direct roles in wetland governance. Focus group discussions were stratified to include pastoralists, fisherfolk, farmers, women, youth and other resource user groups across the participating districts. Household surveys followed a stratified random sampling approach, selecting respondents across sub counties, parishes and villages to reflect variations in dependence on the wetland, livelihood systems and exposure to environmental change. This strategy ensured that both stable resident communities and mobile pastoralist groups are adequately represented, enabling the study to generate inclusive, context appropriate and actionable community-based wetland management strategies. Within each target subcounty, sampling was done hierarchically:

- i. Parish level- Two parishes per subcounty were randomly selected in line with the allocated household sample.
- ii. Village level- From each selected parish, two villages were also randomly selected, and household lists were obtained through local leaders.

- iii. Household level- Households were randomly sampled from each selected village, ensuring equal probability of participation.

The seven (7) selected subcounties have a total of 31,154 households (UBOS, 2024). Therefore, using the Krejcie & Morgan (1970) formula for sample size determination (Equation 1), a total of 385 households were sampled in the communities around Lake Opeta wetland system.

$$s = \frac{X^2NP(1 - P)}{d^2(N - 1) + X^2P(1 - P)} \dots \dots \dots \text{Equation 1}$$

where;

s is the required sample size, X^2 is the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841), N is the population size, P is the population proportion (assumed to be .50 which should provide the maximum sample size), and d is the degree of accuracy expressed as a proportion (.05).

Using the proportional distribution of households, the household sample size per target subcounty is presented in **Table 3**.

Table 3: Household sample size per target subcounty

District	Subcounty	Households	Proportion of Total	Household Sample Size
Bukedea	Kolir	3,664	0.118	45
Bukedea	Malera	3,721	0.119	46
Bulambuli	Bunambutye	1,748	0.056	22
Katakwi	Magoro	5,861	0.188	72
Kumi	Ongino	4,889	0.157	60
Nabilatuk	Lolachat	7,113	0.228	88
Nakapiripirit	Namalu	4,158	0.133	51
Total		31,154	1.000	385

Key Informant Interviews (KIIs): Key Informant Interviews (KIIs) were conducted using a semi-structured qualitative approach to generate in-depth insights from individuals with specialized knowledge, experience, and responsibilities related to the Lake Opeta wetland system. Key informants were purposively selected based on their institutional roles, technical expertise, local knowledge, and direct involvement in wetland management and resource governance.

The respondents included district technical officers, particularly District Natural Resources Officers, District Environment Officers, District Fisheries Officers, and District Community Development Officers, as well as sub-county leaders, representatives of cultural institutions, wetland management committees, and representatives of pastoralist and fisherfolk groups. This composition enabled the study to capture perspectives from both formal governance structures and community-based resource management systems.

A semi-structured interview guide was developed to provide consistency across interviews while allowing flexibility to explore emerging issues and context-specific experiences. The interviews focused on key themes including the drivers and impacts of wetland degradation, patterns and intensity of natural resource use, wetland governance and institutional arrangements, enforcement and compliance challenges, pressures on biodiversity, climate-related changes, resource-based conflicts, community livelihoods, and opportunities for sustainable wetland management and restoration.

Where feasible, interviews were conducted face-to-face with individual respondents. With the informed consent of participants, interviews were recorded to ensure accurate capture of responses and were complemented by detailed field notes documenting key observations, contextual information, and emerging issues. The interview data were subsequently transcribed, organized, and subjected to thematic analysis to identify recurring themes, institutional and governance bottlenecks, areas of convergence and divergence among stakeholders, and context-specific recommendations.

Findings from the KIIs were triangulated with evidence from household surveys, Focus Group Discussions (FGDs), spatial analyses, ecological assessments, and other relevant data sources. This triangulation strengthened the credibility and validity of the findings and enabled the study to develop a more comprehensive, coherent, and evidence-based understanding of the challenges affecting the Lake Opeta wetland system, as well as opportunities for improved governance, sustainable resource use, and long-term wetland management.



Plate 1: Key Informant Interview at Nabilatuk District Local Government

Focus Group Discussions (FGDs): Focus Group Discussions (FGDs) were conducted using a participatory and semi-structured approach to capture the collective experiences, perceptions, priorities, and perspectives of different wetland-dependent and resource-user groups. Participants were purposively selected to ensure representation of key community segments, including pastoralists, fisherfolk, farmers, women, youth, elders, resource-user associations, and other relevant groups across the target districts.

A total of 14 FGDs were conducted across the selected study areas, with two FGDs conducted in each target sub-county. Each FGD comprised approximately 8–12 participants, providing sufficient diversity of perspectives while maintaining a manageable group size that enabled meaningful interaction, discussion, and effective facilitation.

A semi-structured FGD guide was developed to ensure consistency across discussions while allowing participants to raise issues emerging from their lived experiences. Discussions explored key themes including levels and patterns of community dependence on wetland resources, perceived drivers and impacts of wetland degradation, seasonal resource-use patterns, changes in biodiversity and ecosystem services, climate-related impacts, conflicts and competition over access to wetland resources, local norms and customary practices governing resource use, and community priorities and proposed solutions for sustainable wetland management and restoration.

Participatory tools, including resource mapping, seasonal calendars, and problem-ranking exercises, were incorporated into the discussions to facilitate active participation and generate deeper spatial and temporal insights. These tools enabled participants to identify important resource areas, illustrate seasonal variations in resource availability and use, and prioritize the major challenges affecting the wetland and surrounding communities.

The FGDs were conducted in the local languages commonly understood by participants, with the support of trained facilitators and note-takers. Discussions were recorded with participants' consent and complemented by detailed field notes capturing key observations, contextual information, group dynamics, areas of consensus and disagreement, and other relevant non-verbal cues. The information generated through the FGDs was subsequently analysed thematically and triangulated with findings from household surveys, Key Informant Interviews, ecological assessments, and spatial analyses to strengthen the interpretation and validity of the study findings.



Plate 2: FGD at Bunambutye subcounty HDQRs, Bunambutye subcounty, Bulambuli district



Plate 3: FGD at Nachele village, Lotaruk parish, Lolachat subcounty, Nabilatuk district

Household interviews: Household interviews were conducted using a structured tool designed to capture representative data on wetland dependence, livelihood practices, resource use patterns, views of environmental change and household level vulnerabilities. A structured questionnaire was developed and pre tested to ensure clarity, cultural appropriateness and alignment with the study objectives. A total of 385 households were interviewed across the target districts. Enumerators were trained in ethical data collection, interviewing techniques and use of digital data collection tools such as Kobotoolbox.

Interviews were conducted through face-to-face household visits, targeting adult household members with adequate knowledge of household livelihood activities and wetland use. Data was captured electronically to minimise errors and allow real time quality checks. Findings from the household survey were triangulated with qualitative evidence from FGDs and KIIs to produce a comprehensive and empirically grounded understanding of community wetland use and management needs.

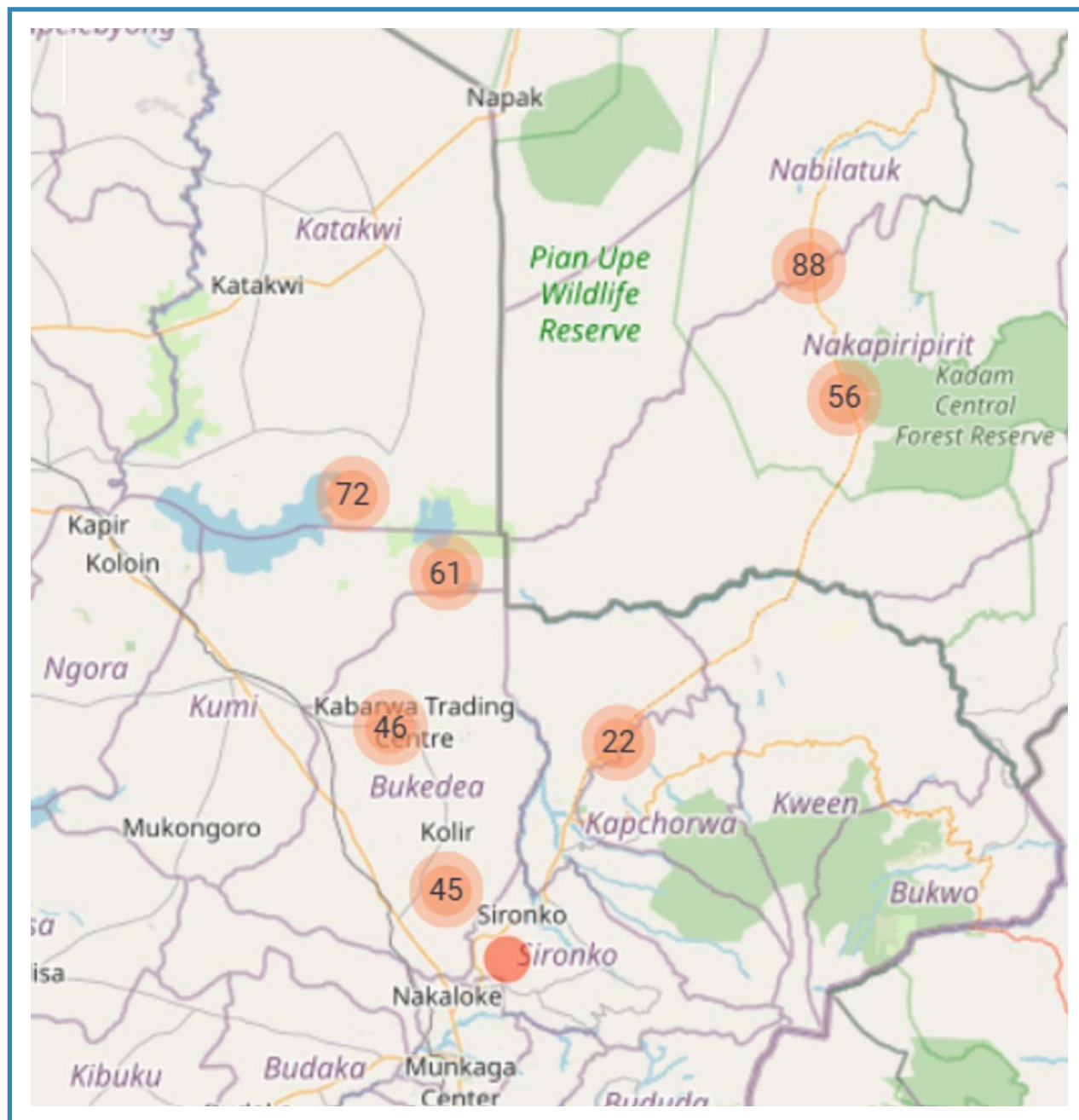


Figure 4: Interviewed households on the Kobotoolbox platform

Socio-economic Data Analysis: The socio-economic analysis integrated quantitative and qualitative evidence from household surveys, Key Informant Interviews (KIIs), and Focus Group Discussions (FGDs) to develop a comprehensive and context-sensitive understanding of livelihoods, dependence on wetland resources, drivers of environmental degradation, climate-related vulnerabilities, and community priorities for building resilience and conserving biodiversity within the Lake Opeta Wetland System.

Household survey data were systematically coded, cleaned, and analysed using descriptive statistics and cross-tabulations. The analysis examined key socio-demographic characteristics, household livelihood and income portfolios, patterns and levels of wetland resource use, dependence on ecosystem services, exposure and responses to climate-related shocks, and community knowledge, attitudes, and practices relating to wetland management and conservation. Where appropriate, the analysis compared findings across geographical locations and key social groups to identify variations in vulnerability, resource dependence, livelihood strategies, and perceptions of environmental change.

Qualitative data generated through KIIs and FGDs were transcribed, systematically coded, and subjected to thematic analysis. This provided deeper insights into institutional and governance arrangements, enforcement and compliance challenges, customary norms and practices governing wetland resource use, resource-related conflicts, access to essential services, and community perceptions of climate and ecological changes. The qualitative evidence was particularly important in explaining the underlying factors and contextual realities behind patterns observed in the household survey data.

The analysis further employed **triangulation across data sources and methods** to strengthen the credibility and robustness of the findings. Areas of convergence were used to validate key findings, while differences and divergent perspectives were examined to identify underlying social, institutional, geographical, or livelihood-related factors. This integrated analytical approach moved beyond simply describing socio-economic conditions to identify the **key drivers of vulnerability, opportunities for resilience, and practical entry points for intervention**.

Ultimately, the analysis provided an evidence base for prioritising feasible, locally appropriate, and community-led measures for sustainable wetland management, climate resilience, biodiversity conservation, and livelihood improvement. Particular attention was given to identifying interventions that respond to community priorities while reducing unsustainable pressure on wetland resources and strengthening local capacities for long-term stewardship of the Lake Opeta Wetland System.

2.5 Mapping the state of Lake Opeta wetland system

The state of Lake Opeta wetland system included biodiversity assessment, water quality assessment, and wetland use/cover changes as detailed below;

2.5.1 Biodiversity assessment

Flora species diversity: Transect walks were conducted within the target sub-counties that were covered by the wetland system (**Table 4**), particularly in areas experiencing human encroachment and ecological vulnerability. Each transect extended 1km on either side of a purposively selected central reference point. Observations and vegetation characteristics were recorded along transects. Collected flora samples were preserved and later identified to genus level, and to species level where morphological features were clear. This was done from the Makerere University Herbarium.

Table 4: Sampled wetlands in the different districts

District	Bukedea	Bulambuli	Katakwi	Kumi	Nabilatuk	Nakapiripirit
Wetland Name	Kakole	Chesebere	Bisina-Opeta-Okorotum	Bisina-Opeta-Okorotum	Leomat	Amaler
Coordinates	1.25225 N, 34.11896 E	1.44765 N, 34.3347 E	1.67080 N, 34.06648 E	1.59272 N, 34.11028 E	1.96326 N, 34.56796 E	1.79438 N, 34.56138 E

The identified plant species data was quantitatively analysed for species diversity, richness, evenness, and species similarity. The species diversity index provides relevant information about species status in a community and is used to compare diversity between habitats (Kent and Coker 1992). It determines the overall importance of each species in a community which was calculated using the formula provided by Shannon and Weiner, (1963). Plant evenness refers to the extent to which individuals in a community split among species. Species with a low evenness value indicate that one or a few species are dominant, whereas a higher value shows relatively equal numbers of individuals belonging to each species (Kent and Coker, 1992). It was calculated using Shannon evenness index formula.

Terrestrial Fauna sampling: Direct sampling and observation surveys were conducted to document birds, reptiles, and amphibians within the wetland and adjacent habitats. Surveys were undertaken during peak activity periods (early morning and late afternoon) along predetermined transects. Species were identified through visual observation and, for birds, vocal recognition. Field guides were used to confirm identifications. Targeted searches were conducted in microhabitats such as grass stands, seasonal pools, mudflats, and grassland patches. Remaining water pools were surveyed, as they served as refuge habitats during the prolonged dry season. For each observation, species name, habitat type, and notable behaviours (e.g., feeding, nesting, basking) were recorded.

Fish stock assessment: Due to very low water levels, in four of the six wetland zones sampled (Kakole, Cheseber, Leomat, and Amaler), gill netting and fish trapping were not conducted. Instead, assessment relied primarily on previous landed catches (wet season) and information from community members regarding species composition, fishing methods, and estimated quantities from the landings. In Bisina-Opeteta-Okorotum wetland and at Kamenu Landing Site (Magoro subcounty, Katakwi district), specific fish convergence zones were identified and sampled using 1mx1m perforated/mesh bags to trap fish in grass-covered shallow areas. Trapping was done in 10-minute intervals for 30 minutes at a randomly chosen sampling point. Captured fish were sorted, identified, and enumerated by species.

Aquatic biodiversity: The aquatic biodiversity that was sampled in Lake Opeteta basin includes phytoplankton, zooplankton, and macro-invertebrates. Aquatic biodiversity is important in several aquatic food webs.

Phytoplankton samples were collected using plastic bottles, then fixed with 1% Lugols iodine solution and wrapped in aluminium foil. In the laboratory, 50ml samples were concentrated and 0.1ml sub-samples were counted using utermohl's inverted microscope methods (Oterler. et.al, 2018). These were identified to the genus level according to Dillard (1999) and expressed as cells per litre.

Zooplankton samples were collected and filtered through 64mm plankton net to concentrate to 100ml and fixed with 70% ethanol. In the laboratory, samples were identified and counted under a light binocular Microscope using 1ml Sedgwick counting chamber. Zooplankton were identified as genus based on literature by Fernando (2002).

The macro-invertebrates were sampled randomly along a transect using a Hackman mud grab sampler to pick the invertebrates at the bottom of the sediment. These were washed in a sieve net or a dip net and then preserved in 95% ethanol in well-labelled containers before laboratory identification. The different benthic macroinvertebrates were put under an electronic microscope: AKRÜSS optronic (D-22297, Hamburg, Germany) and Cole Parmer (Vernon Hill, ILLINOIS, USA) for magnifications of x40-x400 and x20-x80 respectively to observe their morphological structures. Based on the morphological structures, identification keys were used to identify the invertebrates to the genus or species level of the taxonomy.

2.5.2 Water quality assessment

Water quality was assessed through field-based sampling and laboratory analysis to understand the physical chemical status of the wetland and detect potential pollution sources. Sampling points (4-6) were purposively selected to represent inflow areas, outflow points and zones with high human activity such as landing sites, livestock watering points and cultivated wetland fringes. In situ measurements were taken for pH, dissolved oxygen, electrical conductivity, turbidity and temperature using portable multiparameter (HANNA HI-9828, USA). These parameters have been selected due to their ubiquity as water quality assessment parameters globally and their ease of measurement in the field under rough conditions. Water samples were collected following standard protocols and analysed from the Soil, Water and Plant Analytical Laboratory of Makerere University; for nutrients (nitrates, phosphates), suspended solids, biochemical oxygen demand, coliform bacteria and other relevant contaminants. Results were compared with national water quality standards and the National Environment (Standards for Discharge of Effluent into Water or Land) Regulations, 2020; to determine compliance and ecological health. Spatial interpolation was applied to visualise water quality gradients, trend patterns and pollution hotspots linked to land use and human activities.



Plate 4: *In situ water quality assessment in Amaler wetland, Lokatapan Parish, Namalu subcounty, Nakapiripirit district*

2.5.3 Wetland use/cover changes

Changes in wetland use and land cover within the Lake Opeta Wetland System were assessed using an integrated **remote sensing and Geographic Information System (GIS) approach**, complemented by field-based ground verification. The analysis was designed to establish the historical trajectory of wetland transformation and provide evidence of the extent, nature, and spatial distribution of changes in wetland cover over time.

Satellite imagery for **1996, 2006, 2016, and 2026** was acquired to provide a 30-year perspective on historical and contemporary changes in the wetland system. To enhance comparability across the different assessment periods, priority was given to imagery captured during the **dry-season months of January and February**, when seasonal variations in water levels and vegetation cover are relatively reduced. The wetland boundary dataset obtained from the **Ministry of Water and Environment** was used as the reference layer for delineating the area of analysis and ensuring consistency in the assessment across the different years.

The acquired satellite imagery underwent a series of pre-processing procedures to improve image quality and enhance the distinction between different land use/cover features. These included image enhancement, band combination, compositing, and stacking. Atmospheric effects were corrected using the **Dark Object Subtraction (DOS) method**, after which the imagery was further enhanced to improve spectral separability of the different wetland features. Geometric and atmospheric corrections were undertaken to ensure spatial accuracy and comparability of the imagery prior to classification.

Following image pre-processing, **unsupervised image classification** was applied to identify and differentiate major wetland use/cover types. The **Iterative Self-Organizing Data Analysis Technique (ISODATA) algorithm** was used to cluster pixels with similar spectral characteristics within the delineated wetland boundary. The resulting spectral clusters were subsequently interpreted and reclassified into eight information classes representing the principal land use and vegetation categories within the Lake Opeta wetland system. These comprised:

1. Built-up areas;
2. Tree plantations;
3. Commercial farmland;
4. Open water;
5. Grassland;
6. Papyrus and floating vegetation;
7. Small-scale farmland; and
8. Woodland.

The classification results were subjected to **ground-truthing and accuracy assessment** to establish the reliability of the mapped land use/cover classes. Field-based GPS reference points were collected to represent different wetland use/cover categories and were supplemented with high-resolution imagery from Google Earth. An **error matrix (confusion matrix)** was generated to assess the level of agreement between the classified land use/cover categories and the corresponding ground-reference observations. This process enabled identification of classification errors and provided an objective measure of the accuracy of the resulting wetland maps.

Finally, **multi-temporal change detection analysis** was undertaken to quantify and spatially characterise changes in wetland use and cover between 1996, 2006, 2016, and 2026. The analysis examined the extent to which natural wetland vegetation and open-water areas had changed relative to areas converted to agriculture, settlements, plantations, and other human uses. The resulting analysis provided evidence of the **direction, magnitude, spatial distribution, and temporal trends of wetland transformation**, thereby supporting identification of areas experiencing significant ecological pressure and informing priorities for wetland restoration, conservation, sustainable land use, and management within the Lake Opeta Wetland System.

Table 5: Wetland classes that were mapped

No	Wetland classes	Description
1	Papyrus and floating vegetation	These are wetlands with rooted and floating vegetation that can grow up to 5-6m
2	Grasslands	These are wetlands with tall and short grasses. Sometimes include reeds.
3	Woodlands	These are wetlands composed of scattered tall trees, shrubs, palm trees with grasslands underneath
4	Tree plantations	These include wetlands planted with trees such as pine and eucalyptus
5	Open water	Wetland sections covered by natural open water bodies
6	Small-scale farmlands	These include wetlands under cultivation with crops grown purposely for household consumption such as annuals and perennials e.g., Root crops, vegetables, cereals etc
7	Commercial farmlands	These include wetlands under cultivation with crops grown purposely for commercial use such as tea and sugar cane plantations, rice schemes among others
8	Built-up areas	Wetlands converted into settlements, industries, waste treatment plants, roads etc

Status of wetlands

Wetland status refers to the current condition and functional state of a wetland ecosystem relative to its natural or reference condition, as determined by the integrity of its hydrological regime, ecological structure, biological diversity, and ecosystem service provision, as well as the degree of human-induced disturbance (Davidson, 2014). The consultant utilised the classified wetland use/cover types to determine the status of wetlands in the target districts (**Table 6**).

Table 6: Status of wetlands based on the wetland use/cover types

Status of wetlands	Wetland use/cover types
Degraded	Built-up areas, Commercial farmlands, Small-scale farmlands,
Intact	Bushlands, Forested areas, Grasslands, Papyrus and floating vegetation, and Woodlands

2.6 Validation

A validation workshop was conducted on 6th May, 2026 at Mbale Resort Hotel to present, review, and validate the preliminary findings of the study on community-based wetland management strategies for building climate resilience and biodiversity conservation in the Lake Opeta wetland system. The workshop brought together key stakeholders, including representatives from project district local governments, Rural Initiative for Community Empowerment- West Nile (RICE-WN), Advocates Coalition for Development and Environment (ACODE), DANIDA, National Environment Management Authority (NEMA) and the Ministry of Water and Environment (MWE). The representatives from the project districts included the District Natural Resources Officers (DNRO), District Environment Officers (DEO), District Community Development Officers (DCDO), and District Planners.

During the workshop, participants reviewed the study findings and provided feedback on the identified wetland management challenges, climate risks, biodiversity concerns, community practices, and proposed strategic interventions. The comments, observations, and recommendations generated during the validation workshop were used to improve the draft report by refining the findings, strengthening the analysis, clarifying emerging issues, and ensuring that the proposed community-based wetland management strategies reflected local realities, stakeholder priorities, and institutional mandates for the Lake Opeta wetland system.



Plate 5: Validation workshop at Mbale Resort Hotel, Mbale City

CHAPTER

3

FINDINGS

3.1 Status and Trend of Lake Opeta Wetland System

3.1.1 Status of wetland use/cover types

The most dominant wetland use/cover types in all the target districts are grasslands (42.8%), small-scale farmlands (28%), and papyrus & floating vegetation (25.1%) (**Figure 5**). On the other hand, built-up areas (0.3%) and tree plantations (0.1%) occupy the least coverage in all the target districts.

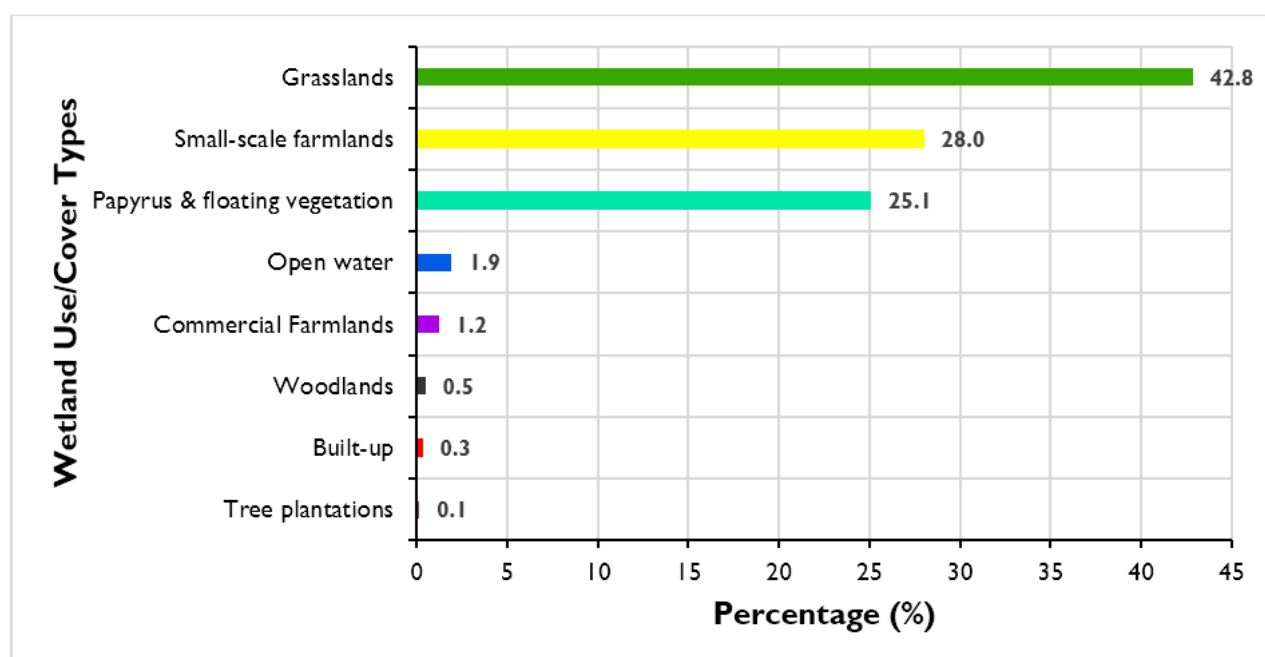


Figure 5: Coverage of wetland use/cover types in the target districts in 2026

The distribution of wetland land use and cover types varies considerably across the target districts, reflecting differences in ecological characteristics, land-use practices, and levels of human pressure. **Bukedea (0.5%) and Katakwi (0.4%)** recorded the highest proportions of built-up areas, indicating relatively greater levels of settlement and infrastructure development within the assessed wetland areas. Commercial agriculture was most prominent in **Bukedea (5.1%) and Bulambuli (2.3%)**, suggesting comparatively higher levels of agricultural intensification in these districts.

Small-scale farming constitutes a particularly significant land-use category in several districts, with the highest coverage recorded in **Bukedea (57.6%), Kumi (53.6%), and Katakwi (27.1%)**. This extensive presence of smallholder cultivation within the wetland landscape highlights the importance of agricultural activities as a major driver of wetland resource use and potential land-cover transformation.

In contrast, **Nabilatuk (90.6%) and Nakapiripirit (72.9%)** are predominantly characterised by grassland cover, reflecting the importance of these areas for grazing and pastoralist livelihoods. Open-water coverage is highest in **Kumi (6.9%) and Katakwi (2.8%)**, while substantial areas of papyrus and floating vegetation occur in **Bulambuli (68.2%) and Kumi (35.8%)**, highlighting the ecological importance of these districts for wetland vegetation and associated biodiversity.

Tree plantations constitute a relatively small proportion of the assessed wetland area, with the highest coverage recorded in **Bukedea (0.9%) and Kumi (0.1%)**. Similarly, woodland cover is relatively limited but is most pronounced in **Nabilatuk (1.0%) and Katakwi (0.8%)**.

Overall, the findings demonstrate **marked spatial variation in wetland use and cover across the target districts**. Districts such as Bukedea, Kumi, and Katakwi exhibit relatively greater levels of agricultural and built-up land use, while Nabilatuk and Nakapiripirit remain predominantly characterised by grassland. Bulambuli and Kumi, on the other hand, retain substantial areas of papyrus and floating vegetation. These patterns point to differing levels and forms of human pressure across the landscape and provide an important basis for **district-specific conservation, restoration, land-use planning, and sustainable wetland management interventions**.

Table 7: Coverage of wetland use/cover types in the different districts in 2026

Wetland Use/Cover Types	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit	
	Area (Km ²)	%	Area (Km ²)	%	Area (Km ²)	%	Area (Km ²)	%	Area (Km ²)	%	Area (Km ²)	%
Built-up	2.2	0.5	0.5	0.2	4.3	0.4	1.0	0.3	0.3	0.1	0.9	0.2
Commercial Farmlands	21.3	5.1	5.3	2.3	0.0	0.0	0.0	0.0	0.0	0.0	7.8	1.9
Small-scale Farmlands	239.8	57.6	34.7	15.3	306.9	27.1	162.7	53.6	23.3	6.0	35.7	8.9
Grasslands	16.2	3.9	31.7	14.0	525.9	46.5	9.8	3.2	352.2	90.6	292.8	72.9
Open water	2.2	0.5	0.0	0.0	31.9	2.8	20.9	6.9	0.4	0.1	0.0	0.0
Papyrus & floating vegetation	130.7	31.4	154.6	68.2	253.6	22.4	108.6	35.8	8.7	2.2	63.4	15.8
Tree plantations	3.7	0.9	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0
Woodlands	0.0	0.0	0.0	0.0	8.7	0.8	0.0	0.0	3.9	1.0	0.9	0.2
Total	416.1	100	226.8	100	1131.3	100	303.4	100	388.8	100	401.5	100

Figure 6 shows the wetland use/cover types in the target districts in 2026. Small-scale farmlands can be largely seen in Bukedea, Kumi, and Katakwi districts.

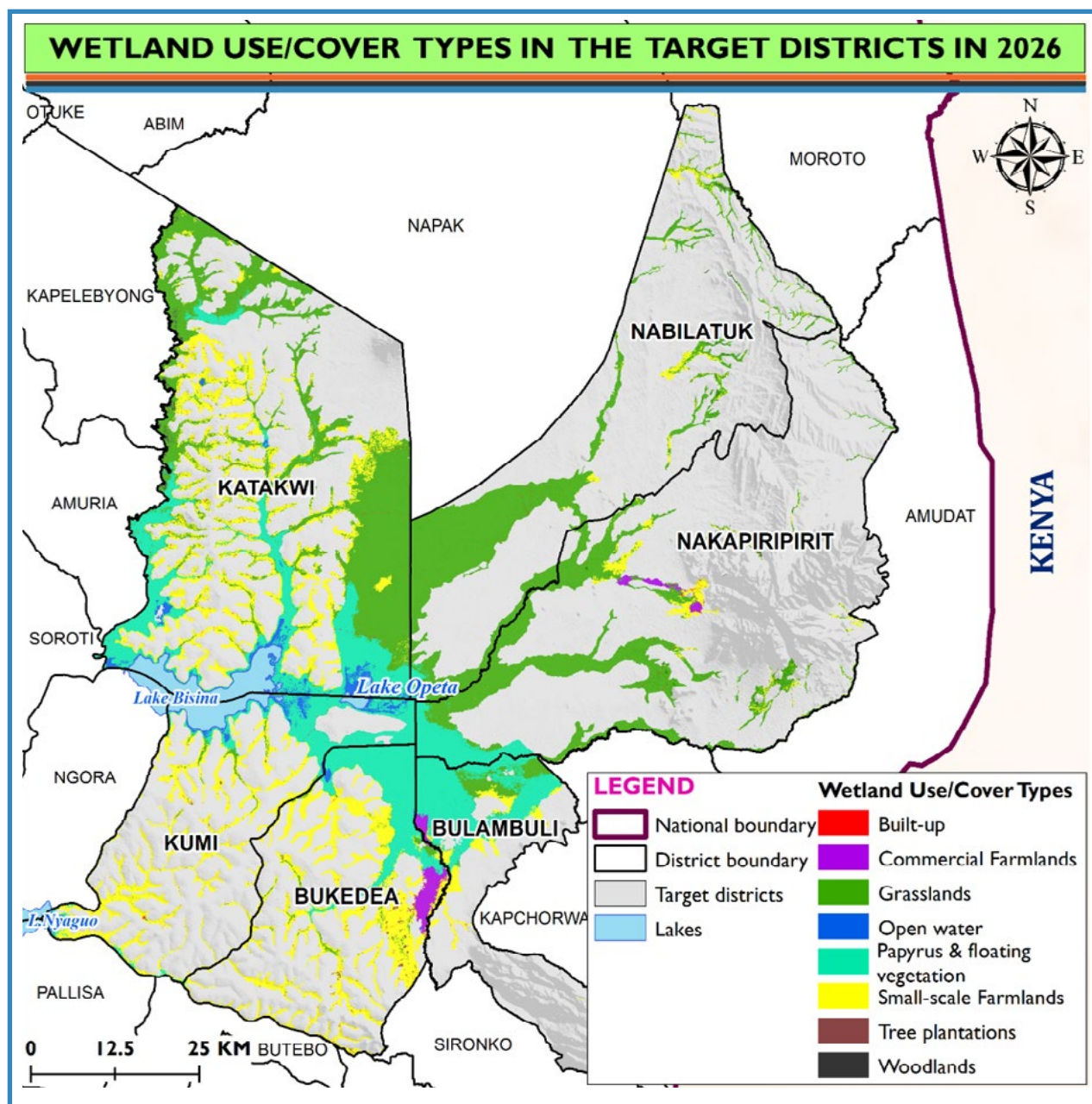


Figure 6: Wetland use/cover types in the target districts in 2026

3.1.2 Trends of wetland coverage in the target districts

The coverage of intact wetlands in all the target districts has decreased between 1996 and 2026. The coverage of intact wetlands in 1996 was 2,672.3km² (93.2%) and 2,289.9km² (79.8%) in 2006. In 2016 and 2026, the coverage of wetlands further decreased to 2,149.3km² (74.9%) and 2,017.1km² (70.3%); respectively. Between 1996 and 2026, all the target districts lost 655.2 sq.km of wetlands. The decrease in wetlands coverage was due to increasing encroachment by small-scale and large-scale farmlands, tree plantations, and built-up areas. (**Figure 7**).

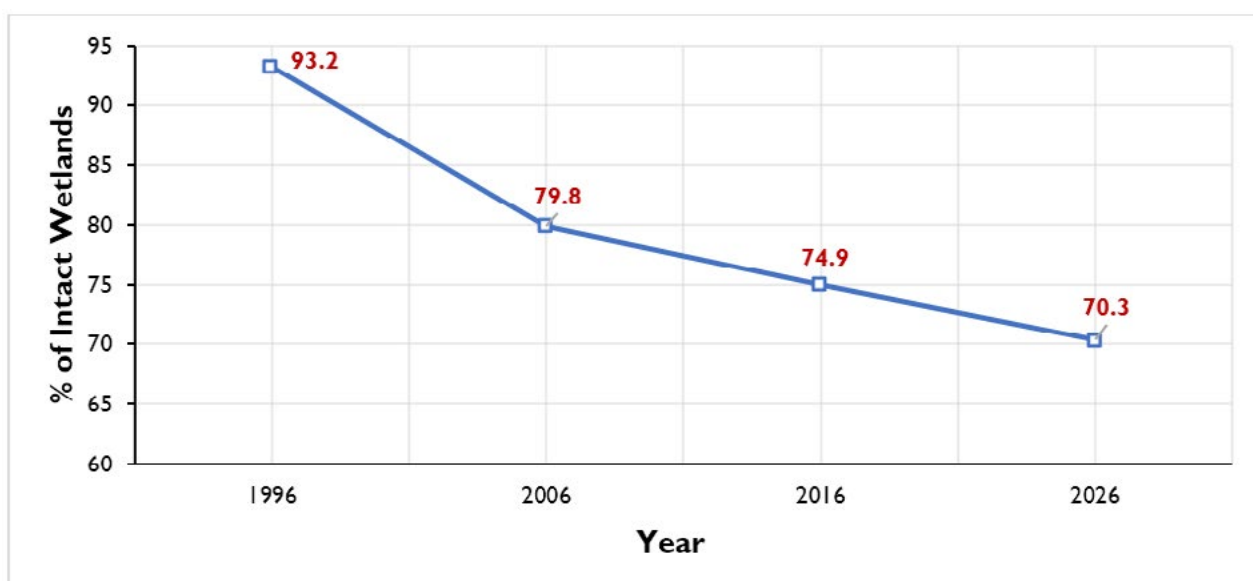


Figure 7: Coverage of intact wetlands in the target districts in 1996, 2006, 2016, and 2026

Between 1996 and 2026, all the districts lost intact wetlands. Between this period, the biggest loss in intact wetlands occurred in Bukedea (58.9%), Kumi (26.8%), and Katakwi (22.4%) (**Table 8**). Nabilatuk (3.6%) and Nakapiripirit (8.3%) districts experienced the least loss in intact wetlands between this period of assessment.

Table 8: District coverage of intact wetlands in 1996, 2006, 2016, and 2026

Year	1996	2006	2016	2026	Net Change (1996-2026)	
Districts	Area (Sq.km)				Area (Sq.km)	%
Bukedea	394.8	268.6	233.8	149.1	-245.7	-58.9
Bulambuli	214.0	200.4	192.7	186.3	-27.8	-12.2
Katakwi	1,073.2	904.7	843.7	820.1	-253.1	-22.4
Kumi	220.6	166.2	146.0	139.3	-81.3	-26.8
Nabilatuk	379.2	361.8	359.1	365.2	-14.0	-3.6
Nakapiripirit	390.5	388.2	374.0	357.1	-33.4	-8.3
Total	2,672.3	2,289.9	2,149.3	2,017.1	-655.2	-22.8

The analysis showed that between 1996 and 2026, built-up areas, commercial farmlands, small-scale farmlands, and tree plantations increased whereas grasslands, papyrus and floating vegetation, and woodlands decreased (**Table 9**). No net change was observed in area covered by open water. During the study period, the biggest decrease was observed in grasslands whereas the biggest increase was observed in small-scale farmlands.

Table 9: Changes in wetland use/cover types in all the target districts between 1996 and 2026

Wetland use/cover types	1996		2006		2016		2026		Net change (1996-2026)	
	Area (Km ²)	%	Area (Km ²)	%	Area (Km ²)	%	Area (Km ²)	%	Area (Km ²)	%
Built-up	0.2	0.0	0.7	0.0	4.4	0.2	9.2	0.3	9.0	0.3
Commercial farmlands	0.6	0.0	1.7	0.1	5.0	0.2	34.3	1.2	33.8	1.2
Grasslands	1,617.4	56.4	1,538.2	53.6	1,428.5	49.8	1,228.8	42.8	-388.6	-13.5
Open water	54.6	1.9	54.6	1.9	55.3	1.9	55.4	1.9	0.8	0.0
Papyrus & floating vegetation	853.8	29.8	829.0	28.9	780.5	27.2	719.6	25.1	-134.2	-4.7
Small-scale farmlands	50.2	1.7	324.0	11.3	533.2	18.6	803.2	28.0	753.0	26.3
Tree plantations	0.1	0.0	1.0	0.0	2.2	0.1	4.2	0.1	4.1	0.1
Woodlands	291.5	10.2	119.0	4.2	59.2	2.1	13.6	0.5	-277.9	-9.7
Total	2,868.3	100	2,868.3	100	2,868.3	100	2,868.3	100		

Figure 8 compares wetland use and cover in 1996, 2006, 2016, and 2024 across the study districts. Across all years, grasslands form the dominant matrix, while open water and papyrus concentrate around Lake Bisina and Lake Opeta and along connecting wetland corridors, particularly within and around Katakwi, Kumi, and Bulambuli. The sequence also suggests progressive expansion and consolidation of small-scale farmland patches around the southern and central parts (notably towards Bukedea), while built-up areas, tree plantations, commercial farmland, and woodlands remain comparatively limited and spatially localised through time; the northeastern highland and rangeland settings around Nakapiripirit and Nabilatuk appear largely dominated by grasslands with smaller, scattered wetland classes.

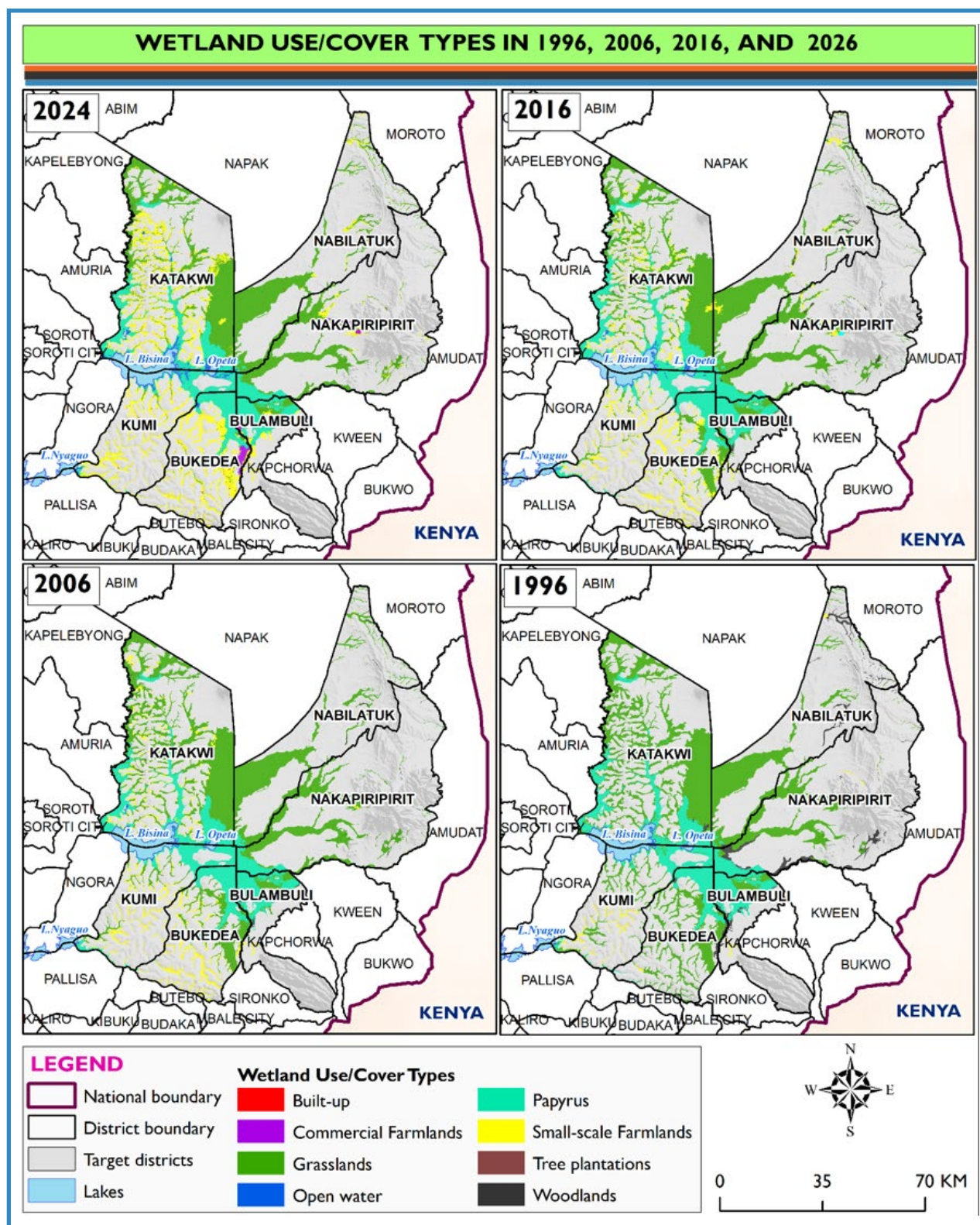


Figure 8: Wetland use/cover types in the target districts in 1996, 2006, 2016, and 2026

3.1.3 Status and trend of wetland degradation

The intact wetlands in the target districts cover a total area of 2,017.1 sq.km (70.3%) whereas the degraded wetlands cover a total area of 850.8 sq.km (29.7%) (**Table 10**). Nabilatuk (93.9%) and Nakapiripirit (88.9%) districts have the biggest coverage of intact wetlands, whereas Bukedea (64.2%) and Kumi (54.1%) districts have the biggest coverage of degraded wetlands.

Table 10: District wetlands status in 2026

Districts	Degraded		Intact		Total
	Area (Km ²)	%	Area (Km ²)	%	Area (Km ²)
Bukedea	267.0	64.2	149.1	35.8	416.1
Bulambuli	40.5	17.8	186.3	82.2	226.8
Katakwi	311.2	27.5	820.1	72.5	1,131.3
Kumi	164.1	54.1	139.3	45.9	303.4
Nabilatuk	23.6	6.1	365.2	93.9	388.8
Nakapiripirit	44.4	11.1	357.1	88.9	401.5
Total	850.8	29.7	2,017.1	70.3	2,867.9

Figure 9 shows the percentage of degraded wetlands in 2026. The most severe degradation is concentrated in the south-western portion of the map, particularly across Kumi and Bukedea, with several neighbouring subcounties registering very high degraded-wetland percentages (80-100%). Katakwi shows a mixed pattern, with moderate to high degradation in some subcounties but lower levels in others, notably around the wetland-lake complex associated with Lake Opeta. In contrast, much of the north-eastern rangeland area, including Nakapiripirit and Nabilatuk, is dominated by green classes, indicating comparatively lower proportions of degraded wetlands.

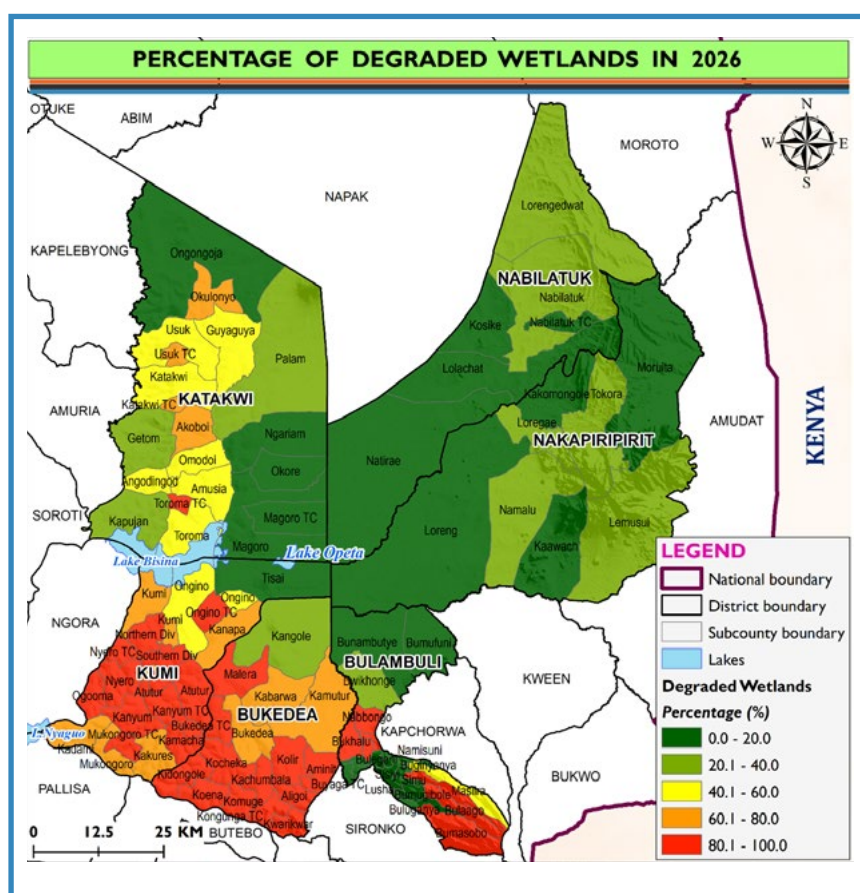


Figure 9: Percentage of degraded wetlands, by subcounty, in 2026

Figure 10 indicates variation in the percentage change in wetland degradation between 1996 and 2026 across the six districts, with Bukedea showing the largest increase (63.7%), followed by Kumi (38.5%) and Katakwi (27.4%). Moderate change is observed in Bulambuli (16.0%), while the smallest increases occur in Nakapiripirit (10.6%) and Nabilatuk (5.6%). Overall, the pattern suggests that degradation intensified most sharply in the more south-western districts, whereas the Karamoja districts experienced comparatively limited change over the same period.

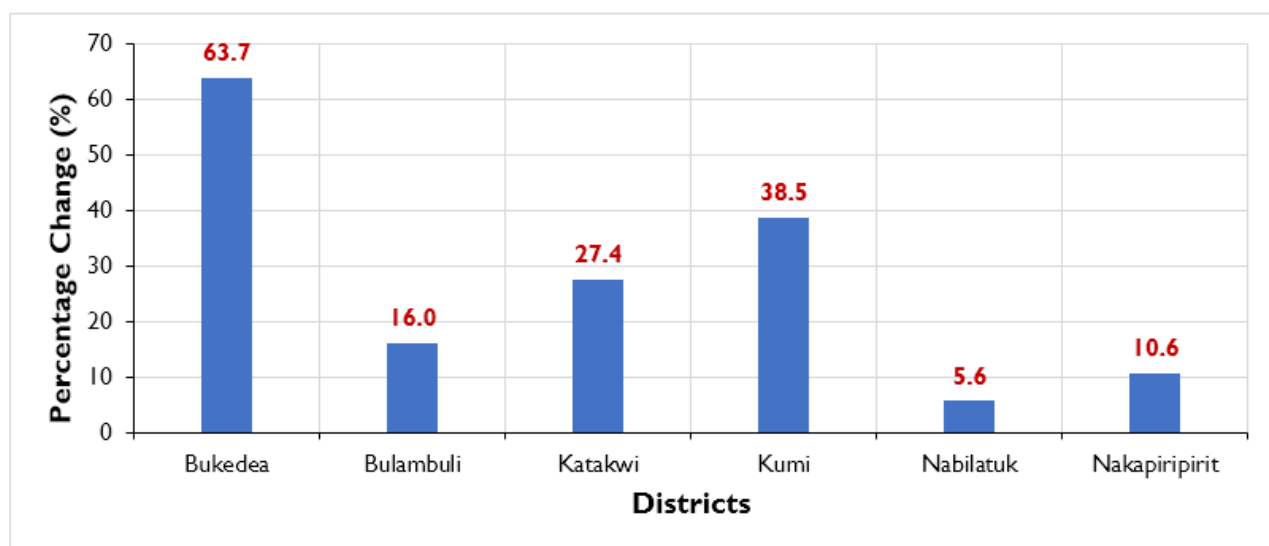


Figure 10: Percentage change in wetland degradation between 1996 and 2026

3.1.4 Status of water quality

The water quality assessment across the sampled wetlands indicates that **most salinity-related parameters were within the applicable NEMA and UNBS guideline ranges**, although several sites recorded exceedances for key physicochemical parameters. These deviations point to **localised water quality stress** and potential ecological pressures within parts of the Lake Opeta wetland system (Table 11).

Temperature: Water temperatures exceeded the NEMA reference range of **20–30°C** at several sites. Elevated temperatures were recorded in **Chesebere Wetland in Bulambuli (31.4°C)**, **Bisina-Opeta-Okorotum Wetland in Katakwi (31.0°C)** and **Kumi (33.4°C)**, and **Amaler Wetland in Nakapiripirit (33.8°C)**. Higher water temperatures can accelerate microbial and biochemical processes while simultaneously reducing the capacity of water to retain dissolved oxygen. Prolonged exposure to elevated temperatures can therefore place additional stress on aquatic organisms, particularly when combined with low oxygen levels.

Dissolved oxygen: Dissolved oxygen concentrations fell below the NEMA minimum guideline of **≥5.0 mg/L** at two sites within Bisina-Opeta-Okorotum Wetland—**3.5 mg/L in Katakwi** and **4.4 mg/L in Kumi**. These levels indicate conditions of oxygen stress that may adversely affect aquatic ecosystem health. Low dissolved oxygen can reduce habitat suitability for oxygen-sensitive fish and macroinvertebrates, favour more tolerant species, and increase the likelihood of fish mortality during periods of high temperature, low water movement, or organic matter accumulation.

pH: Variations outside the recommended pH range were observed at selected sites. Chesebere Wetland recorded a pH of **6.4**, slightly below the NEMA range of **6.5–8.5**, while Bisina-Opeta-Okorotum Wetland in Katakwi recorded a notably high pH of **9.9**, exceeding both NEMA and UNBS guideline values. Such deviations can affect nutrient availability and physiological processes in aquatic organisms. In particular, elevated pH can increase the proportion and potential toxicity of un-ionised ammonia where sufficient nitrogen is present, thereby increasing risks to aquatic life.

Total nitrogen: The most widespread water quality concern was elevated total nitrogen. Concentrations exceeded the NEMA effluent guideline of **10 µg/L** in almost all measured wetlands, with the exception of **Kakole Wetland in Bukedea (7.99 µg/L)**. Exceedances relative to the UNBS potable water guideline of **45 µg/L** were also recorded in **Chesebere Wetland (55.67 µg/L)**, **Bisina-Opeta-Okorotum Wetland in Katakwi (47.37 µg/L)** and **Kumi (61.31 µg/L)**. **Amaler Wetland in Nakapiripirit (44.91 µg/L)** was close to the UNBS threshold.

The elevated nitrogen concentrations are likely associated with a combination of **agricultural runoff from fertilised fields, livestock grazing, soil erosion and sediment-laden inflows, domestic wastewater and possible latrine leakage, as well as the decomposition of organic matter**. These potential sources are consistent with the observed patterns of land use and resource dependence within the surrounding wetland catchments.

The combined occurrence of **elevated temperatures, increased nitrogen concentrations, and low dissolved oxygen** is of particular ecological concern. Such conditions can promote excessive algal growth and eutrophication, alter aquatic plant communities, reduce habitat quality, and place stress on sensitive fish and macroinvertebrate species. If persistent, these changes may contribute to declining aquatic biodiversity and reduced ecological functioning of the wetlands.

The implications extend beyond ecological integrity to the **livelihoods and well-being of surrounding communities**. Deteriorating water quality may reduce fisheries productivity, affect the taste and odour of water, increase the risks associated with consumption of untreated water, and raise household and institutional costs associated with water treatment. Continued deterioration may also undermine important wetland ecosystem services, including **natural water purification, fisheries production, water storage, and flood regulation**.

Overall, the water quality results point to a need for **targeted monitoring and preventive management**, particularly in sites where multiple parameters were outside recommended thresholds. Priority measures should include strengthening control of agricultural and livestock-related runoff, improving sanitation and wastewater management, protecting wetland vegetation and buffer zones, reducing direct pollution inputs, and establishing routine water quality monitoring to detect and respond to emerging changes before they become widespread or irreversible.

Table 11: Water quality in the sampled wetlands

District	Wetland	DO (mg/L)	Temp (°C)	TDS (mg/L)	Salinity (mg/L)	EC (µS/cm)	pH	Total phosphate (µg/L)	Total Nitrogen (µg/L)
Bukedea	Kakole	6.2	24.8	15.4	10.6	21.7	7.9	0.298	7.99
Bulambuli	Chesebere	6.53	31.4	75.6	52.8	108	6.4	0.26	55.67

District	Wetland	DO (mg/L)	Temp (°C)	TDS (mg/L)	Salinity (mg/L)	EC (µS/cm)	pH	Total phosphate (µg/L)	Total Nitrogen (µg/L)
Katakwi	Bisina-Opeta-Okorotum	3.5	31	25.5	18.2	36	9.9	0.28	47.37
Kumi	Bisina-Opeta-Okorotum	4.4	33.4	154	11.1	23	6.9	0.14	61.31
Nabilatuk	Leomat	-	-	-	-	-	-	-	-
Nakapiripirit	Amaler	8.4	33.8	14.3	10.9	21.8	8.1	0.38	44.91
NEMA Standard (for Effluent Discharge)		≥5.0	20 to 30	<500	<100	<300	6.5- 8.5	5	10
UNBS Standard (for potable water)		-	-	<1500	-	<2500	5.5- 9.5	2.2	45

3.1.5 Status of Biodiversity

Flora diversity of Lake Opeta wetland system

The plant species diversity is presented in **Figure 11** using the Shannon-Weiner Diversity Index (H'). The analysis shows consistently high diversity overall (H' ranges from 3.16 to 4.02). The highest diversity was recorded at Chesebere wetland in Bulambuli district ($H' = 4.02$), while the lowest diversity was recorded at Leomat wetland in Nabilatuk district ($H' = 3.16$). The remaining sites were clustered closely, including Kakole wetland in Bukedea district ($H' = 3.32$), Bisina-Opeta-Okorotum wetland in Kumi district ($H' = 3.43$) and in Katakwi district ($H' = 3.21$), and Amaler wetland in Nakapiripirit district ($H' = 3.20$).

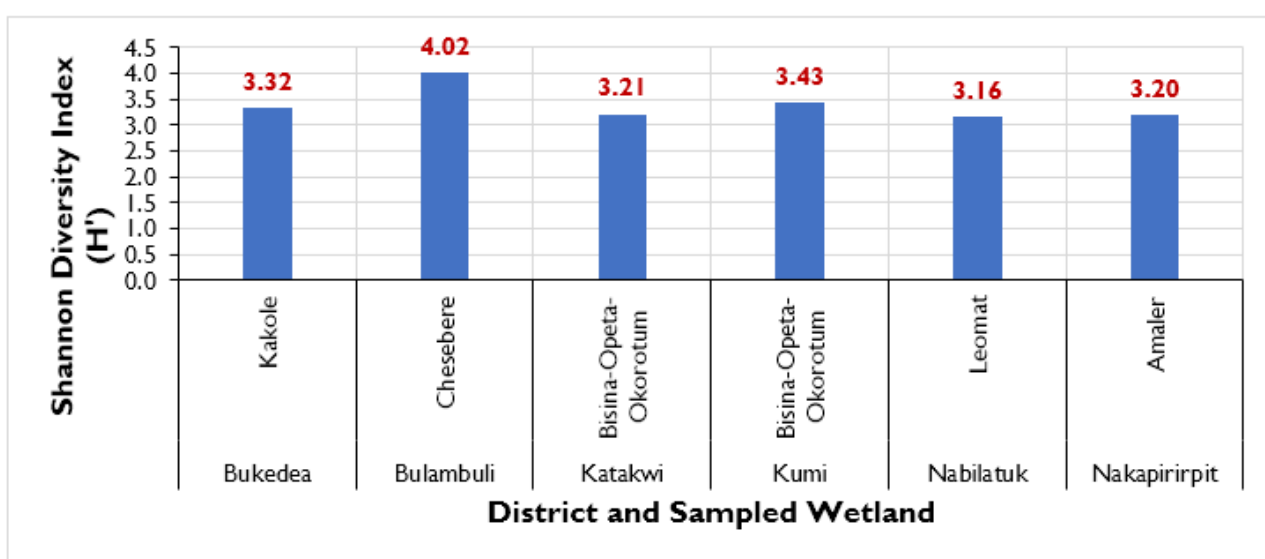


Figure 11: Plant species diversity in the different sampled wetlands and districts

A total of 190 plant species were recorded across the sampled wetlands and districts. **Figure 12** shows variation in species richness across the sampled wetlands, ranging from 31 to 86 species. The highest richness was recorded at Chesebere wetland in Bulambuli district (86 species), followed by Bisina-Opeta-Okorotum wetland in Kumi district (67 species). Moderate values were observed at Kakole wetland in Bukedea district (55 species) and Amaler wetland in Nakapiripirit district (54 species), while lower richness was reported for the same Bisina-Opeta-Okorotum site in Katakwi (40 species). The lowest richness occurred at Leomat wetland in Nabilatuk district (31 species), indicating comparatively fewer species at that site.

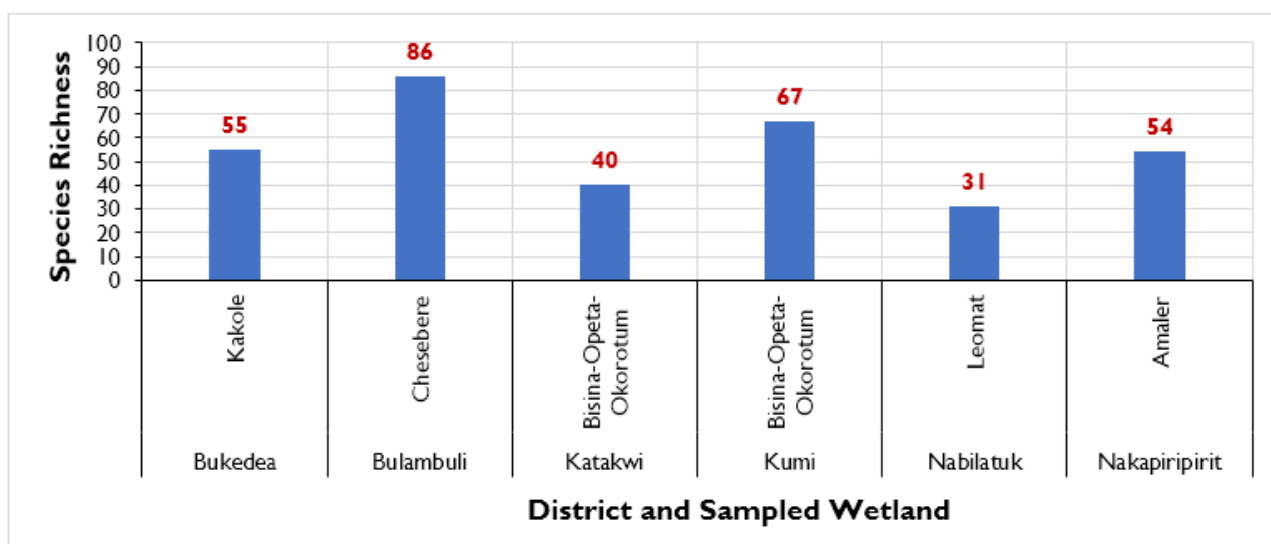


Figure 12: Plant species richness in the different sampled wetlands and districts

The most dominant plant species per sampled wetland and district are presented in **Table 12**. Overall, the most common plant species include *Oryza sativa*, *Vossia cuspidata*, *Cynodon dactylon*, *Panicum repens*, and *Phragmites australis* (Plates 10-13).

Table 12: Most dominant plant species in the different sampled wetlands and districts

District	Sampled wetland	Most dominant plant species
Bukedea	Kakole	<i>Oryza sativa</i> (200), <i>Cynodon dactylon</i> (50), <i>Digitaria abyssinica</i> (50), <i>Imperata cylindrica</i> (50), and <i>Panicum repens</i> (50)
Bulambuli	Chesebere	<i>Oryza sativa</i> (200), <i>Cynodon dactylon</i> (50), <i>Enhydra fluctuans</i> (50), <i>Panicum repens</i> (50), and <i>Pennisetum purpureum</i> (50)
Katakwi	Bisina-Opeta-Okorotum	<i>Vossia cuspidata</i> (200), <i>Nymphaea caerulea</i> (50), <i>Panicum repens</i> (50), <i>Potamogeton pectinatus</i> (50), and <i>Potamogeton schweinfurthii</i> (50)
Kumi	Bisina-Opeta-Okorotum	<i>Cynodon dactylon</i> (200), <i>Panicum repens</i> (200), <i>Vossia cuspidata</i> (200), <i>Heteropogon contortus</i> (50), and <i>Imperata cylindrica</i> (50)
Nabilatuk	Leomat	<i>Cynodon dactylon</i> (50), <i>Pennisetum purpureum</i> (50), <i>Chloris gayana</i> (30), <i>Digitaria abyssinica</i> (30), and <i>Eragrostis ciliaris</i> (30)
Nakapiripirit	Amaler	<i>Phragmites australis</i> (200), <i>Cynodon dactylon</i> (30), <i>Echinochloa pyramidalis</i> (30), <i>Heteropogon contortus</i> (30), and <i>Panicum repens</i> (30)



Plate 6: *Oryza sativa* in Chesebere wetland, Bulambuli district



Plate 7: *Vossia cuspidata* in Bisina-Opeta-Okorotum wetland, Katakwi district



Plate 8: *Cynodon dactylon* in Amaler wetland, Nakapiripirit district



Plate 9: *Panicum repens* in Bisina-Opeta-Okorotum wetland, Kumi district

The growth forms of the different plant species are shown in **Figure 13**. Herbs dominate the recorded growth forms in every district, contributing the largest share of counts in Bukedea (40), Bulambuli (62), Katakwi (34), Kumi (43), Nabilatuk (25) and Nakapiripirit (34). Shrubs and trees form a smaller but consistent component across sites (for example, trees range from 3 in Bulambuli and Katakwi to 12 in Kumi). Climbers are the least represented growth form, absent in Bukedea, Katakwi and Nabilatuk, but present at low levels in Bulambuli (7), Kumi (2) and Nakapiripirit (5).

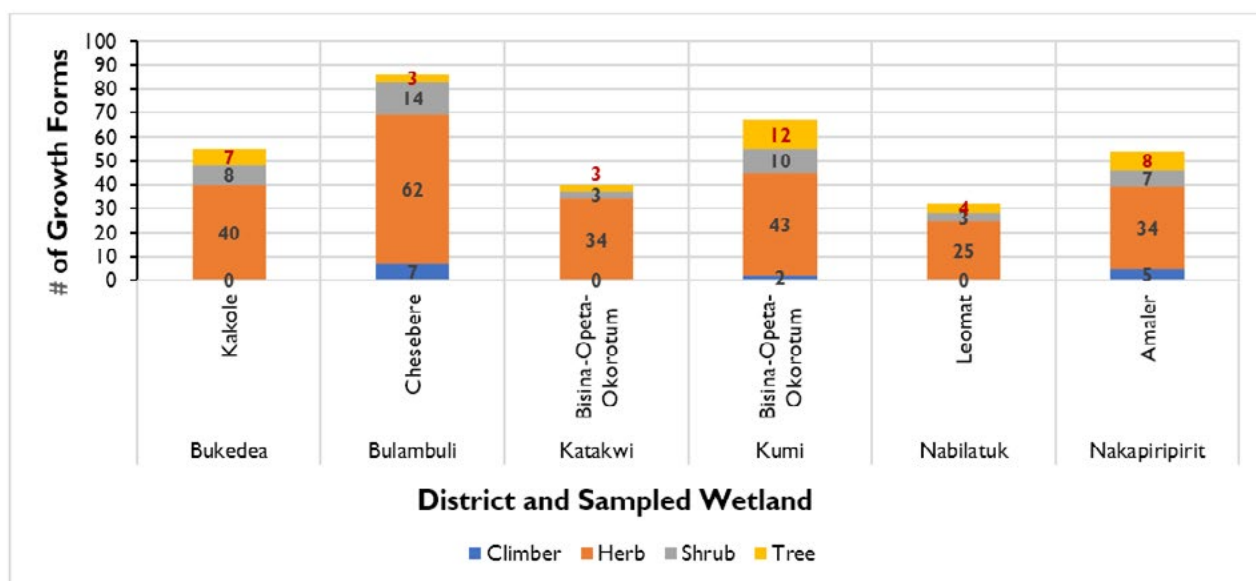


Figure 13: Number of growth forms in the different sampled wetlands and districts

Figure 14 presents the IUCN status of recorded plant species across six sampled wetlands and shows that Not Evaluated (NE) species dominate at every site, ranging from 27 at Leomat wetland in Nabilatuk to 76 at Chesebere wetland in Bulambuli. Least Concern (LC) species form the next largest share, with values of 11 at Kakole wetland in Bukedea, 10 at Chesebere wetland, 4 at Bisina-Opete-Okorotum wetland in Katakwi, 15 at the same wetland in Kumi, 5 at Leomat wetland in Nabilatuk, and 15 at Amaler wetland in Nakapiripirit. Near Threatened (NT) species are rare, recorded only as single species at Kakole wetland in Bukedea and at Bisina-Opete-Okorotum wetland in Kumi, and absent at the other sites. The Near Threatened (NT) species is *Eucalyptus camaldulensis* belonging to family Myrtaceae.

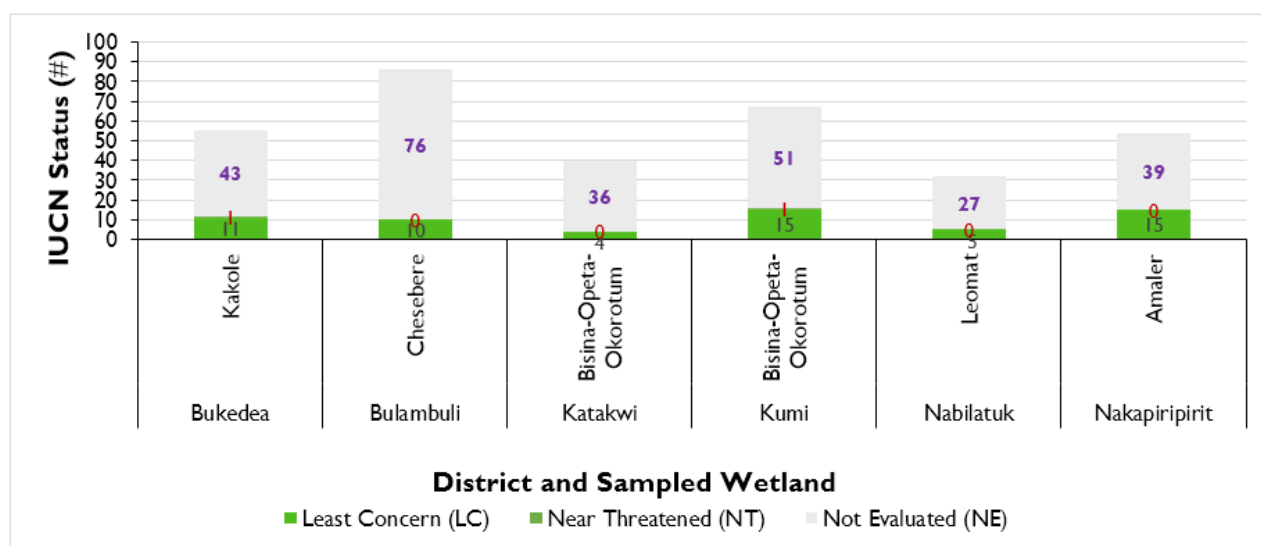


Figure 14: IUCN status of the plant species in the different sampled wetlands and districts

Fauna diversity of Lake Opeta wetland system

Terrestrial Fauna

Even though sampling was done in the dry season, in which many parts of the wetland were dry, several fauna species were observed and recorded (**Table 13**), indicating relatively healthy systems, although encroachment affected their distribution and abundance overall. The commonest were birds i.e., pied kingfishers and white egrets, especially near water sources and grazing patches, respectively. White butterflies and grass frogs were also common where water was undisturbed and less turbid.

Fauna data showed that the sampled wetlands were ecologically functional but disturbed by human encroachment. Most of the organisms recorded were generalist and disturbance-tolerant species, for example, the cattle egrets, pied kingfishers, frogs, butterflies, and grasshoppers. The amphibians recorded were a sign of some wet conditions in the wetlands. Absence of wetland sensitive species like clawless frogs and jacanas reflected declining ecological integrity. This pattern is widely reported in human-modified wetlands (IPBES, 2019; Davidson et al., 2020).

High numbers of western cattle egrets (white egrets) are strongly associated with livestock grazing rather than natural wetland productivity, while the presence of pied kingfishers indicated fish presence under pressure from subsistence fishing. Insects dominated grass patches and cultivated areas, suggesting simplified vegetation structure and early successional habitats typical of disturbed wetlands (Keddy, 2010; Murray et al., 2018).

Seasonal wetlands such as Leomat wetland in Nabilatuk district, showed reduced aquatic fauna due to drying and burning, processes known to disrupt animal breeding cycles, and biodiversity in tropical wetlands (Ramsar Convention Secretariat, 2018; UNEP, 2021).

Amphibians are sensitive bio-indicators; their abundance reflected declining water quality and loss of suitable breeding habitats (Grant et al., 2020). Continued wetland encroachment through farming, grazing, and burning is likely to accelerate degradation, particularly in seasonal wetlands that are highly vulnerable to permanent conversion under climate variability (IPBES, 2019; Junk et al., 2022). Ecologically, these patterns imply progressive biodiversity loss, simplified food webs increasingly dominated by adaptable species, and progressive loss of wetland integrity.

Table 13: Terrestrial fauna from sampled sites

District	Wetland	Organism name	No. of ind.	Habitat type	Behavior	Observed Wetland status
Bukedea	Kakole wetland	Finch's agama (gecko)	2	Tree	Resting	Encroached (crop growing and cattle grazing in the wetland, domestic water point)
		African striped skink (Black and white lined lizards)	2	Tree	Resting	
		Crowned bull frog (<i>Peleothrax spp</i>)	5	Grass patch	Feeding	
		Grass frog	3	Grass patch	Resting	
		Pied kingfisher	4	Trees	Feeding/ resting	
		Western cattle egrets (White egrets, <i>Ardea ibis</i>)	20	Cattle grazing patch	Feeding	
		Black-headed heron (<i>Ardea melanocephala</i>)	1	Floating grass patch	Feeding	
Kumi	Bisina-Opeta-Okorotum	Small Crocodiles (reported)				Encroached (cattle grazing at the edges of the wetland, fish landing site)
		Western cattle egrets (White egrets, <i>Ardea ibis</i>)	35	Cattle grazing patch	Feeding	
		Pied Kingfishers (<i>Ceryle rudis</i>)	10			
		Crowned bull frog (<i>Peleothrax spp</i>)	3	Grass patch	Feeding	
		Green grasshoppers	7	Grass patch	Resting	
Katakwi	Bisina-Opeta-Okorotum	Crowned bull frog (<i>Peleothrax spp</i>)	5	Grass patch	Resting	Encroached (cattle grazing at the edges of the wetland, subsistence fishing and small-scale farming of sunflower and millet)
		White butterflies (Pierinae group)	7	Grass patch	Resting and feeding	
		Black kite (<i>Milvus migrans</i>)	1	Tree branch	Resting	
		Pied crow (<i>Corvus albus</i>)	2	Tree branches	Resting	
		Pied Kingfishers (<i>Ceryle rudis</i>)	2	Tree	Resting	
Nabilatuk	Leomat wetland	Pied Kingfishers (<i>Ceryle rudis</i>)	3	Thorny Tree branch	Resting	Seasonal wetland (visible signs of water that dried), grass burnt
		Common grass yellow butterflies (<i>Eurema hecabe</i>)	2	Grass patch	Feeding	
		Black kite <i>Milvus migrans</i>)	2	Tree branch	Resting	

District	Wetland	Organism name	No. of ind.	Habitat type	Behavior	Observed Wetland status
Bulambuli	Chesebere	Leopard grass frog	4	Grass patch	Resting	Encroached (medium scale farming)
		White butterflies (<i>Pierinae</i> group)	6	Stream edge	Feeding	
		Common grass yellow butterflies (<i>Eurema hecabe</i>)	5	Grass patch	Resting	
Nakapiripirit	Amaler	White butterflies (<i>Pierinae</i> group)	4	Grass patch	Resting	Encroached (medium scale rice and maize farming in the wetland, subsistence fishing activities)
		Pied Kingfishers (<i>Ceryle rudis</i>)	7	Tree branch	Resting	
		Brown grasshoppers	10	Grass patch	Resting	



Plate 10: Yellow butterfly in Chesebere wetland, Bulambuli district



Plate 11: Brown grasshopper in Amaler wetland, Nakapiripirit district

Fish Stock Assessment

Fish data across the sampled districts confirm that wetlands still support fish (Table 14), however, the fishermen reported declining fish stocks. In Kakole wetland (Bukedea District), no fish were captured because dry-season water levels were extremely low, and fish presence was mainly reported for the wet season. This was the same for Leomat wetland (Nabiatuk district) where catfish (Nsonzi) were reported during the wet season. Fish were caught at Bisina-Opeta-Okorotum wetland (Kumi District) and Kamenu landing site (Katakwi District), and they mainly included *Haplochromis spp.* and mudfish (*Clarias spp.*).

Larger, commercially valuable species such as African catfish and lungfish were mostly reported by fishermen but were not captured, suggesting low local populations. Fishermen also noted seasonal fish disappearance linked to wetland drying and declining water quality, consistent with broader wetland degradation in Uganda driven by agricultural expansion, settlement, and other pressures (NEMA, 2020). As wetlands provide key breeding and feeding habitats for species such as *Clarias* and *Haplochromis*, their degradation or drainage threatens fish productivity, with knock-on effects on livelihoods, food security, and wetland ecological functions (Uganda NBSAP, 2002; CBD/FAO, 2013; NEMA, 2020).

Table 14: Fish diversity in the sampled wetlands

District	Wetland	Fish type	Numbers	Main Purpose
Bukedea	Kakole	Mud fish (Nsonzi) – <i>Clarias spp</i>	Not encountered; fishermen reported existence	Home consumption, local trade
		African catfish (Mmale) <i>Clarias gariepinus</i>	Not encountered; fishermen reported existence	Home consumption, local trade
		Lung fish (Mamba/kamongo) – <i>Protopterus spp.</i>	Not encountered; fishermen reported existence	Home consumption, local trade
		Bagrid catfish (Semutundu/ebileng) – <i>Bagrus spp</i>	Not encountered; fishermen reported existence	Home consumption, extra pieces are sold smoked
Kumi	Bisina-Opeta-Okorotum	<i>Haplochromis spp</i> (Bluelip haplos, golden haplos, grey fin haplos)	43	Home consumption
		Mud fish (Nsonzi) – <i>Clarias spp</i>	10	Home consumption, local trade
		African catfish (Mmale) <i>Clarias gariepinus</i>	Not encountered; fishermen reported existence	Home consumption, local trade
		Bagrid catfish (Semutundu/ebileng) – <i>Bagrus spp</i>	Not encountered; fishermen reported existence	Home consumption, extra pieces are sold smoked
Kataakwi	Bisina-Opeta-Okorotum	<i>Haplochromis spp</i>	30	Home consumption
		Mud fish (Nsonzi) – <i>Clarias spp</i>	45	Home consumption
		African catfish (Mmale) <i>Clarias gariepinus</i>	Not encountered; fishermen reported existence	Home consumption
Nabilatuk	Leomat	No water source sampled Catfish was reported	-	Home consumption
Bulambuli	Chesebere	<i>Haplochromine spp</i> (Nkejje)	50	Home consumption
		Mud fish (Nsonzi) – <i>Clarias spp</i>	Not encountered; fishermen reported existence	Home consumption, local trade
		African catfish (Mmale) <i>Clarias gariepinus</i>	Not encountered; fishermen reported existence	Home consumption, local trade
		Lung fish (Mamba/kamongo) – <i>Protopterus spp.</i>	Not encountered; fishermen reported existence	Home consumption, extra pieces are sold smoked
Nakapiripirit	Amaler	Mud fish (Nsonzi) – <i>Clarias spp</i>	60	Home consumption
		<i>Haplochromine spp</i> (Nkejje)	21	Home consumption
		African catfish – <i>Clarias spp</i>	Not encountered; fishermen reported existence	Home consumption



Plate 12: Haplochromines on stick



Plate 13: Golden yellow haplochromine

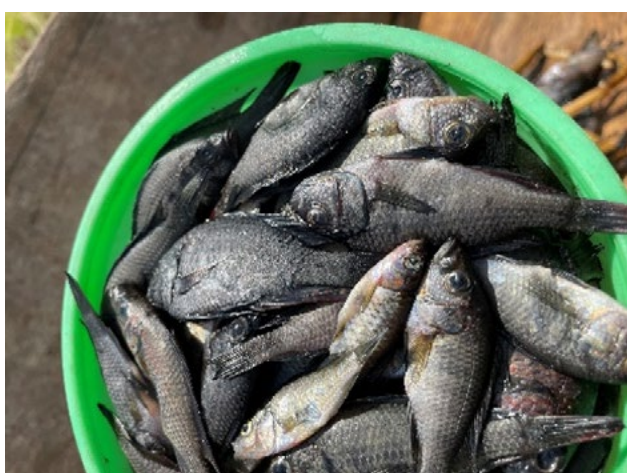


Plate 14: Haplochromines for home consumption



Plate 15: Fishing boats at Kamenu landing site, Magoro subcounty, Katakwi district

Phytoplankton Analysis

Phytoplankton composition across the sampled wetlands indicates varying but notable nutrient and organic enrichment consistent with wetland disturbance (**Table 15**). The Bisina-Opeta-Okorotum wetland in Katakwi District showed high abundances of *Oscillatoria* and *Microcystis*, alongside low dissolved oxygen and elevated pH, conditions associated with poor circulation and organic pollution that can constrain sensitive fish and other aquatic organisms (Paerl & Otten, 2013; NEMA, 2016). Filamentous green algae, including *Spirogyra*, *Microspora*, *Urothrix*, and *Zygnema*, were common in Bisina-Opeta-Okorotum (Kumi) and Kakole (Bukedea), consistent with nutrient enrichment linked to agricultural inputs and human disturbance and favouring more tolerant taxa such as *Clarias* and small cichlids (Kansiime et al., 2007).

The scarcity of diatoms (*Synedra*) suggests limited clean-water habitats, while the occurrence of flagellates (*Phacus* and *Uroglenia*) in Chesebere and Bisina-Opeta-Okorotum points to organic enrichment and fluctuating oxygen regimes (Reynolds, 2006). The dominance of cyanobacteria and filamentous green algae, together with indications of oxygen stress and reduced presence of sensitive taxa, supports an interpretation of moderate to high nutrient enrichment and localised ecological degradation in the assessed wetlands, consistent with eutrophication pressures driven by human activities (Kolding et al., 2014).

Table 15: Phytoplankton assessment in the sampled wetlands

District	Nakapiripirit	Katakwi	Kumi	Bukedea	Bulambuli
Wetland	Amaler wetland	Bisina-Opeta-Okortum	Bisina-Opeta-Okortum	Kakole	Chesebere
Taxon	No. of organisms per liter				
Blue-green algae					
<i>Microcystis (sp)</i>	64	42	56	38	62
<i>Tolypothrix (sp)</i>	45	36	49	32	–
<i>Calothrix (sp)</i>	28	30	–	65	46
<i>Desmidium (sp)</i>	34	16	34	–	20
<i>Oscillatoria (sp)</i>	–	48	26	48	54
<i>Anabaena (sp)</i>	50	33	–	42	–
Green algae					
<i>Microspora (sp)</i>	58	44	65	60	54
<i>Urothrix (sp)</i>	26	52	46	74	56
<i>Zygnema (sp)</i>	34	–	38	–	62
<i>Spirogyra (sp)</i>	15	36	72	34	40
<i>Cladophora (sp)</i>	28	12	–	25	18
<i>Hildenbrandia (sp)</i>	–	45	20	38	45
<i>Dedogonium (sp)</i>	17	35	08	25	–
<i>Microsterias (sp)</i>	20	–	–	46	52
Flagellates					
<i>Phacus (sp)</i>	10	16	24	–	38
<i>Uroglena (sp)</i>	04	12	06	18	36
Diatoms					
<i>Synedra (Sp)</i>	09	05	–	02	08

Zooplankton Analysis

Zooplankton assemblages across the wetlands were characterised by dominance of rotifers (*Euchlanis*, *Brachionus*, *Proales*, *Trichocerca*, *Polyathra*, *Lecane*, *Ascomopha*) and comparatively low representation of crustaceans (*Cyclops*, *Bosmina*) (Table 16), a pattern consistent with systems experiencing environmental variability because rotifers tend to tolerate stress and reproduce rapidly. High rotifer abundance in Kakole wetland (Bukedea) and Bisina-Opeta-Okorotum (Kumi) suggests that water and nutrient availability were sufficient to sustain basic food-web processes, although this does not by itself indicate good ecological condition.

The notably lower crustacean abundance in Chesebere (Bulambuli) and Bisina-Opeta-Okorotum (Katakwi) is significant because crustaceans are generally more sensitive to poor water quality and oxygen fluctuations; their scarcity therefore aligns with the physico-chemical and phytoplankton evidence of nutrient enrichment, elevated algal biomass, and reduced dissolved oxygen, implying moderate ecological stress at these sites (Chapman et al., 2003). Sites where rotifer diversity was higher and crustaceans were still present (notably Kakole and Amaler) corresponded with field observations of

fish and amphibians, whereas Bisina-Opeta-Okorotum (Kumi), with reduced zooplankton richness and low crustacean counts, also showed fewer fish and a greater presence of tolerant taxa, indicating that water-quality stressors are likely influencing higher trophic levels (Wetzel, 2001).

Table 16: Zooplankton assessment in the sampled wetlands

District	Nakapiripirit	Katakwi	Kumi	Bukedea	Bulambuli
Wetland	Amaler	Bisina-Opeta-Okortum	Bisina-Opeta-Okortum	Kakole	Chesebere
No. of organisms per liter					
Rotifers					
<i>Euchlanis (sp)</i>	42	28	54	66	34
<i>Brachionus (sp)</i>	26	45	32	45	26
<i>Proales (sp)</i>	64	36	–	–	30
<i>Trichocerca (sp)</i>	45	20	08	54	46
<i>Polyathra (sp)</i>	24	–	44	32	15
<i>Lecane(sp)</i>	–	52	35	20	–
<i>Brachionus (sp)</i>	28	34	46	48	26
<i>Ascomopha (sp)</i>	22	-	40	56	24
<i>Keratera (sp)</i>	–	26	18	–	18
Crustaceans					
<i>Cyclops (sp)</i>	38	20	–	24	08
<i>Bosmina (sp)</i>	12	05	14	10	22

Benthic Organisms (macro-invertebrates) assessment

The benthic communities were dominated by disturbance-tolerant taxa, including chironomids (red midges), oligochaetes, and water beetles, water striders, and *Bulinus* snails (**Table 17**). These organisms tolerate moderate pollution and low oxygen, reflecting the overall moderate ecological condition of the wetlands (Rosenberg & Resh, 1993).

Kakole wetland (Bulambuli district) had fairly balanced abundances of chironomids, oligochaetes, snails, and water beetles, suggesting moderate wetland health despite human encroachment. Bisina-Opeta-Okorotum wetland (Kumi) had high oligochaete numbers, indicating organic enrichment and nutrient stress, which aligns with the cyanobacteria and green algae dominance observed in phytoplankton data. Similarly, Bisina-Opeta-Okorotum wetland (Katakwi) showed more diverse benthic fauna, including dragonfly and damselfly larvae, which are more sensitive to pollution. This suggests localized microhabitats with better oxygen and habitat complexity. In contrast, Leomat wetland (Nabilatuk) lacked benthic organisms due to drying, while Amaler wetland (Nakapiripirit) had low predator abundance and simplified communities, consistent with nutrient enrichment and habitat disturbance.

The benthic findings align with fish, zooplankton, and phytoplankton patterns: wetlands with higher benthic diversity (Kakole, Bisina-Opeta-Okorotum) also supported more fish and amphibians, whereas degraded or drying wetlands (Leomat, Amaler) had simplified food webs dominated by tolerant species.

Table 17: Benthic macroinvertebrates in the sampled wetlands

District	Wetland	Organism	Mean Count / m ²	Phylum	Class	Subclass/ Order	Family/ Division
Bukedea	Kakole	Chironomids (red midges)	20	Arthropoda	Insecta	Nematocera	Chironomidae
		Oligochetes (aquatic earth-worms)	15	Annelida	Clitellata	Oligochaeta	Oligochaetae
		Water Beetles	12	Arthropoda	Insecta	Coleoptera	Gyrinidae
		Bulinus spp. (fresh water snail)	22	Mollusca	Gastropoda	–	Planorbidae
Kumi	Bisina-Opeta-Okorotum	Chironomids (red midges)	14	Arthropoda	Insecta	Nematocera	Chironomidae
		Oligochetes (aquatic earth-worms)	22	Annelida	Clitellata	Oligochaeta	Oligochaetae
		Water Beetles (	4	Arthropoda	Insecta	Coleoptera	Dytiscidae
		Chaoborid larvae (biting midges)	7	Arthropoda	Insecta	Diptera	Chaoboridae
		Bulinus spp. (fresh water snail)	4	Mollusca	Gastropoda	–	Planorbidae
		Biompalaria spp – (ram-horn snail)	3	Mollusca	Gastropoda	Hygrophila	Planorbidae
Katakwi	Bisina-Opeta-Okorotum	Water beetles	11	Arthropoda	Insecta	Coleoptera	Gyrinidae
		Water striders	20	Arthropoda	Insecta	Hemiptera	Gerridae
		Bulinus spp. (fresh water snail)	4	Mollusca	Gastropoda	–	Planorbidae
		Chironomids (red midges)	7	Arthropoda	Insecta	Nematocera	Chironomidae
		Oligochetes (aquatic earth worms)	6	Annelida	Clitellata	Oligochaeta	Oligochaetae
		Damsel fly larvae	15	Arthropoda	Insecta	Odonata	Zygoptera
		Dragon fly larvae	10	Arthropoda	Insecta	Odonata	Anisoptera
Nabilatuk	Leomat	No benthic macro-invertebrate organisms sampled	–	–	–	–	–

District	Wetland	Organism	Mean Count / m ²	Phylum	Class	Subclass/ Order	Family/ Division
Bulambuli	Chesebere	Bulinus spp. (fresh water snail)	25	Mollusca	Gastropoda	–	Planorbidae
		Chironomids (red midges)	19	Arthropoda	Insecta	Nematocera	Chironomidae
		Oligochetes (aquatic earth worms)	13	Annelida	Clitellata	Oligochaeta	Oligochaetae
		Damsel fly larvae	4	Arthropoda	Insecta	Odonata	Zygoptera
Nakapiripirit	Amaler	Water beetles	8	Arthropoda	Insecta	Coleoptera	Gyrinidae
		Water striders	9	Arthropoda	Insecta	Hemiptera	Gerridae
		Bulinus spp. (fresh water snail)	5	Mollusca	Gastropoda	–	Planorbidae
		Oligochetes (aquatic earth worms)	17	Annelida	Clitellata	Oligochaeta	Oligochaetae
		Dragon fly larvae	3	Arthropoda	Insecta	Odonata	Anisoptera

3.2 Drivers of degradation

3.2.1 Drivers of wetland degradation

The major drivers of wetland degradation in all the target districts include grazing from wetlands (17.1%), cultivation from wetlands (14.3%), limited awareness and poor knowledge about wetlands (10.4%), burning of wetland vegetation (9.9%), and over-harvesting of wetland resources (8.9%) (**Table 18**). Other drivers of wetland degradation include dumping of solid waste (7.7%), soil erosion, especially from nearby catchments/farms (7.1%), and channeling water from wetlands (6.4%). Sand and clay mining were also highlighted as drivers of wetland degradation in Nabilatuk (21.5%) and Bukedea (13.1%) districts.

Grazing degrades wetlands through trampling and soil compaction, removal of protective vegetation, and increased erosion and nutrient loading, which collectively reduce water-retention and ecological integrity; cultivation further degrades wetlands by clearing vegetation and draining water, disturbing and compacting soils, and accelerating erosion and nutrient runoff, thereby weakening hydrological functions and biodiversity; and limited awareness and poor knowledge about wetlands encourages harmful practices and non-compliance with regulations, leading to vegetation loss, pollution, and encroachment that undermine wetland functions and biodiversity.

Table 18: Perceived drivers of wetland degradation in the target districts

Drivers of wetland degradation	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Grazing from wetlands	21	19.6	20	12.2	64	16.3	27	33.8	17	18.3	28	14.2	177	17.1
Cultivation from wetlands	46	43.0	20	12.2	43	10.9	4	5.0	12	12.9	23	11.7	148	14.3
Limited awareness and poor knowledge about wetlands	7	6.5	16	9.8	25	6.4	16	20.0	9	9.7	35	17.8	108	10.4
Burning of wetland vegetation	1	0.9	20	12.2	37	9.4	17	21.3	18	19.4	9	4.6	102	9.9
Over-harvesting of wetland resources	1	0.9	16	9.8	60	15.3	11	13.8	3	3.2	1	0.5	92	8.9
Dumping of solid waste	0	0.0	6	3.7	21	5.3	0	0.0	1	1.1	52	26.4	80	7.7
Soil erosion, especially from nearby catchments/farms	0	0.0	20	12.2	40	10.2	1	1.3	10	10.8	2	1.0	73	7.1
Channeling water from wetlands	8	7.5	20	12.2	10	2.5	2	2.5	1	1.1	25	12.7	66	6.4
Sand and clay mining	14	13.1	0	0.0	24	6.1	0	0.0	20	21.5	1	0.5	59	5.7
Tree planting	9	8.4	13	7.9	22	5.6	0	0.0	0	0.0	0	0.0	44	4.3
Brick making	0	0.0	0	0.0	22	5.6	0	0.0	0	0.0	0	0.0	22	2.1
Excessive water abstraction	0	0.0	6	3.7	4	1.0	1	1.3	0	0.0	11	5.6	22	2.1
Establishment of washing bays	0	0.0	1	0.6	7	1.8	0	0.0	0	0.0	9	4.6	17	1.6
Construction of roads and valley dams	0	0.0	3	1.8	11	2.8	1	1.3	0	0.0	1	0.5	16	1.5
Infrastructural developments	0	0.0	3	1.8	3	0.8	0	0.0	2	2.2	0	0.0	8	0.8
Total	107	100	164	100	393	100	80	100	93	100	197	100	1,034	100



Plate 16: Grazing in Kabarwa wetland, Kabarwa parish, Kabarwa subcounty, Bukedea district



Plate 17: Rice cultivation in Okichira wetland, Abilaep parish, Kamutur subcounty, Bukedea district



Plate 18: Channeling water from Chesebere wetland, Buluguya parish, Bunambutye subcounty, Bulambuli district



Plate 19: Brick making in Kamwon wetland, Emokori parish, Bukedea TC, Bukedea district

3.2.2 Drivers of Lake Opeta degradation

The most drivers of Lake Opeta degradation include grazing around the lake (19.6%), poverty (16.6%), cultivation around the lake (13.7%), climate change impacts such as drought (13.4%), over harvesting of lake resources such as fish (11%), and soil erosion from nearby farms (9.8%) (**Table 19**). Grazing contributes to lake degradation when livestock concentrate along shorelines and wetland margins, where trampling compacts soils, breaks down vegetation buffers, and accelerates erosion, increasing sediment and nutrient inputs that cloud the water and stimulate algal growth.

Cultivation degrades the lake by clearing and draining wetland vegetation and exposing soils, which raises runoff and sedimentation while fertilisers and agro-chemicals can wash into the lake, degrading water quality and aquatic habitats. Poverty acts as an underlying driver by limiting access to alternative livelihoods and energy sources, pushing households to intensify farming, grazing, fishing, and fuelwood harvesting in and around the lake, often beyond sustainable levels and with limited capacity to adopt conservation practices. Climate change compounds these pressures through more erratic rainfall, heavier storms, and longer dry spells, which increase flood-driven runoff and pollution during wet periods while lowering water levels and concentrating contaminants during dry periods, together weakening the lake's ecological resilience and the services it provides.

Table 19: Drivers of Lake Opeta degradation in Katakwi and Kumi districts

Drivers of Lake Opeta degradation	Katakwi		Kumi		Total	
	N	%	N	%	N	%
Grazing around the lake	57	17.5	23	27.4	80	19.6
Poverty	53	16.3	15	17.9	68	16.6
Cultivation around the lake	45	13.8	11	13.1	56	13.7
Climate change impacts such as drought	48	14.8	7	8.3	55	13.4
Over harvesting of lake resources such as fish	33	10.2	12	14.3	45	11.0
Soil erosion from nearby farms	31	9.5	9	10.7	40	9.8
Dumping of solid waste	18	5.5	0	0.0	18	4.4
Invasion of invasive species	10	3.1	4	4.8	14	3.4
Sand mining	11	3.4	0	0.0	11	2.7
Brick making	8	2.5	0	0.0	8	2.0
Clay mining	6	1.8	0	0.0	6	1.5
Excessive water abstraction	1	0.3	2	2.4	3	0.7
Infrastructural developments like industries	3	0.9	0	0.0	3	0.7
Channelling of water into gardens	1	0.3	1	1.2	2	0.5
Total	325	100	84	100	409	100

3.3 Climate risks in Lake Opeta wetland system

3.3.1 Climate risks in the target districts

The major reported climate risks affecting communities include drought (29.8%), floods (25.9%), extreme heat (20.7%), and strong winds (15.6%) (**Table 20**). Extreme coldness was only reported in Kumi (7.5%) and Katakwi (2.6%) districts. Hailstorms was largely reported amongst the communities in Nabilatuk district (6.9%).

Table 20: Climate risks affecting the target districts

Climate shocks	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Drought	91	33.6	19	25.7	71	37.6	8	20.0	86	34.7	0	0.0	275	29.8
Floods	67	24.7	20	27.0	70	37.0	8	20.0	32	12.9	42	41.6	239	25.9
Extreme heat	24	8.9	18	24.3	38	20.1	19	47.5	61	24.6	31	30.7	191	20.7
Strong winds	45	16.6	16	21.6	4	2.1	2	5.0	50	20.2	27	26.7	144	15.6
Lightning	44	16.2	1	1.4	0	0.0	0	0.0	2	0.8	0	0.0	47	5.1
Hail storms	0	0.0	0	0.0	1	0.5	0	0.0	17	6.9	1	1.0	19	2.1
Extreme coldness	0	0.0	0	0.0	5	2.6	3	7.5	0	0.0	0	0.0	8	0.9
Total	271	100	74	100	189	100	40	100	248	100	101	100	923	100



Plate 20: Flooding in Namalu subcounty, Nakapiripirit district in August 2022

Source: Nakapiripirit District Local Government

3.3.2 Impacts of climate risks on livelihoods

The major reported impacts of climate risks on livelihoods include crop failure (14.9%), decrease in income (8.9%), increased food prices (8.3%), damage to infrastructure (7.2%), reduced crop productivity (6.6%), loss of animals (6.6%), loss of property (6.2%), decrease in fodder for livestock (6.0%), and displacement (5.2%) . Other secondary impacts reported by communities include reduced food security in Kumi district (11.4%) and loss of human lives in Nakapiripirit district (10.3%). These impacts show that climate risks are undermining both production systems and household purchasing power, with cascading effects from reduced harvests to higher market prices and deeper vulnerability **(Table 21)**.

Other secondary impacts reported by communities include reduced food security in Kumi district (11.4%) and loss of human lives in Nakapiripirit district (10.3%). These impacts show that climate risks are undermining both production systems and household purchasing power, with cascading effects from reduced harvests to higher market prices and deeper vulnerability.

Table 21: Impacts of climate change on livelihoods in the target districts

Impacts of climate change on livelihoods	Bukedea		Bulambuli		Katakwi		Kumi		Nablatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Crop failure	92	28.3	22	7.6	53	7.7	21	14.1	75	24.1	43	14.8	306	14.9
Decrease in income	53	16.3	22	7.6	45	6.5	11	7.4	8	2.6	43	14.8	182	8.9
Increased food prices	54	16.6	22	7.6	30	4.3	9	6.0	6	1.9	49	16.8	170	8.3
Damage to infrastructure	10	3.1	21	7.3	43	6.2	0	0.0	71	22.8	3	1.0	148	7.2
Reduced crop productivity	16	4.9	22	7.6	46	6.6	12	8.1	14	4.5	26	8.9	136	6.6
Loss of animals	28	8.6	2	0.7	57	8.2	13	8.7	5	1.6	30	10.3	135	6.6
Loss of property	1	0.3	2	0.7	59	8.5	0	0.0	36	11.6	30	10.3	128	6.2
Decrease in fodder for livestock	41	12.6	20	6.9	53	7.7	3	2.0	6	1.9	0	0.0	123	6.0
Displacement	2	0.6	0	0.0	56	8.1	2	1.3	13	4.2	34	11.7	107	5.2
Reduced soil fertility	3	0.9	22	7.6	29	4.2	10	6.7	29	9.3	0	0.0	93	4.5
Increased pests, parasites, and diseases	17	5.2	22	7.6	42	6.1	5	3.4	3	1.0	1	0.3	90	4.4
Reduced food security	2	0.6	22	7.6	45	6.5	17	11.4	2	0.6	0	0.0	88	4.3
Reduced livestock productivity	0	0.0	22	7.6	40	5.8	8	5.4	6	1.9	0	0.0	76	3.7
Moving long distances in search for pastures and water	0	0.0	21	7.3	35	5.1	7	4.7	10	3.2	0	0.0	73	3.6
Soil erosion	0	0.0	21	7.3	16	2.3	4	2.7	17	5.5	2	0.7	60	2.9
Reduced water availability	4	1.2	22	7.6	19	2.7	6	4.0	6	1.9	0	0.0	57	2.8
Loss of human lives	2	0.6	0	0.0	5	0.7	0	0.0	4	1.3	30	10.3	41	2.0
School dropout	0	0.0	3	1.0	19	2.7	5	3.4	0	0.0	0	0.0	27	1.3
No major impact	0	0.0	0	0.0	0	0.0	16	10.7	0	0.0	0	0.0	16	0.8
Total	325	100	288	100	692	100	149	100	311	100	291	100	2,056	100

Gendered disaggregation of climate risk impacts

Table 22 shows that climate-risk impacts are gendered and unevenly distributed across the project districts, with women bearing the greatest burden in Nabilatuk (91%), Nakapiripirit (40%), Katakwi (54%) and Kumi (47%), while men are more affected in Bulambuli (61%), and Bukedea (52%). The most pronounced gender disparity is observed in Nabilatuk, where women account for the majority of respondents affected by nearly all reported impacts, including crop failure (89.3%), damage to infrastructure (87.3%), decreased income (87.5%), displacement (84.6%), loss of property (94.4%), reduced crop productivity (92.9%), reduced soil fertility (96.6%), soil erosion (94.1%), and reduced livestock productivity (100%). A similar pattern is evident in Nakapiripirit, where women constitute 74.4% of those affected by crop failure, 65.1% by decreased income, 67.6% by displacement, 66.7% by loss of animals, 66.7% by loss of property, and 69.4% by increased food prices.

In Katakwi, women are more affected by key livelihood and welfare impacts such as crop failure (52.8%), damage to infrastructure (62.8%), decreased income (60.0%), displacement (57.1%), increased food prices (66.7%), and loss of human lives (80.0%). In Kumi, women also dominate several impact categories, including crop failure (52.4%), reduced food security (52.9%), loss of animals (61.5%), reduced crop productivity (66.7%), reduced water availability (66.7%), and reduced livestock productivity (62.5%). These findings indicate that climate risks affect women mainly through disruption of household food systems, decline in agricultural productivity, loss of assets, displacement, reduced access to water, and increased pressure on household survival systems.

The pattern reflects a strong climate justice concern because climate hazards are not only environmental events; they interact with existing social, economic and gender inequalities to produce unequal burdens. Women are more affected in several districts because they are often highly dependent on climate-sensitive natural resources, have major responsibilities for food production, household food management, water collection, care work and post-shock recovery, yet often have less control over productive assets, income, land, livestock, extension services and adaptation finance. Therefore, when droughts, floods, dry spells, pests and diseases, soil erosion or water scarcity occur, the impacts reach women through multiple pathways: crop failure reduces household food availability, increased food prices increase the burden of feeding families, water scarcity increases time and labour demands, loss of animals and property reduces household wealth, and displacement increases care, protection and recovery burdens.

Table 22 also shows that men are more affected in Bulambuli, where they account for 68.2% of those affected by crop failure, decreased income, increased food prices, increased pests and diseases, reduced crop productivity, and reduced food security, suggesting that men's exposure is higher where they are more engaged in market-oriented farming, income generation, livestock ownership or land-based production systems. In Bukedea, the pattern is more balanced, with men more affected by some impacts such as displacement, loss of property, reduced food security and reduced soil fertility, while women are more affected by impacts such as damage to infrastructure, fodder decline, pests and diseases, increased food prices and loss of animals. Generally, the findings demonstrate that climate impacts are not socially neutral; they are shaped by who depends on which resources, who controls assets, who carries household responsibilities, and who has access to adaptation support. This calls for gender-responsive and climate-justice-oriented wetland management interventions that prioritise the most affected groups in each district, especially women in Nabilatuk, Nakapiripirit, Katakwi and Kumi, while also addressing male livelihood losses in Bulambuli and Bukedea.

Table 22: Gender-disaggregated distribution of reported climate-risk impacts across the project districts (%)

Impacts of climate risks	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Crop failure	50.0	50.0	68.2	31.8	47.2	52.8	47.6	52.4	10.7	89.3	25.6	74.4
Damage to infrastructure	40.0	60.0	66.7	33.3	37.2	62.8	0.0	0.0	12.7	87.3	0.0	100.0
Decrease in fodder for livestock	48.8	51.2	65.0	35.0	45.3	54.7	33.3	66.7	0.0	100.0	0.0	0.0
Decrease in income	52.8	47.2	68.2	31.8	40.0	60.0	54.5	45.5	12.5	87.5	34.9	65.1
Displacement	100.0	0.0	0.0	0.0	42.9	57.1	50.0	50.0	15.4	84.6	32.4	67.6
Increased food prices	46.3	53.7	68.2	31.8	33.3	66.7	44.4	55.6	0.0	100.0	30.6	69.4
Increased pests, parasites, and diseases	47.1	52.9	68.2	31.8	50.0	50.0	40.0	60.0	0.0	100.0	100.0	0.0
Loss of animals	46.4	53.6	100.0	0.0	49.1	50.9	38.5	61.5	20.0	80.0	33.3	66.7
Loss of human lives	50.0	50.0	0.0	0.0	20.0	80.0	0.0	0.0	25.0	75.0	33.3	66.7
Loss of property	100.0	0.0	50.0	50.0	49.2	50.8	0.0	0.0	5.6	94.4	33.3	66.7
Moving long distances in search for pastures and water	0.0	0.0	66.7	33.3	48.6	51.4	42.9	57.1	10.0	90.0	0.0	0.0
Reduced crop productivity	56.3	43.8	68.2	31.8	47.8	52.2	33.3	66.7	7.1	92.9	42.3	57.7
Reduced food security	100.0	0.0	68.2	31.8	51.1	48.9	47.1	52.9	0.0	100.0	0.0	0.0
Reduced livestock productivity	0.0	0.0	68.2	31.8	42.5	57.5	37.5	62.5	0.0	100.0	0.0	0.0
Reduced soil fertility	100.0	0.0	68.2	31.8	58.6	41.4	50.0	50.0	3.4	96.6	0.0	0.0
Reduced water availability	50.0	50.0	68.2	31.8	57.9	42.1	33.3	66.7	16.7	83.3	0.0	0.0
Soil erosion	0.0	0.0	66.7	33.3	56.3	43.8	50.0	50.0	5.9	94.1	50.0	50.0
Overall	52.2	30.1	60.5	27.7	45.7	54.3	35.4	46.9	8.5	91.5	24.5	40.3

3.3.3 Coping mechanisms to climate risks

The major coping mechanisms of communities to climate risks include diversification of livelihoods (14.6%), livestock vaccination (9.2%), spraying crops to control pests (9.1%), digging small drainage channels around homes to divert rainwater (8.5%), spraying livestock to control pests (8.5%), participation in climate awareness programs (8.4%), participation in community savings groups (7.9%), and planting of drought-resistant crop varieties (7.1%) (**Table 23**).

These responses indicate that households are combining immediate, practical risk-reduction actions with longer-term strategies that spread income risk and strengthen resilience, particularly through livelihood diversification and collective savings mechanisms. However, the dominance of short-term measures also suggests gaps in access to more durable adaptation support such as improved water management, extension services, and climate-resilient infrastructure, highlighting an opportunity for district programmes to scale up proven practices while aligning them with wetland protection and restoration to reduce flood and drought impacts.

Table 23: Coping mechanisms of communities to climate change impacts

Coping mechanisms	Bukedea		Bulambuli		Katakwi		Kumi		Nablatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Diversification of livelihoods	36	15.5	21	8.0	47	8.6	17	14.5	69	18.7	55	36.7	245	14.6
Livestock vaccination	40	17.2	17	6.4	69	12.6	3	2.6	25	6.8	0	0.0	154	9.2
Spraying crops to control pests	40	17.2	22	8.3	49	9.0	5	4.3	37	10.0	0	0.0	153	9.1
Digging small drainage channels around homes to divert rainwater	5	2.2	21	8.0	62	11.3	0	0.0	2	0.5	52	34.7	142	8.5
Spraying livestock to control pests	37	15.9	21	8.0	45	8.2	2	1.7	37	10.0	0	0.0	142	8.5
Participation in climate awareness programs	28	12.1	21	8.0	21	3.8	13	11.1	49	13.3	9	6.0	141	8.4
Participation in community savings groups	27	11.6	18	6.8	34	6.2	27	23.1	18	4.9	8	5.3	132	7.9
Planting of drought-resistant crop varieties	4	1.7	22	8.3	66	12.1	9	7.7	18	4.9	1	0.7	120	7.1
Composting of organic waste	7	3.0	21	8.0	1	0.2	0	0.0	67	18.2	0	0.0	96	5.7
Tree planting	5	2.2	22	8.3	26	4.8	4	3.4	32	8.7	6	4.0	95	5.7
Rearing of improved animal breeds	0	0.0	9	3.4	46	8.4	9	7.7	4	1.1	0	0.0	68	4.1

Coping mechanisms	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Practice soil conservation techniques	3	1.3	20	7.6	21	3.8	10	8.5	4	1.1	0	0.0	58	3.5
Rainwater harvesting	0	0.0	2	0.8	27	4.9	11	9.4	0	0.0	9	6.0	49	2.9
Join regular clean-ups to prevent drainage blockages and flooding	0	0.0	16	6.1	10	1.8	1	0.9	4	1.1	6	4.0	37	2.2
Use of solar energy at home	0	0.0	10	3.8	7	1.3	1	0.9	2	0.5	0	0.0	20	1.2
Use of improved cookstoves	0	0.0	0	0.0	10	1.8	2	1.7	1	0.3	0	0.0	13	0.8
Water storage in preparation of water scarcity	0	0.0	1	0.4	2	0.4	2	1.7	0	0.0	4	2.7	9	0.5
Use of biogas systems	0	0.0	0	0.0	4	0.7	1	0.9	0	0.0	0	0.0	5	0.3
Total	232	100	264	100	547	100	117	100	369	100	150	100	1,679	100

Gendered disaggregation coping mechanisms to climate risks

Table 24 shows that coping with climate risks is strongly gendered across the project districts, with women dominating many household-level and livelihood-protection strategies, while men are more visible in several production-oriented responses. In Nabilatuk, women account for the majority of respondents using most coping mechanisms, including composting of organic waste (88.1%), digging small drainage channels around homes (100%), livelihood diversification (88.4%), livestock vaccination (100%), climate awareness participation (87.8%), community savings and loans groups (88.9%), regular clean-up activities (100%), drought-resistant crop varieties (88.9%), improved animal breeds (100%), spraying crops and livestock to control pests (91.9% each), tree planting (90.6%) and improved cookstoves (100%). Women also dominate key coping responses in Nakapiripirit, including drainage channels (65.4%), livelihood diversification (65.5%), savings groups (62.5%), drought-resistant crops (100%) and rainwater harvesting (77.8%).

In Kumi, women lead in clean-up activities (100%), drought-resistant crops (66.7%), soil conservation (70.0%), rainwater harvesting (54.5%), tree planting (75.0%), biogas systems (100%), improved cookstoves (100%), solar energy (100%) and water storage (100%). In Katakwi, coping is more balanced, although women still lead in drainage channels (56.5%), livelihood diversification (51.1%), livestock vaccination (55.1%), savings groups (58.8%), soil conservation (66.7%), rainwater harvesting (51.9%) and solar energy use (71.4%). By contrast, men are more prominent in Bukedea, especially in composting (85.7%), livelihood diversification (55.6%) and drought-resistant crops (75.0%), and in Bulambuli, where they dominate composting (66.7%), drainage channels (66.7%), livelihood diversification (66.7%), climate awareness participation (71.4%), drought-resistant crops (71.4%), soil conservation (66.7%), spraying crops (71.4%), spraying livestock (66.7%) and tree planting (71.4%).

The findings show that adaptation is not socially neutral; it reflects gender roles, livelihood responsibilities, access to resources and control over productive assets. Women dominate many coping mechanisms because climate risks directly affect household systems they manage, including food preparation, water storage, sanitation, care work, small-scale farming, energy use, savings and post-shock recovery. Communities are coping with crop failure through drought-resistant crops, composting and soil conservation; flooding through drainage channels and clean-up activities; water scarcity through rainwater harvesting and storage; pest and disease outbreaks through spraying; livestock stress through vaccination and improved breeds; and income shocks through livelihood diversification and savings groups.

The gender pattern matters because women often carry greater responsibility for household survival while having less access to land, finance, extension services, equipment and formal decision-making. Men's higher participation in Bukedea and Bulambuli suggests stronger involvement in production, livestock, pest control and public-facing adaptation activities. Generally, the findings show that women are not only highly affected by climate risks but also carry much of the adaptation workload, requiring climate-resilient wetland management to strengthen women's access to finance, climate information, water technologies, clean energy, extension services and resilient livelihoods, while also engaging men in sustainable land management, livestock adaptation, pest control, tree planting and wetland restoration.

Table 24: Gender-disaggregated distribution of reported coping mechanisms across the project districts (%)

Coping mechanisms	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Composting of organic waste	85.7	14.3	66.7	33.3	100.0	0.0	0.0	0.0	11.9	88.1	0.0	0.0
Digging small drainage channels around homes to divert rainwater	40.0	60.0	66.7	33.3	43.5	56.5	0.0	0.0	0.0	100.0	34.6	65.4
Diversification of livelihoods	55.6	44.4	66.7	33.3	48.9	51.1	52.9	47.1	11.6	88.4	34.5	65.5
Livestock vaccination	47.5	52.5	57.1	23.8	44.9	55.1	66.7	33.3	0.0	100.0	0.0	0.0
Participation in climate awareness programs	42.9	57.1	71.4	28.6	47.6	52.4	53.8	46.2	12.2	87.8	55.6	44.4
Participation in community-based savings and loans groups	51.9	48.1	61.9	23.8	41.2	58.8	55.6	44.4	11.1	88.9	37.5	62.5
Participation in regular clean-up activities	0.0	0.0	52.4	23.8	30.0	70.0	0.0	100.0	0.0	100.0	66.7	33.3

Coping mechanisms	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Practice soil conservation techniques	0.0	100.0	66.7	28.6	33.3	66.7	30.0	70.0	50.0	50.0	0.0	0.0
Rainwater harvesting	0.0	0.0	9.5	0.0	48.1	51.9	45.5	54.5	0.0	0.0	22.2	77.8
Rearing of improved animal breeds	0.0	0.0	38.1	4.8	47.8	52.2	55.6	44.4	0.0	100.0	0.0	0.0
Spraying crops to control pests	45.0	55.0	71.4	33.3	49.0	51.0	60.0	40.0	8.1	91.9	0.0	0.0
Spraying livestock to control pests	45.9	54.1	66.7	33.3	46.7	53.3	50.0	50.0	8.1	91.9	0.0	0.0
Tree planting	40.0	60.0	71.4	33.3	53.8	46.2	25.0	75.0	9.4	90.6	50.0	50.0
Use of biogas systems	0.0	0.0	0.0	0.0	25.0	75.0	0.0	100.0	0.0	0.0	0.0	0.0
Use of improved cookstoves	0.0	0.0	0.0	0.0	40.0	60.0	0.0	100.0	0.0	100.0	0.0	0.0
Use of solar energy at home	0.0	0.0	33.3	14.3	28.6	71.4	0.0	100.0	50.0	50.0	0.0	0.0
Water storage in preparation of water scarcity	0.0	0.0	4.8	0.0	50.0	50.0	0.0	100.0	0.0	0.0	75.0	25.0

3.3.4 Barriers to climate adaptation

The major challenges that limit communities from adopting climate smart practices and/or technologies include limited knowledge on climate risks and adaptation options (11.3%), weak community organization or limited collective action (10.8%), limited access to finance or credit (9.9%), limited support from government or development partners (9.9%), lack of appropriate tools, equipment, or technologies (9.2%), labour constraints within the household (9.0%), high cost of adaptation technologies or inputs (8.9%), and limited access to extension or technical support services (8.9%) (**Table 25**).

Table 25: Barriers to climate change adaptation in the target districts

Barriers to climate change adaptation	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Limited knowledge on climate risks and adaptation options	37	12.9	22	10.3	36	10.6	33	25.6	29	6.7	17	12.1	174	11.3
Weak community organisation or limited collective action	2	0.7	20	9.4	17	5.0	8	6.2	67	15.5	52	37.1	166	10.8
Limited access to finance or credit	14	4.9	22	10.3	36	10.6	21	16.3	53	12.3	7	5.0	153	9.9
Limited support from government or development partners	21	7.3	22	10.3	32	9.4	20	15.5	29	6.7	29	20.7	153	9.9
Lack of appropriate tools, equipment, or technologies	27	9.4	22	10.3	53	15.6	2	1.6	33	7.6	5	3.6	142	9.2
Labour constraints within the household	47	16.4	21	9.9	50	14.7	2	1.6	12	2.8	7	5.0	139	9.0
High cost of adaptation technologies or inputs	64	22.4	20	9.4	40	11.8	3	2.3	7	1.6	3	2.1	137	8.9
Limited access to extension or technical support services	41	14.3	11	5.2	31	9.1	22	17.1	32	7.4	0	0.0	137	8.9

Barriers to climate change adaptation	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Cultural beliefs or social norms that limit adoption of new practices	10	3.5	16	7.5	2	0.6	13	10.1	78	18.1	17	12.1	136	8.8
Poor access to markets for climate-resilient products	9	3.1	22	10.3	21	6.2	2	1.6	48	11.1	3	2.1	105	6.8
Insecure land tenure or land use restrictions	14	4.9	15	7.0	21	6.2	3	2.3	44	10.2	0	0.0	97	6.3
Total	286	100	213	100	339	100	129	100	432	100	140	100	1,539	100

3.3.5 Measures to strengthen the resilience of communities to climate risks

Table 26 shows the community proposed measures to strengthen the resilience of communities to climate impacts. The most suggest options include sensitization of communities (19.7%), planting of trees and creation of green spaces (12.1%), restoration of wetlands (9.3%), integration of climate education into school curricula (9.2%), provision of access to climate risk insurance and microloans (8.3%), construction and maintenance of drainage systems (7.5%), developing early warning systems for major hazards (7.4%), and formation of climate action groups (7.2%).

Table 26: Measures to strengthen community resilience to climate change impacts

Measures to strengthen resilience	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Sensitization of communities	91	22.9	21	9.1	67	16.0	58	61.1	88	16.1	53	23.2	378	19.7
Planting of trees and creation of green spaces	35	8.8	22	9.5	48	11.4	1	1.1	71	13.0	54	23.7	231	12.1
Restoration of wetlands	47	11.8	21	9.1	57	13.6	7	7.4	34	6.2	13	5.7	179	9.3
Integration of climate education into school curricula	77	19.4	20	8.7	10	2.4	1	1.1	62	11.4	6	2.6	176	9.2
Provision of access to climate risk insurance and microloans	46	11.6	22	9.5	21	5.0	1	1.1	63	11.5	6	2.6	159	8.3
Construction and maintenance of drainage systems	15	3.8	22	9.5	15	3.6	0	0.0	51	9.3	41	18.0	144	7.5
Developing early warning systems for major hazards	18	4.5	14	6.1	49	11.7	2	2.1	43	7.9	15	6.6	141	7.4
Formation of climate action groups	16	4.0	21	9.1	43	10.2	4	4.2	41	7.5	13	5.7	138	7.2
Improving waste collection and disposal systems	7	1.8	22	9.5	11	2.6	0	0.0	47	8.6	22	9.6	109	5.7
Implementation of soil conservation techniques	18	4.5	21	9.1	40	9.5	13	13.7	10	1.8	1	0.4	103	5.4
Promoting the use of energy-saving appliances and techniques	14	3.5	13	5.6	31	7.4	2	2.1	30	5.5	1	0.4	91	4.7
Investing in renewable energy solutions	13	3.3	12	5.2	28	6.7	6	6.3	6	1.1	3	1.3	68	3.5
Total	397	100	231	100	420	100	95	100	546	100	228	100	1,917	100

3.4 Factors affecting wetland management

3.4.1 Governance factors affecting wetland management

The assessment identified several interrelated governance challenges that constrain effective management of the Lake Opeta wetland system. These challenges relate to institutional coordination, enforcement and accountability, political and livelihood pressures, inclusiveness of decision-making, integration of wetland management into local development planning, and the effectiveness of community-level governance mechanisms.

(i) Fragmented institutional coordination across administrative boundaries

The Lake Opeta wetland system spans several administrative areas, yet planning, enforcement, restoration, and community mobilisation are largely organised and implemented within individual district boundaries. This has resulted in fragmented management approaches across **Bukedea, Bulambuli, Katakwi, Kumi, Nabilatuk, and Nakapiripirit**, despite the wetland functioning as a single interconnected ecological system.

Differences in district priorities, enforcement approaches, institutional capacity, and resource allocation further limit coordinated action. Consequently, interventions undertaken in one part of the wetland may have limited impact where pressures continue in adjacent areas. A more coordinated landscape-level governance framework is therefore required to align planning, enforcement, restoration, monitoring, and resource mobilisation across the six districts.

(ii) Weak enforcement and regulation of wetland resource use

The continued intensity of wetland resource use points to gaps in the enforcement of existing wetland regulations and management measures. Overall, **82.6% of respondents reported having access to wetland resources**, with particularly high levels recorded in **Nabilatuk (95.5%), Bukedea (89.1%), Katakwi (86.1%), and Kumi (85.2%)**.

This widespread access reflects the important role of the wetland in sustaining local livelihoods, but also highlights the scale of pressure placed on its resources. Cultivation, livestock grazing, fishing, harvesting of wetland materials, charcoal production, and other livelihood activities continue to occur within or around wetland areas. The persistence of these activities suggests that existing regulatory and enforcement mechanisms have not yet been sufficiently effective in balancing livelihood needs with ecological protection.

(iii) Political and livelihood pressures constrain enforcement

Wetland governance is closely intertwined with local livelihoods, food security, and household income, creating a complex environment for enforcement. Local leaders may face competing demands to protect wetland resources while also responding to communities whose immediate livelihoods depend on continued access to them.

The livelihood data illustrate the scale of this challenge. Crop production is the dominant livelihood source in **Bukedea (61.3%) and Nakapiripirit (57.4%)**, while charcoal burning is particularly significant in **Nabilatuk (29.8%)**. In such contexts, enforcement measures that restrict access to wetland resources can have immediate socio-economic consequences for households. Without viable alternative livelihood opportunities, this creates incentives for continued wetland exploitation and can weaken political commitment to strict enforcement and restoration measures.

(iv) **Limited inclusiveness in community participation and decision-making**

Community participation in wetland restoration and sustainable management remains uneven, with men accounting for **60.9%** of reported participation, compared with **23.0% women, 11.3% youth, 1.8% girls, and 3.1% boys**. The participation pattern points to significant gaps in the representation of groups that are important users and managers of natural resources.

The limited involvement of women and young people is particularly significant given their roles in household livelihoods, natural resource collection, agriculture, and community-level resilience. More inclusive governance structures would broaden the range of knowledge and experiences informing wetland management while strengthening community ownership of restoration and conservation interventions.

(v) **Weak accountability and local monitoring mechanisms**

The continued occurrence of environmentally damaging activities alongside existing leadership and environmental governance structures suggests weaknesses in local accountability systems. In districts such as **Nabilatuk, Bukedea, Katakwi, and Kumi**, high levels of wetland access coincide with activities including cultivation, charcoal production, livestock grazing, and fishing.

This pattern indicates gaps in community-level monitoring, reporting, enforcement, sanctioning, and follow-up. Where violations are not consistently identified and addressed, compliance is likely to remain weak and unsustainable resource use can become normalised. Strengthening locally accessible reporting mechanisms, community monitoring structures, enforcement linkages, and transparent follow-up procedures would therefore be important for improving accountability.

(vi) **Limited integration of wetland management into local development planning**

Wetland conservation cannot be effectively pursued as a stand-alone environmental intervention when surrounding communities depend heavily on natural resources for their livelihoods. Across the study area, **crop production accounts for 38.9% of livelihoods, followed by livestock production (15.8%), casual labour (14.9%), charcoal burning (10.8%), and fishing/fish farming (7.5%)**.

These livelihood patterns demonstrate the strong link between wetland condition and local economic well-being. However, wetland conservation, climate resilience, biodiversity protection, and sustainable resource management are not yet sufficiently integrated into broader district and lower local government development priorities. Effective wetland governance therefore requires stronger linkages with **agriculture, livestock, fisheries, energy, livelihoods, disaster risk reduction, and climate adaptation planning**. Such integration would help address the underlying socio-economic drivers of wetland degradation rather than focusing predominantly on restricting resource use.

(vii) **Gaps in local rules and community by-laws**

Existing community-level rules and by-laws do not appear to provide sufficiently strong or consistently enforced mechanisms for regulating access to wetland resources. High levels of resource access, particularly in **Nabilatuk, Bukedea, Katakwi, and Kumi**, suggest that local governance arrangements have not adequately defined or enforced rules governing **who can access wetland resources, the nature of permitted activities, where and when these activities can occur, and the conditions under which resources may be used**.

The absence, inadequacy, or inconsistent application of locally agreed rules creates uncertainty around acceptable resource-use practices and limits the effectiveness of community-based wetland

management. Strengthening locally owned by-laws, clarifying resource-use rights and responsibilities, and linking community rules to formal district and national regulations could improve compliance and local stewardship.

(viii) **Limited transparency and communication in wetland decision-making**

Effective wetland governance also depends on transparency, access to information, and meaningful feedback between authorities and resource users. Wetland-dependent communities require clear and timely information on **wetland boundaries, permitted and prohibited activities, restoration areas, enforcement measures, benefit-sharing arrangements, and available alternative livelihood opportunities**.

Where such information is unclear or communication channels are weak, communities may perceive conservation measures as externally imposed restrictions rather than collectively agreed management actions. Limited opportunities for feedback can further weaken trust between communities and authorities. Improving communication, disclosure of management decisions, participatory planning, and community feedback mechanisms would therefore be critical for building legitimacy, strengthening compliance, and increasing community ownership of wetland conservation and restoration initiatives.

Overall governance implication

Taken together, these findings indicate that the governance challenges affecting the Lake Opeta wetland system are **structural and interconnected rather than isolated enforcement problems**. Fragmented institutional arrangements, limited accountability, livelihood pressures, inadequate local rules, weak participation, and insufficient integration of wetland priorities into development planning collectively reduce the effectiveness of existing management efforts.

Addressing these challenges will require a shift from predominantly site- or district-based interventions towards **coordinated, inclusive, and landscape-level wetland governance**. Strengthening inter-district coordination, community participation, local accountability systems, enforcement capacity, livelihood alternatives, and integration of wetland priorities into district development planning will be essential for achieving sustainable management and long-term ecological resilience of the Lake Opeta wetland system.

3.4.1.1 Wetland Governance Challenge in Uganda and the Lake Opeta Wetland System

(i) Who is Responsible?

Wetland management in Uganda is a shared responsibility involving the Wetlands Management Department under the Ministry of Water and Environment, NEMA, district and lower local governments, local environment committees, community wetland management structures, and wetland resource users. The Wetlands Management Department provides national coordination, policy guidance, technical support, and oversight. NEMA regulates, monitors, and supervises environmental compliance, while district and lower local governments are responsible for local planning, enforcement, community mobilisation, and monitoring. Community structures and resource users are expected to support local rules, report illegal activities, participate in restoration, and comply with wetland management requirements.

(ii) Where Does Enforcement Break Down?

Enforcement breaks down at several points. First, unclear wetland boundaries and weak demarcation make it difficult for communities and enforcement officers to know where regulated wetland areas begin and end. Second, land administration and permitting processes can create confusion where land claims, local approvals, or sectoral development interests contradict wetland protection objectives. Third, district and lower local governments often lack adequate staffing, transport, funding, technical tools, and monitoring systems to enforce wetland regulations consistently. Fourth, enforcement becomes difficult where wetland users depend on the resource for cultivation, grazing, fishing, charcoal production, harvesting, and other livelihood needs.

(iii) Who is Failing?

The failure is systemic rather than limited to one institution. At national level, responsible agencies provide laws, policies, and technical guidance, but follow-through is weakened by limited resources, contradictory sector decisions, and weak coordination. At district and lower local government level, enforcement, monitoring, demarcation, and integration of wetland priorities into local development planning remain weak. At community level, some resource users continue activities such as cultivation, grazing, fishing pressure, charcoal burning, harvesting, and encroachment. Political and administrative leadership also affects implementation where conservation objectives compete with livelihood, settlement, and local development pressures.

(iv) What Sustains Weak Enforcement?

Weak enforcement is sustained by several incentives. The strongest is livelihood dependence, because communities rely on wetlands for food, income, water, grazing, fish, materials, and survival. Strict enforcement can therefore be socially and politically sensitive. Weak enforcement is also sustained by political survival and patronage, where leaders face pressure to tolerate wetland use because users are also voters and livelihood groups. Other incentives include pressure for agriculture, grazing, fishing, settlement, charcoal production, and local income; weak or unprofitable alternative livelihoods; contradictory authority and mixed signals from different institutions; and institutional risk avoidance by under-resourced enforcement officers.

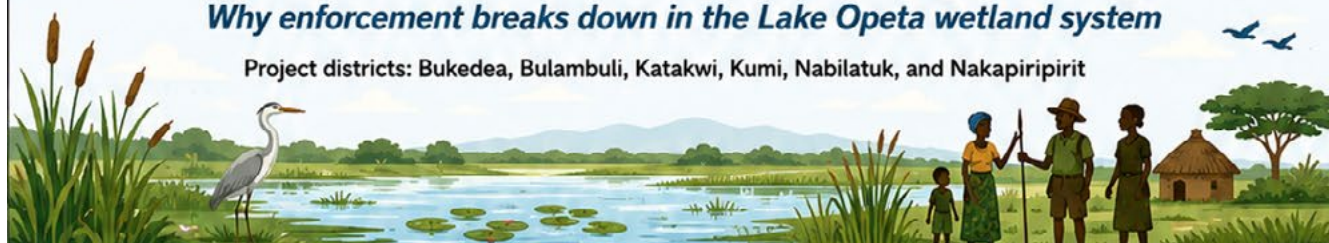
(v) What Does This Mean for Lake Opeta?

For the Lake Opeta wetland system, the governance challenge is especially serious because the wetland functions as one connected ecosystem but is managed through separate district administrative structures, including Bukedea, Bulambuli, Katakwi, Kumi, Nabilatuk, and Nakapiripirit. This creates fragmented planning, inconsistent enforcement, and weak cross-district coordination. The implication is that wetland degradation can continue despite the existence of formal laws and institutions. Strengthening governance in Lake Opeta therefore requires clear boundary demarcation, stronger inter-district coordination, functional community wetland committees, inclusive participation of women and youth, realistic livelihood alternatives, consistent enforcement, and stronger accountability from both institutions and wetland users.

Wetland Governance Challenge in Uganda

Why enforcement breaks down in the Lake Opeta wetland system

Project districts: Bukedea, Bulambuli, Katakwi, Kumi, Nabilatuk, and Nakapiripirit



1. Who is responsible?



Wetlands Management Department (MWE) – leads national coordination, guidance, and oversight



NEMA – regulates, monitors, and supervises environmental compliance



District & lower local governments – enforce, plan, monitor, and mobilize communities



Local committees & community wetland structures – support local rules, reporting, and restoration



Communities & resource users – comply with rules and participate in stewardship



Problem: responsibility is shared, but implementation is fragmented.

2. Where does enforcement break down?

1



Boundary & land administration – unclear wetland boundaries, overlapping claims, and land titles in wetland areas

2



Permits & approvals – some permits, local approvals, and sector decisions contradict wetland protection

3



District capacity – limited staff, transport, funding, and tools for monitoring and follow-up

4



Political–enforcement interface – leaders face pressure where wetland users are also voters and livelihood groups

5



Community compliance – high dependence on wetlands makes restrictions difficult to enforce

6



Cross-district coordination – Lake Opeta is one ecosystem, but enforcement is split by district boundaries

3. Who is failing?



National level: weak follow-through and contradictory sector decisions



Local governments: weak enforcement, monitoring, and integration into district planning



Political / administrative leadership: conservation often gives way to livelihood and development pressures



Communities / resource users: continued encroachment, grazing, cultivation, fishing pressure, harvesting, and charcoal production

The failure is systemic



This is not a failure of law alone; it is a failure of implementation, accountability, and incentives.

4. What sustains weak enforcement?



Livelihood dependence on wetlands



Political survival and patronage



Institutional risk avoidance by under-resourced officers



Political survival and patronage



Pressure for agriculture, grazing, fishing, settlement, and local income



Contradictory authority and mixed signals



Weak or unprofitable livelihood alternatives

Incentives sustaining non-compliance



When non-enforcement is easier than strict enforcement, degradation persists.

What this means for Lake Opeta



• Wetland degradation persists despite a strong formal governance framework



• High livelihood dependence weakens compliance and enforcement



• Cross-district coordination is essential for a shared wetland system



• Stronger accountability, clear boundaries, realistic livelihood options, and inclusive local governance are needed



Core message: Uganda does not lack wetland laws — the main challenge is the governance gap between formal responsibility and actual enforcement.

Figure 15: Wetland governance challenge in Uganda and the Lake Opeta Wetland System

3.4.1.2 *Citizen accountability mechanisms for wetland management*

Citizen accountability mechanisms refer to the formal and informal ways through which communities, wetland users, local leaders, civil society actors, and district local governments can demand responsible wetland governance, report degradation, monitor compliance, and ensure that duty-bearers act on wetland protection and restoration commitments. In the Lake Opeta wetland system, these mechanisms are important because wetland management involves several actors, including district and lower local governments, natural resources departments, local councils, parish and village structures, community wetland committees, resource-user groups, cultural and religious leaders, civil society organisations, and wetland-dependent households. Citizen accountability therefore begins with community participation in wetland planning, where women, men, youth, fishers, farmers, pastoralists, charcoal producers and other wetland users are involved in identifying wetland problems, setting management rules, agreeing on restoration priorities, validating findings, and monitoring whether agreed actions are implemented.

An important accountability mechanism is the **development and enforcement of community by-laws and locally agreed wetland-use rules**. About 62.1% of respondents reported existence and awareness of wetland by-laws, especially in Bukedea (80.4%), and Katakwi (69.4%) districts. These rules define who is allowed to access the wetland, which activities are permitted, which activities are prohibited, where grazing or harvesting may occur, which areas should be restored, and what sanctions apply when rules are violated. Local by-laws also help translate national wetland regulations into practical community-level obligations that people understand and can monitor. For example, communities can agree on restrictions against wetland burning, cultivation in restored areas, cutting of wetland vegetation, charcoal production, and uncontrolled livestock access. When such rules are developed through participatory processes, they strengthen ownership, reduce conflict, and make it easier for citizens to hold each other and local leaders accountable.

Another mechanism already happening in the districts is **community involvement in wetland restoration and sustainable management**, but participation is highly gendered. Men dominate involvement, accounting for 60.9% of those engaged in restoration and sustainable wetland management, compared to 23.0% women, 11.3% youth, 1.8% girls, and 3.1% boys. This shows that citizen accountability is currently being exercised mainly through male participation, while women, youth, girls and boys have limited voice and visibility. The imbalance is most pronounced in Katakwi, where men account for 93.1% of those involved, and women only 6.9%. In Kumi, participation is more balanced, with men at 45.9% and women at 41.0%, suggesting relatively stronger female involvement. In Nakapiripirit, women account for 32.1%, boys 14.3%, and girls 10.7%, showing broader but still male-led participation.

Another mechanism is **participatory wetland mapping and boundary verification**. Since unclear wetland boundaries are a major source of conflict and weak enforcement, citizens have been involved in identifying wetland boundaries, seasonal water movement, grazing areas, cultivation zones, sacred or cultural sites, biodiversity hotspots, fish breeding areas and degraded sections requiring restoration. Participatory mapping increases community understanding of wetland limits and helps reduce disputes between users and enforcement institutions. It also allows citizens to hold leaders accountable where wetland boundaries are ignored, altered, encroached upon, or selectively enforced.

Public disclosure of wetland plans, and decisions. Districts and sub-counties make wetland management plans, restoration priorities, beneficiary selection criteria, enforcement actions and monitoring reports accessible to communities. This helps citizens know what has been promised, who is responsible, which areas are targeted, and what progress has been made. Without public disclosure, wetland governance can be affected by misinformation, elite capture, unfair benefit-sharing and weak trust. In the Lake Opeta wetland system, public disclosure is especially important because restoration and livelihood support must be seen as fair across districts and among different user groups.

Citizen accountability is also reflected in the **extent to which communities are actively accessing and using wetland resources**, because resource users are the people expected to follow, monitor, report and enforce local wetland rules. Overall, 82.6% of respondents reported access to wetland resources, compared to 17.4% with no access. Access is highest in Nabilatuk (95.5%), Bukedea (89.1%), Katakwi (86.1%), and Kumi (85.2%), meaning that citizen accountability in these districts is occurring in a context of strong wetland dependence. This creates both an opportunity and a weakness: many people are close enough to monitor wetland use, but the same people also depend on wetland resources for livelihoods, making enforcement and reporting of illegal use more difficult. In Bulambuli, only 27.3% reported access to wetland resources, which partly explains the very low awareness of wetland by-laws and weaker citizen engagement around wetland accountability.

3.4.2 Institutional factors affecting wetland management

Institutional factors affecting wetland management include the legal, administrative, financial, coordination, enforcement, and community governance arrangements that determine how wetlands are protected, restored, and sustainably used. In Uganda, wetland management is supported by institutions such as the Ministry of Water and Environment, NEMA, district local governments, sub-county structures, and community-based wetland management committees. NEMA is the principal agency responsible for coordinating, monitoring, regulating, and supervising environmental management in the country, while the Ministry of Water and Environment leads sector-level wetland management functions. However, the effectiveness of these institutions is often affected by limited coordination, inadequate funding, weak enforcement, unclear local responsibilities, and low capacity at district and community levels.

(i) Limited technical capacity and logistical support

District and sub-county institutions face capacity gaps that constrain their ability to effectively plan, monitor, enforce, and support restoration of wetland resources. Wetland management requires specialised technical skills as well as access to equipment, transport, updated maps, ecological information, and other field-based resources. However, environment and natural resource officers may be responsible for supervising extensive wetland areas, assessing degradation, supporting restoration, conducting compliance monitoring, and preparing technical reports with limited operational tools and logistical support.

These constraints reduce the frequency and coverage of field supervision and make it difficult for technical teams to respond promptly to emerging threats such as encroachment, vegetation loss, pollution, and unsustainable resource use.

(ii) Inadequate and unpredictable financing

Financing remains a critical constraint to effective wetland management. Core activities such as boundary demarcation, community sensitisation, enforcement patrols, ecological monitoring, restoration, training of community management structures, and promotion of alternative livelihoods require sustained financial investment.

Limited allocations to district and sub-county environment functions often mean that wetland activities are implemented intermittently or depend on externally funded projects. This creates a gap between the management measures identified in plans and the resources available to implement them, ultimately limiting the scale and continuity of conservation and restoration efforts.

(iii) Inadequate staffing and overstretched technical personnel

Wetland management is inherently multi-sectoral, requiring coordinated contributions from environment, natural resources, agriculture, fisheries, forestry, water, community development, physical planning, and local administration. However, staffing constraints can leave a small number of officers responsible for multiple sub-counties and wetland sites.

The resulting workload limits routine supervision, technical follow-up, community engagement, enforcement support, and timely response to emerging environmental pressures. Overstretched personnel are therefore less able to maintain consistent presence and oversight across the extensive Lake Opeta wetland landscape.

(iv) Weak implementation of wetland management and restoration plans

The existence of a wetland management, restoration, or community action plan does not necessarily translate into implementation. District and community-level plans may identify measures such as wetland demarcation, controlled access, restoration of degraded areas, alternative livelihood development, and community monitoring, yet implementation remains partial in some areas.

The gap between planning and implementation is associated with inadequate financing, limited supervision, competing institutional priorities, and insufficient follow-through. As a result, management plans may function more as strategic documents than as actively implemented frameworks for guiding wetland management.

(v) Unclear institutional mandates and overlapping responsibilities

Wetland management involves multiple institutions and technical departments whose responsibilities intersect across land use, natural resource management, production, water resources, fisheries, forestry, physical planning, and local administration. Where institutional mandates and reporting responsibilities are not clearly defined, there is a risk of duplication, gaps in action, or shifting of responsibility between agencies.

Potential contradictions between sector priorities can further complicate management. For instance, agricultural production initiatives may encourage cultivation in areas adjacent to wetlands while environmental authorities seek to strengthen restoration and protection. Such institutional inconsistencies can create mixed messages for communities and undermine confidence in wetland management measures.

(vi) Weak monitoring, information management, and evidence systems

Effective wetland governance depends on reliable and regularly updated information on wetland boundaries, land-use and land-cover change, biodiversity, resource use, restoration progress, and compliance. However, gaps in monitoring and data management limit the availability of timely evidence for decision-making.

Where maps, ecological records, compliance information, or restoration monitoring data are outdated or incomplete, changes such as encroachment, vegetation loss, biodiversity decline, pollution, and re-encroachment of restored areas may go undetected. Strengthening routine monitoring and establishing accessible, regularly updated wetland information systems would therefore improve evidence-based planning and enforcement.

(vii) Unclear wetland boundaries and inadequate demarcation

Unclear physical boundaries remain a significant challenge for both enforcement and community compliance. This is particularly relevant in seasonal wetlands where the visible extent of water and vegetation changes throughout the year. In the absence of clear maps, boundary markers, and community awareness, resource users may have difficulty distinguishing protected wetland areas from zones where particular activities are permitted.

This uncertainty can facilitate gradual expansion of cultivation, grazing, settlement, brick making, and other activities into wetland areas. It may also generate disputes between communities and enforcement authorities, particularly where restrictions are introduced without prior clarification and participatory boundary demarcation.

(viii) Dependence on short-term project financing

The sustainability of wetland interventions is also constrained by reliance on short-term government programmes, NGO projects, and development partner funding. Activities such as community sensitisation, restoration, monitoring, committee support, and enforcement may become more active during project implementation but decline once external financing ends.

This creates risks to continuity and can result in re-encroachment of restored areas, reduced functionality of community structures, loss of institutional momentum, and declining community engagement. Sustainable wetland management therefore requires stronger integration of core activities into government financing and institutional systems rather than relying predominantly on project-based support.

(ix) Weak functionality of community wetland management committees

Community wetland management committees have an important role in translating formal management objectives into local action. Their responsibilities may include community sensitisation, monitoring resource use, resolving local conflicts, enforcing agreed rules, and mobilising communities for restoration activities.

However, their effectiveness can be undermined by inadequate training, limited facilitation, unclear roles and responsibilities, weak reporting linkages, and insufficient recognition within local government structures. In some cases, committees may therefore exist formally but have limited capacity to perform their intended functions. Strengthening their skills, legitimacy, reporting mechanisms, and linkages with local government would enhance community-level stewardship.

(x) Limited integration of wetland priorities into local government planning and budgeting

Wetland management remains less effective where conservation and restoration priorities are not systematically incorporated into district, sub-county, parish, and village development plans, budgets, and annual workplans. Without integration into mainstream planning and financing systems, wetland activities tend to remain isolated environmental interventions rather than forming part of broader development priorities.

3.4.3 Community factors affecting wetland management

Community dependence on wetland resources: Wetland management in the Lake Opeta wetland system is strongly influenced by the extent to which communities depend on wetland resources for livelihoods and household welfare. Across almost all the sampled sub-counties, communities rely on the wetland for fish, farming, animal rearing, papyrus harvesting, domestic water, grazing, rice growing, craft materials, and fish farming. This high level of dependence increases pressure on the wetland and makes restrictions on use more difficult to enforce.

Community perceptions of wetlands also shape management outcomes. For example, in Bukedea, some participants described wetlands as “no man’s land”, suggesting an open-access perception that can weaken stewardship and encourage unsustainable use. In Nakapiripiriti, by contrast, the wetland was reportedly viewed as a valuable community resource for production, with community members using it primarily for cultivation. The community further enforces local rules and regulations to protect the resource. For example, the rule that heavily penalizes theft of wetland-based produce. In this case, the community appears to protect the livelihood value derived from the wetland more than the ecological integrity of the wetland itself.

Community attitudes towards conservation and regulation vary across communities and affect compliance with wetland management measures. In Bukedea, respondents reported a largely negative attitude towards wetland conservation, with over 70% expressing negative views towards new rules and restrictions. In Bulambuli, community members indicated that there was no need for additional wetland rules and regulations and felt that new by-laws would interfere with the perceived benefits of the existing situation. By contrast, in Katakwi, respondents expressed acceptance of wetland conservation measures, showing that community attitudes towards wetland management are not uniform across the landscape.

Local awareness and knowledge also influence how communities interact with wetlands. In Kumi, limited awareness about wetland management was explicitly identified as a cause of degradation, pointing to the importance of environmental education. Similarly, both Bukedea and Katakwi emphasised community sensitisation as a necessary measure for changing behaviour and improving wetland protection.

Availability and viability of alternative livelihoods: Community willingness to move away from degrading practices is closely linked to the availability of alternative livelihoods and the support systems needed to sustain them. Across the districts, respondents suggested potential alternatives such as poultry, small-scale trade, and produce business, but emphasised the need for training, start-up capital, and extension services to make these options sufficiently profitable to support household livelihoods.

Social organisation and local participation also affect management effectiveness. In Katakwi, although the wetland was described as free to everyone, people whose land bordered the wetland were said to restrict others from access, showing how informal control over access can shape wetland use. In Bulambuli, wetland land was reported as individually owned, although others could hire it, indicating that local tenure arrangements also influence use patterns. In contrast, Kumi presented a more organised local management structure through the Beach Management Unit, which was said to help conserve the lake and wetland and prevent waste disposal into the system.

3.5 Socio-economic conditions and community practices

3.5.1 Demographic characteristics of communities

Study districts: According to the 2024 UBOS Census, the study districts have a total population of 1,288,045. Of these, 604,446 people (46.9%) are males, whereas 683,599 people (53.1%) are females (**Table 27**). The total number of households in the study area is 275,570, and the average household size is 4.6. Kumi district has the biggest population (286,992), and households (58,393) in the district. Nakapiripirit district has the least population and number of households in the district. The average household size is still lowest in Nakapiripirit (4.0) and highest in Bukedea (5.0).

Table 27: Population of the study districts in 2024

District	Males		Females		Total	Households	Average Household Size
	Pop	%	Pop	%	Pop		
Bukedea	133,204	47.1	149,660	52.9	282,864	55,960	5.0
Bulambuli	101,286	43.0	134,105	57.0	235,391	55,103	4.3
Katakwi	111,791	47.7	122,541	52.3	234,332	50,864	4.6
Kumi	134,979	47.0	152,013	53.0	286,992	58,393	4.9
Nabilatuk	68,203	49.9	68,582	50.1	136,785	28,266	4.6
Nakapiripirit	54,983	49.2	56,698	50.8	111,681	26,984	4.0
Total	604,446	46.9	683,599	53.1	1,288,045	275,570	4.6

Data Source: UBOS, 2024

Study subcounties: The study subcounties have a total population of 145,158 (UBOS Census, 2024). Of these, 69,264 people (47.7%) are males, whereas 75,894 people (52.3%) are females (**Table 28**). The total number of households in the study subcounties is 31,154, and the average household size is 4.7. Lolachat subcounty, Nabilatuk district has the biggest population (34,241), and households (7,113) amongst the target subcounties. Bunambutye subcounty, Bulambuli district has the least population and number of households amongst the target subcounties. The average household size is still lowest in Magoro subcounty, Katakwi district (3.9) and highest in Malera subcounty, Bukedea district (5.5).

Table 28: Population of the study subcounties in 2024

District	Subcounty	Males		Females		Total	Households	Average Household Size
		Pop	%	Pop	%	Pop		
Bukedea	Kolir	8,554	46.7	9,767	53.3	18,321	3,664	5.0
Bukedea	Malera	9,624	47.3	10,722	52.7	20,346	3,721	5.5
Bulambuli	Bunambutye	3,764	45.3	4,543	54.7	8,307	1,748	4.7
Katakwi	Magoro	11,053	48.0	11,973	52.0	23,026	5,861	3.9
Kumi	Ongino	11,256	47.3	12,545	52.7	23,801	4,889	4.9
Nabilatuk	Lolachat	16,730	48.9	17,511	51.1	34,241	7,113	4.7
Nakapiripirit	Namalu	8,283	48.4	8,833	51.6	17,116	4,158	4.1
Total		69,264	47.7	75,894	52.3	145,158	31,154	4.7

Data Source: UBOS, 2024

3.5.2 Sources of livelihood

Table 29 shows that crop production is the dominant source of livelihood across the study districts, accounting for 38.9% of all respondents, with the highest reliance recorded in Bukedea (61.3%) and Nakapiripirit (57.4%). This is followed by livestock production (15.8%), which is most important in Bukedea, Kumi, Bulambuli, and Katakwi, but notably absent in Nakapiripirit and very low in Nabilatuk. Casual labouring (14.9%) is also an important livelihood source, especially in Nakapiripirit (27.8%), Katakwi, Bulambuli, and Nabilatuk, suggesting reliance on informal income opportunities. Charcoal burning (10.8%) is particularly significant in Nabilatuk (29.8%), indicating pressure on woody biomass resources and possible environmental degradation risks. Business enterprises contribute 7.9%, while fishing/fish farming (7.5%) is mainly concentrated in Kumi (34.0%) and Katakwi (13.9%), reflecting localized dependence on aquatic resources. Remittances, brick making, and formal employment are minor livelihood sources, together contributing less than 5%, which suggests limited diversification into stable wage-based or external income sources. The findings indicate that livelihoods in the study area are largely natural resource-based, with crop farming, livestock keeping, fishing, charcoal burning, and casual labour forming the main livelihood pillars.

Table 29: Sources of livelihood in the target districts

Sources of livelihood	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Crop production	92	61.3	22	21.8	65	30.1	35	37.2	83	36.4	31	57.4	328	38.9
Livestock production	44	29.3	22	21.8	42	19.4	21	22.3	4	1.8	0	0.0	133	15.8
Casual labouring	2	1.3	18	17.8	48	22.2	4	4.3	39	17.1	15	27.8	126	14.9
Charcoal burning	1	0.7	10	9.9	11	5.1	1	1.1	68	29.8	0	0.0	91	10.8
Business enterprises	6	4.0	20	19.8	5	2.3	0	0.0	28	12.3	8	14.8	67	7.9
Fishing/Fish farming	0	0.0	1	1.0	30	13.9	32	34.0	0	0.0	0	0.0	63	7.5
Remittances	0	0.0	8	7.9	11	5.1	0	0.0	5	2.2	0	0.0	24	2.8
Brick making	5	3.3	0	0.0	3	1.4	0	0.0	1	0.4	0	0.0	9	1.1
Formal employment	0	0.0	0	0.0	1	0.5	1	1.1	0	0.0	0	0.0	2	0.2
Total	150	100	101	100	216	100	94	100	228	100	54	100	843	100

3.5.3 Access to wetland resources

Table 30 shows that access to wetland resources is generally high across the study districts, with 82.6% of respondents reporting that they access wetland resources compared to 17.4% who do not. The highest level of access was recorded in Nabilatuk (95.5%), followed by Bukedea (89.1%), Katakwi (86.1%), and Kumi (85.2%), indicating strong community dependence on wetlands for livelihood and household needs. Nakapiripirit also recorded relatively high access at 66.1%, although a notable proportion of respondents (33.9%) reported no access. In contrast, Bulambuli had the lowest access to wetland resources, with only 27.3% of respondents reporting access while 72.7% reported no access, suggesting possible limitations related to wetland availability, location, restrictions, degradation, or alternative livelihood patterns. The findings indicate that wetlands remain an important resource base for most communities in the study area, with varying levels of access across districts.

Table 30: Access and use of wetland resources

Districts	Yes		No		Total
	N	%	N	%	N
Bukedea	82	89.1	10	10.9	92
Bulambuli	6	27.3	16	72.7	22
Katakwi	62	86.1	10	13.9	72
Kumi	52	85.2	9	14.8	61
Nabilatuk	84	95.5	4	4.5	88
Nakapiripirit	37	66.1	19	33.9	56
Total	323	82.6	68	17.4	391

3.5.4 Community dependence on Lake Opeta Wetland System

3.5.4.1 Community dependence on the wetland system

The major benefits and services from Lake Opeta wetland system include crop cultivation (19.2%), collection of firewood (15.9%), grazing (13.5%), water for domestic use (9.9%), water for livestock (7.7%), fish harvesting (7.0%), and collection of herbal medicine (5.1%) (**Table 31**). Flood regulation, groundwater recharge, and water purification were largely reported by communities in Bulambuli district. This indicates that household use is dominated by direct provisioning services, which can intensify pressure on vegetation cover, soils, and water quality if not regulated and supported by viable alternatives. The stronger recognition of regulating services in Bulambuli suggests higher exposure to flood and water-supply risks, underscoring the need for targeted by-laws, restoration of riparian buffers, and catchment-level measures that protect wetland functions while sustaining local livelihoods. Katakwi district shows a considerable appreciation of the tourism benefit (2.0%), due to the presence of ecotourism for shoebill watching in Opeta parish, Magoro subcounty. However, this service is diminishing due to the degradation of the wetland.

Table 31: Benefits and services of the Lake Opeta Wetland system

Wetland benefits and services	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Crop cultivation	61	28.1	6	7.0	48	10.6	3	2.2	75	29.6	35	81.4	228	19.2
Collection of firewood	39	18.0	6	7.0	57	12.6	11	8.2	71	28.1	5	11.6	189	15.9
Grazing	39	18.0	6	7.0	57	12.6	23	17.2	35	13.8	0	0.0	160	13.5
Water for domestic use	37	17.1	6	7.0	37	8.2	35	26.1	2	0.8	0	0.0	117	9.9
Water for livestock	36	16.6	6	7.0	28	6.2	17	12.7	4	1.6	0	0.0	91	7.7
Fish harvesting	1	0.5	6	7.0	46	10.2	27	20.1	2	0.8	1	2.3	83	7.0
Collection of herbal medicine	0	0.0	5	5.8	51	11.3	2	1.5	2	0.8	0	0.0	60	5.1
Sand mining	1	0.5	0	0.0	13	2.9	0	0.0	38	15.0	0	0.0	52	4.4
Collection of craft materials like papyrus	2	0.9	5	5.8	38	8.4	0	0.0	0	0.0	2	4.7	47	4.0
Climate regulation	0	0.0	6	7.0	18	4.0	1	0.7	8	3.2	0	0.0	33	2.8
Grasses for mulching	1	0.5	5	5.8	13	2.9	4	3.0	2	0.8	0	0.0	25	2.1
Biodiversity conservation	0	0.0	6	7.0	12	2.7	1	0.7	3	1.2	0	0.0	22	1.9
Water for irrigation	0	0.0	6	7.0	8	1.8	1	0.7	1	0.4	0	0.0	16	1.4
Clay mining	0	0.0	0	0.0	5	1.1	1	0.7	8	3.2	0	0.0	14	1.2
Fish farming (ponds)	0	0.0	0	0.0	8	1.8	5	3.7	0	0.0	0	0.0	13	1.1
Flood regulation	0	0.0	5	5.8	4	0.9	0	0.0	1	0.4	0	0.0	10	0.8
Tourism	0	0.0	0	0.0	9	2.0	0	0.0	1	0.4	0	0.0	10	0.8
Groundwater recharge	0	0.0	6	7.0	0	0.0	1	0.7	0	0.0	0	0.0	7	0.6
Water purification	0	0.0	6	7.0	0	0.0	1	0.7	0	0.0	0	0.0	7	0.6
Water for industries	0	0.0	0	0.0	0	0.0	1	0.7	0	0.0	0	0.0	1	0.1
Total	217	100	86	100	452	100	134	100	253	100	43	100	1,185	100



Plate 21: A man fishing in Bisina-Opeta-Okorotum wetland in Kachelekwany parish, Ongino subcounty, Kumi district

Figure 16 presents gendered utilization of wetland resources across the different districts. In Bukedea district, utilization is split mainly between men (37.8%) and youth (37.8%), with women at 14.6% and smaller contributions from girls (6.1%) and boys (3.7%). In Bulambuli and Katakwi districts, men dominate reported utilization (66.7% and 75.8%, respectively), with limited participation from other groups. By contrast, women account for the largest shares in Kumi district (50.0%) and especially Nabilatuk district (75.0%), where youth and men make up smaller proportions. Nakapiripirit district is more mixed, with women (32.4%) and men (27.0%) complemented by a substantial share of boys (29.7%) and girls (10.8%). While no group is restricted from using the wetlands in all six districts, women dominate usage in Kumi, Nabilatuk, and Nakapiripirit Districts because of their central role in collecting construction materials for grass-thatched houses, the collection of firewood, and water for domestic use.

To ensure fair utilisation of wetland resources by women, men, youth, girls and boys, local by-laws should require gender- and youth-balanced representation on wetland committees, set clear and non-discriminatory access rules for key resources (water points, grazing routes, harvesting areas and fishing access), and use transparent permits or user registers to prevent elite capture. These rules should be supported by practical measures that remove barriers to participation, including accessible meeting arrangements, targeted training for under-represented groups, and investments in gender-responsive infrastructure and livelihood support (such as safer water access, controlled livestock corridors,

improved cookstoves, and alternative income options linked to conservation). Routine monitoring should track access and benefits by gender and age, supported by a grievance mechanism, so that management actions improve equity while protecting the wetland's ecological functions.

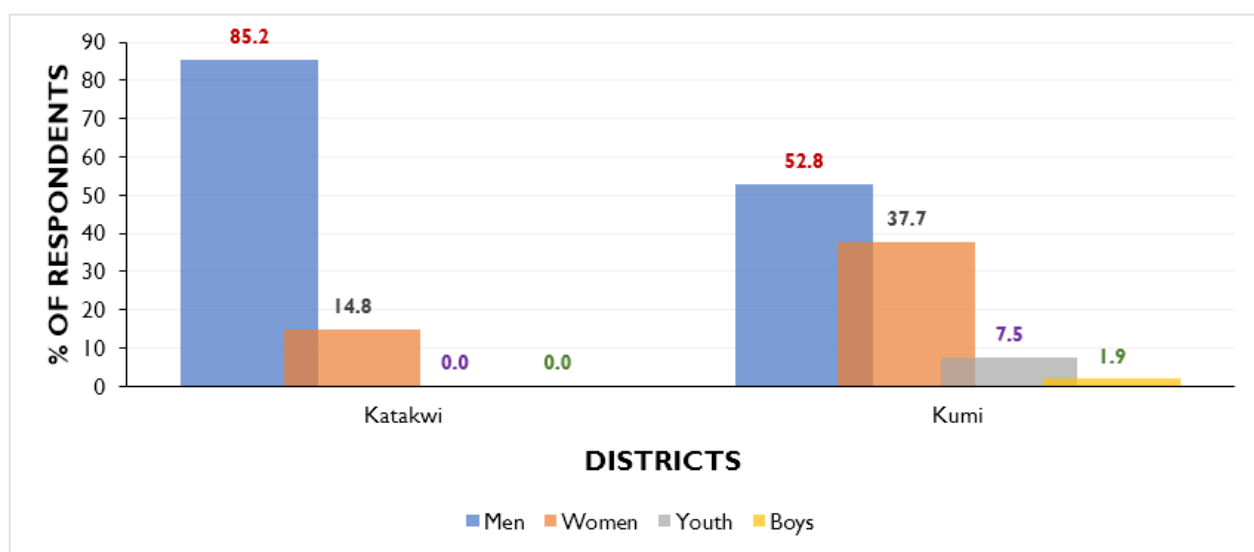


Figure 16: Gendered utilisation of wetland resources in the different districts

3.5.4.2 Community dependence on Lake Opeta

The major benefits and services from Lake Opeta include food (27.6%), water for domestic use (20.3%), water for production (19%), water storage (8.8%), and cultural/religious importance (8.0%) (**Table 32**). The results show that the lake is primarily valued for direct livelihood support and water security, while also providing important regulating and cultural services that strengthen social cohesion and community identity. It also implies that degradation of the lake and its surrounding wetlands would have immediate household-level consequences through reduced food and water access, alongside longer-term risks linked to diminished storage capacity and weakened resilience to climate shocks. It is important to note that Lake Opeta is also used as a means of water transport for the nearby communities.

Table 32: Benefits and services of the Lake Opeta

Benefits and services of Lake Opeta	Katakwi		Kumi		Total	
	N	%	N	%	N	%
Food e.g., fish	61	22.1	49	39.8	110	27.6
Water for domestic use	41	14.9	40	32.5	81	20.3
Water for production (e.g., livestock, irrigation and industry)	55	19.9	21	17.1	76	19.0
Storage of water	28	10.1	7	5.7	35	8.8
Cultural/religious importance	31	11.2	1	0.8	32	8.0
Tourism	25	9.1	0	0.0	25	6.3
Breeding ground for birds and other wildlife	20	7.2	0	0.0	20	5.0

Benefits and services of Lake Opeta	Katakwi		Kumi		Total	
	N	%	N	%	N	%
Habitat for biodiversity	14	5.1	2	1.6	16	4.0
Ground water recharge	0	0.0	3	2.4	3	0.8
Absorb pollutants form the atmosphere	1	0.4	0	0.0	1	0.3
Total	276	100	123	100	399	100

Note: Lake Opeta lies within Katakwi and Kumi districts, and therefore views about the lake were collected only from respondents in these two districts.

Figure 17 shows marked differences in the gender and age groups reported to utilize Lake Opeta across the two lake-bordering districts. In Katakwi district, utilization is overwhelmingly attributed to men (85.2%), with women accounting for the remaining 14.8%, and no reported involvement from youth or boys (0.0% each). In Kumi district, utilization is more evenly distributed, with men still forming the largest group (52.8%) but with a substantial share reported for women (37.7%), alongside participation by youth (7.5%) and a small contribution from boys (1.9%), indicating a broader spread of access and use compared to Katakwi.

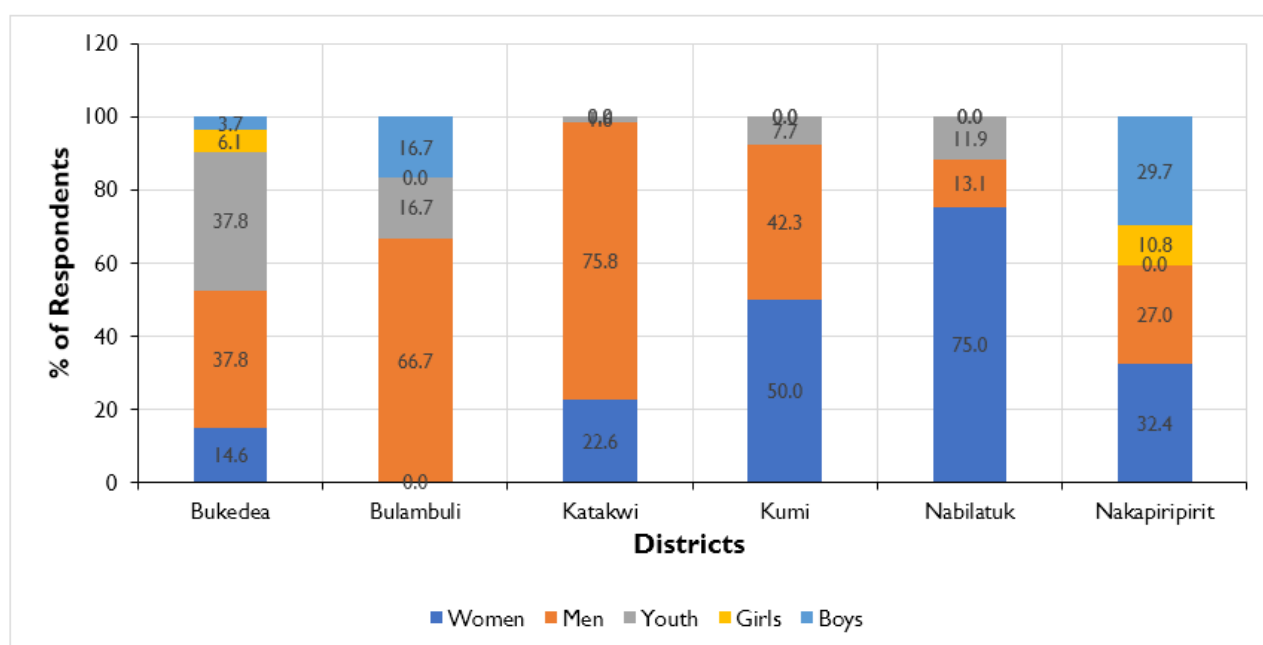


Figure 17: Gendered utilization of Lake Opeta in Katakwi and Kumi districts

3.5.5 Traditional conservation approaches in Lake Opeta wetland system

The commonest traditional conservation approaches include community collective actions for protection (38%), regulation by elders or clan leaders (15.2%), sacred or culturally protected wetland sites (10.2%), cultural restrictions or taboos on wetland use (8.4%), controlled harvesting practices (e.g., only mature plants) (6.9%), and traditional rules on settlement or farming near wetlands (6.5%) (**Table 33**). Traditional awareness practices that promote wise use and stewardship were largely reported in Nabilatuk (11.6%) and Katakwi districts (9.1%).

These approaches reflect locally embedded governance systems that rely on shared norms, social accountability, and cultural values to regulate wetland use. Collective community protection actions indicate strong potential for community-led enforcement where coordination structures remain functional, while regulation by elders or clan leaders demonstrates the continued influence of customary authority in resource management. Sacred sites, taboos, and culturally protected areas further reinforce conservation by assigning social and spiritual significance to specific wetland spaces, thereby discouraging encroachment. However, the effectiveness of these mechanisms is likely to depend on the strength of local institutions and the extent to which customary rules are recognised and aligned with formal wetland management by-laws.

Table 33: Traditional conservation approaches in Lake Opeta wetland system

Traditional conservation approaches	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Community collective actions for protection	82	45.8	1	3.3	29	16.6	37	50.7	84	57.1	43	35.2	276	38.0
Regulation by elders or clan leaders	29	16.2	2	6.7	9	5.1	11	15.1	21	14.3	38	31.1	110	15.2
Sacred or culturally protected wetland sites	1	0.6	0	0.0	70	40.0	0	0.0	3	2.0	0	0.0	74	10.2
Cultural restrictions or taboos on wetland use	21	11.7	1	3.3	9	5.1	0	0.0	5	3.4	25	20.5	61	8.4
Controlled harvesting practices (e.g., only mature plants)	33	18.4	2	6.7	12	6.9	2	2.7	1	0.7	0	0.0	50	6.9
Traditional rules on settlement or farming near wetlands	1	0.6	1	3.3	17	9.7	2	2.7	13	8.8	13	10.7	47	6.5
None	0	0.0	20	66.7	0	0.0	20	27.4	0	0.0	1	0.8	41	5.6
Traditional awareness practices (e.g., local storytelling) promoting “wise use” and stewardship	0	0.0	1	3.3	16	9.1	1	1.4	17	11.6	0	0.0	35	4.8

Traditional conservation approaches	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Customary sanctions for degrading wetlands	12	6.7	0	0.0	8	4.6	0	0.0	2	1.4	2	1.6	24	3.3
Seasonal rules on harvesting or access to allow regeneration	0	0.0	2	6.7	5	2.9	0	0.0	1	0.7	0	0.0	8	1.1
Total	179	100	30	100	175	100	73	100	147	100	122	100	726	100

Plate 22 shows a culturally protected wetland in Bulambuli district. The site plays an important role during the *Mbalu* festival, when boys are ceremonially smeared with soil and water drawn from the wetland before proceeding to the main festivities. This strong cultural significance reinforces local stewardship and has contributed to the wetland's protection from activities that could lead to degradation.



Plate 22: A culturally protected Bukhalu-Sironko wetland in Bunamaliro parish, Bukhalu subcounty, Bulambuli district

3.5.6 Gendered participation in wetland conservation and restoration

Table 34 shows that men are the most involved group in the restoration and sustainable management of wetlands, accounting for 60.9% of total respondents, with particularly high involvement in Katakwi (93.1%), Bulambuli (63.6%), Nabilatuk (62.5%), and Bukedea (54.3%). Women's involvement stands at 23.0% overall, with the highest participation recorded in Kumi (41.0%), Nakapiripirit (32.1%), and Nabilatuk (28.4%), suggesting that women play an important but still secondary role in wetland restoration and management activities. Youth participation is relatively low at 11.3%, although it is more visible in Bukedea (29.3%) and Bulambuli (18.2%), while no youth involvement was reported in Katakwi and Nakapiripirit. The participation of girls and boys is very limited overall, at 1.8% and 3.1%, respectively, though boys' involvement is relatively higher in Nakapiripirit (14.3%). The findings indicate that wetland restoration and sustainable management are largely male-dominated, with moderate participation of women and limited engagement of youth, girls, and boys, highlighting the need for more inclusive approaches that deliberately strengthen the involvement of women and young people in community-based wetland management.

Table 34: Gender involvement in restoration and sustainable management of wetlands

Gender Groups	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Women	13	14.1	4	18.2	5	6.9	25	41.0	25	28.4	18	32.1	90	23.0
Men	50	54.3	14	63.6	67	93.1	28	45.9	55	62.5	24	42.9	238	60.9
Youth	27	29.3	4	18.2	0	0.0	5	8.2	8	9.1	0	0.0	44	11.3
Girls	0	0.0	0	0.0	0	0.0	1	1.6	0	0.0	6	10.7	7	1.8
Boys	2	2.2	0	0.0	0	0.0	2	3.3	0	0.0	8	14.3	12	3.1
Total	92	100	22	100	72	100	61	100	88	100	56	100	391	100

3.5.7 Proposed restoration and management measures for Lake Opeta Wetland System

Lake Opeta Wetland System

The most proposed wetland restoration and management measures across the target districts include demarcating wetland boundaries (15.0%), developing and enforcing wetland by-laws (14.3%), sensitizing communities on wetland values and protection (11.6%), developing and implementing community wetland management plans (9.6%), blocking illegal drainage channels (9.5%), and training communities in sustainable wetland management (9.0%) (**Table 35**).

Table 35: Proposed wetland restoration and management measures in the different districts

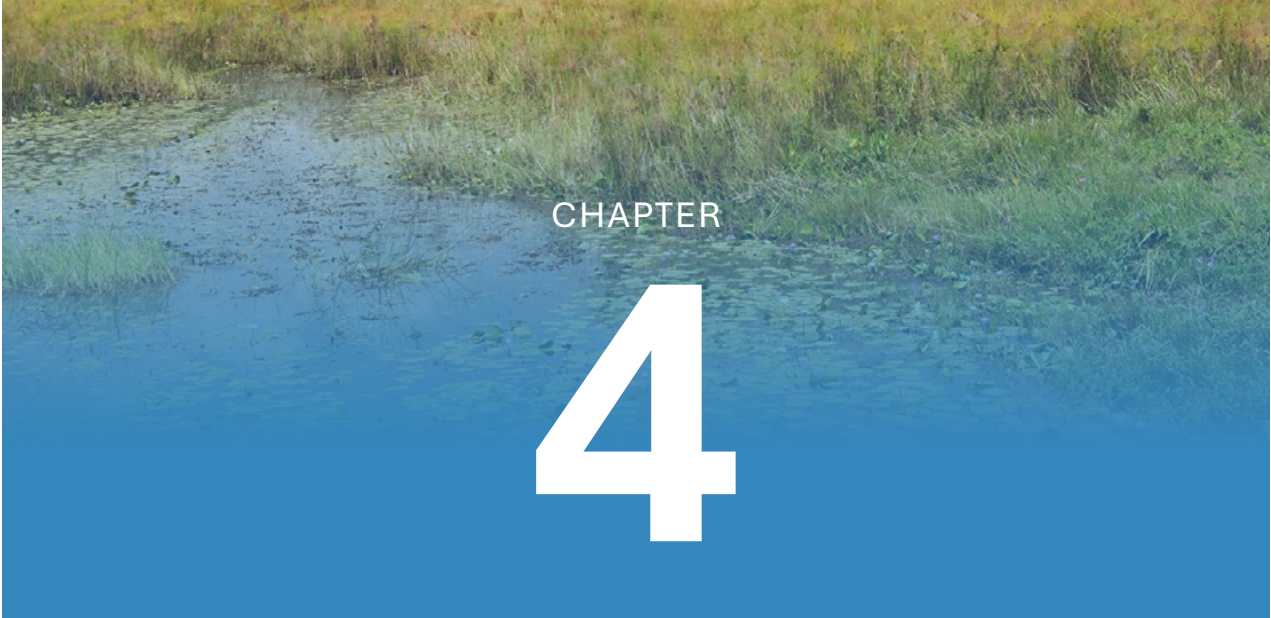
Wetland restoration and management measures	Bukedea		Bulambuli		Katakwi		Kumi		Nabilatuk		Nakapiripirit		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Demarcate wetland boundaries	90	21.4	21	8.2	67	16.2	31	28.2	26	7.9	49	13.5	284	15.0
Develop and enforce wetland by-laws	86	20.4	22	8.6	67	16.2	10	9.1	33	10.0	53	14.6	271	14.3
Sensitize communities on wetland values and protection`	53	12.6	22	8.6	51	12.3	19	17.3	42	12.7	33	9.1	220	11.6
Develop and implement community wetland management plans	56	13.3	22	8.6	28	6.8	8	7.3	35	10.6	32	8.8	181	9.6
Block illegal drainage channels	47	11.2	20	7.8	8	1.9	1	0.9	50	15.2	54	14.9	180	9.5
Train communities in sustainable wetland management	21	5.0	22	8.6	38	9.2	4	3.6	42	12.7	44	12.1	171	9.0
Regulate human activities in wetlands	19	4.5	22	8.6	65	15.7	11	10.0	13	3.9	20	5.5	150	7.9
Employ local communities in wetland restoration works	24	5.7	21	8.2	27	6.5	17	15.5	31	9.4	19	5.2	139	7.3
Support alternative livelihoods to reduce wetland pressure	20	4.8	22	8.6	35	8.5	1	0.9	41	12.4	13	3.6	132	7.0
Remove invasive species such as water hyacinth	0	0.0	20	7.8	20	4.8	4	3.6	4	1.2	17	4.7	65	3.4
Plant native vegetation species such as papyrus	3	0.7	22	8.6	2	0.5	1	0.9	11	3.3	17	4.7	56	3.0
Promote waste segregation and recycling to reduce dumping in wetlands	2	0.5	21	8.2	5	1.2	3	2.7	2	0.6	12	3.3	45	2.4
Total	421	100	257	100	413	100	110	100	330	100	363	100	1,894	100

Lake Opeta

The most proposed Lake Opeta restoration and management measures across the target districts include enforcing local by-laws and regulations (17.1%), regulation of human activities (12.8%), increasing community sensitization on lake protection (11.5%), supporting alternative livelihoods for lake-dependent households (11.2%), restoring and enforcing lake buffer zones (10.8%), development and implementation of catchment management plans (10.3%), and strengthening community lake management committees (10.3%) (**Table 36**).

Table 36: Proposed measures to restore and manage Lake Opeta

Lake Opeta restoration and management measures	Katakwi		Kumi		Total	
	N	%	N	%	N	%
Enforce local by-laws and regulations	59	17.4	17	16.2	76	17.1
Regulation of human activities	37	10.9	20	19.0	57	12.8
Increase community sensitization on lake protection	42	12.4	9	8.6	51	11.5
Support alternative livelihoods for lake-dependent households	44	12.9	6	5.7	50	11.2
Restore and enforce lake buffer zones	37	10.9	11	10.5	48	10.8
Development and implementation of catchment management plans	30	8.8	16	15.2	46	10.3
Strengthen community lake management committees	34	10.0	12	11.4	46	10.3
Regulate fishing gear and fishing seasons	33	9.7	6	5.7	39	8.8
Replant native wetland and shoreline vegetation	14	4.1	5	4.8	19	4.3
Improve solid waste and wastewater management	10	2.9	3	2.9	13	2.9
Total	340	100	105	100	445	100



CHAPTER

4

CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

This study provides strong evidence that the Lake Opeta wetland system remains a strategically important ecological and socio-economic asset, but one that is under increasing pressure from intersecting land use, livelihood, governance, and climate-related stresses. The system is nationally and internationally significant because it supports biodiversity conservation, fisheries, water provision, dry-season grazing, and broader climate resilience functions, while also carrying Ramsar Site and Important Bird Area status. The study's mixed-methods design, combining geospatial analysis, ecological assessment, water quality testing, household surveys, key informant interviews, and focus group discussions, provides a sufficiently robust basis for drawing management and policy conclusions, even though some aquatic observations were constrained by dry-season conditions and limited fish sampling in several sites.

The most important ecological finding is that wetland degradation is no longer localised or incidental, but a measurable landscape-scale process. Intact wetland cover across the six districts declined from 2,672.3 km² in 1996 to 2,017.1 km² in 2026, representing a net loss of 655.2 km² over the assessment period. This decline has been accompanied by a major increase in conversion to small-scale farmland, which expanded from 50.2 km² to 803.2 km², while woodlands and grasslands declined substantially. The burden of degradation is unevenly distributed, with Bukedea, Kumi, and Katakwi showing the most severe transformation, while Nabilatuk and Nakapiripirit retain a comparatively larger proportion of intact wetland cover. These patterns indicate that wetland degradation in Lake Opeta is strongly tied to agricultural expansion and associated land use change rather than to isolated biophysical disturbance alone.

The study also shows that ecological degradation is already affecting core wetland functions. Water quality results reveal localised but important stress signals, including low dissolved oxygen, high temperatures, elevated pH in some sites, and widespread nitrogen enrichment above relevant standards in most sampled wetlands. These conditions are consistent with nutrient loading, sediment inflows,

livestock pressure, and cultivation around wetland margins, and they imply declining habitat quality for fish, macroinvertebrates, and other aquatic organisms. At the same time, biodiversity findings suggest that the wetland system still retains substantial ecological value, including relatively high plant diversity in several sampled wetlands, but increasing dominance of disturbance-tolerant fauna and reports of declining fish stocks point to a system under stress rather than one in stable equilibrium. In scientific terms, the evidence suggests a wetland landscape that still retains important ecological integrity in some areas, but is undergoing functional simplification in more heavily used zones.

Another major conclusion is that Lake Opeta wetland system is as much a governance and development issue as it is an environmental one. Wetland use is deeply embedded in local livelihood systems. Across the study area, about 82.6% of respondents reported access to wetland resources, and the broader livelihood structure remains heavily natural resource-dependent, with crop production, livestock keeping, casual labour, charcoal burning, and fishing/fish farming forming the main livelihood base. Around Lake Opeta itself, communities identified food, domestic water, water for production, water storage, and cultural values as key benefits derived from the lake. This means that wetland degradation cannot be adequately addressed through enforcement alone. It must be understood as the outcome of persistent livelihood dependence, limited economic alternatives, and weak integration of wetland priorities into local development planning.

The report further demonstrates that the current governance arrangement is insufficient for a wetland system that functions ecologically as one connected landscape but is administratively divided across six districts. Fragmented planning, inconsistent enforcement, weak coordination, inadequate financing, limited technical capacity, poor demarcation, and weak accountability mechanisms all reduce the effectiveness of formal wetland governance. These institutional weaknesses are reinforced by political economy factors, especially where local leaders face pressure to tolerate unsustainable wetland use because the same activities sustain household welfare and local income. The implication is that wetland degradation in Lake Opeta is not due to an absence of laws or institutions, but to a persistent implementation gap between policy intent and local practice.

At the same time, the study identifies important foundations on which future policy and management can build. Communities already recognise the value of the wetland system, traditional conservation practices remain visible in several districts, and respondents proposed management responses that are broadly consistent with sound policy directions, including stronger by-law enforcement, regulation of human activities, sensitisation, support for alternative livelihoods, restoration of buffer zones, catchment management planning, and stronger community committees. Taken together, the evidence indicates that Lake Opeta remains recoverable, but that continued delay will likely deepen ecological decline, increase livelihood vulnerability, and raise the future cost of restoration. The central policy conclusion is that Lake Opeta wetland system now requires coordinated, system-wide wetland governance that integrates biodiversity conservation, climate resilience, water resource protection, and rural livelihood transition within a single management framework.

4.2 Recommendations

Policy recommendations

- I. Establish an inter-district Lake Opeta Wetland Management Coordination Framework:**
Because the Lake Opeta wetland system functions as one connected ecosystem but is managed through separate district administrative structures, a formal inter-district coordination mechanism should be established to harmonise planning, enforcement, restoration, monitoring, and reporting across Bukedea, Bulambuli, Katakwi, Kumi, Nabilatuk, and Nakapiripirit. This framework should provide for joint annual action planning, harmonised enforcement priorities, common monitoring indicators, and regular cross-district technical review meetings. This is necessary because fragmented management, weak cross-district coordination, and inconsistent enforcement are already undermining effective wetland governance.
- II. Prioritise wetland boundary demarcation and legally backed zoning of the wetland system:**
A practical policy priority should be to demarcate critical wetland boundaries and establish clear zoning for protection, regulated use, restoration, and community livelihood transition areas. The report shows that unclear wetland boundaries and weak demarcation are major points at which enforcement breaks down, while communities also require clarity on permitted and prohibited activities. A zoning approach would reduce disputes, improve compliance, and give district authorities and community structures a more operational basis for enforcement and restoration.
- III. Strengthen and harmonise local by-laws and wetland use regulations across the wetland system:**
The study shows that weak local rules, inconsistent enforcement, and limited compliance continue to allow cultivation, grazing, fishing pressure, harvesting, and other unsustainable uses to persist within the wetland system. Policy action should therefore focus on reviewing, updating, and harmonising district and lower local government by-laws so that they clearly define who may use the wetland, for what purpose, under what conditions, and with what sanctions for non-compliance. These by-laws should also be aligned with national wetland regulations and implemented consistently across districts. In addition, evidence from the Lake Opeta area itself shows that enforcement of local by-laws and regulations was the single most frequently proposed management measure, further underscoring the policy importance of strengthening local regulatory systems.
- IV. Integrate wetland management into district development planning and sectoral decision-making:**
Wetland management should be mainstreamed into district and lower local government planning, budgeting, and implementation across agriculture, livestock, fisheries, land use, energy, climate resilience, and disaster risk reduction. The evidence shows that wetland degradation is driven by livelihood pressures and that wetland priorities are still poorly integrated into local development planning. Treating wetland management as a stand-alone conservation issue will therefore continue to weaken implementation. Policy should require every relevant district department to integrate wetland protection, restoration, and climate resilience actions into routine planning and budgeting processes.
- V. Adopt a policy approach that links wetland protection with viable livelihood alternatives:**
Since weak enforcement is reinforced by high livelihood dependence on wetland resources, policy responses should not rely on restriction alone. The report shows that 82.6% of respondents across the study area reported access to wetland resources, indicating the extent to which wetland use is embedded in local livelihoods. A practical policy direction is therefore to embed wetland-sensitive livelihood transition measures within district development and climate resilience frameworks,

especially for communities dependent on cultivation, livestock grazing, fishing, and charcoal production. This approach is further supported by findings from the Lake Opeta area, where support for alternative livelihoods emerged as one of the leading proposed management measures

- VI. Institutionalise resource community wetland management committees within the formal governance system:** Community wetland management committees should be formally recognised, trained, and linked to district and sub-county governance structures so that they can support local monitoring, reporting, restoration, and compliance. This recommendation is justified by the wider finding that weak accountability and limited follow-up at community level continue to undermine effective wetland governance. It is also reinforced by evidence from the Lake Opeta area, where strengthening community lake management committees was identified as one of the leading proposed management measures. Policy should therefore define their mandate, reporting lines, and minimum operational support.
- VII. Make wetland governance more inclusive by requiring representation of women and youth in decision-making structures:** The findings show that restoration and sustainable management activities are largely male-dominated, with women accounting for 23.0% and youth 11.3% of participation compared to 60.9% for men. Policy should therefore require a minimum representation of women and youth in community wetland committees, local planning processes, and restoration decision-making platforms. This would strengthen legitimacy, improve inclusion of different wetland user interests, and make community-based management more representative of actual resource users.
- VIII. Increase policy support for enforcement capacity, monitoring, and accountability:** The study points to inadequate staffing, funding, transport, technical tools, and monitoring systems as persistent institutional barriers to wetland protection. Policy action should therefore prioritise budgeted support for enforcement patrols, monitoring systems, restoration supervision, committee training, and accountability mechanisms at district and sub-county levels. Without this, even sound laws and plans will continue to face weak implementation.

Advocacy recommendations

- I. Frame wetland protection as a livelihood and resilience issue:** Advocacy should emphasise that the Lake Opeta wetland system underpins household welfare, water access, production, and resilience. This is supported by the finding that access to wetland resources is high across the study area, with 82.6% of respondents reporting access, showing that wetland protection must be communicated in relation to everyday livelihoods, not biodiversity alone.
- II. Use lake-specific messages when advocating for Lake Opeta itself:** Where advocacy is directed specifically at Lake Opeta, the message should focus on the benefits communities attach to the lake, especially food, domestic water, water for production, water storage, and cultural value. This keeps advocacy aligned with how lake-adjacent communities themselves understand its importance.
- III. Promote clear public understanding of rules, boundaries, and permitted uses:** Advocacy should explain wetland boundaries, permitted and prohibited activities, restoration zones, and local responsibilities. The report shows that limited transparency and weak communication are reducing trust, compliance, and community ownership of restoration measures.

- IV. Build support for enforceable local action:** Advocacy should back practical measures such as enforcement of local by-laws, regulation of harmful activities, and protection of buffer zones. This is justified by the Lake Opeta findings, where enforcement of by-laws emerged as the single most frequently proposed management measure at 17.1%, followed by regulation of human activities and protection of buffer zones.
- V. Highlight the governance problem, not only the environmental one:** Advocacy should show that degradation persists because the wetland functions as one connected ecosystem but is managed across separate districts with fragmented planning, inconsistent enforcement, and weak coordination. This makes institutional reform and joint action a legitimate advocacy priority.
- VI. Advocate for livelihood alternatives alongside protection measures:** Because wetland use is closely tied to survival and income, advocacy should not call for protection in isolation. The report links weak enforcement to continued dependence on cultivation, grazing, fishing, charcoal production, and other livelihood uses, indicating the need to pair protection messages with realistic livelihood alternatives.
- VII. Use existing community and customary practices as entry points:** Advocacy should build on community-level stewardship, local rules, and traditional authority structures where they still shape resource use. The report's methodology and findings show that local norms, community views, and user-group priorities are central to how wetland management is experienced and contested on the ground.
- VIII. Promote more inclusive participation in wetland governance:** Advocacy should deliberately encourage greater involvement of women and youth in wetland management. This is supported by the finding that restoration and sustainable management are still male-dominated, with men accounting for 60.9% of participation compared to 23.0% for women and 11.3% for youth.

Programming recommendations

- I. Prioritise restoration in the most degraded parts of the wetland system:** Programming should first target Bukedea, Kumi, and the more affected parts of Katakwi, where wetland degradation and conversion have been most pronounced. This would direct limited resources to the areas of greatest ecological pressure.
- II. Support boundary demarcation and buffer zone restoration:** Programmes should invest in marking wetland boundaries and restoring buffer zones, especially where encroachment is ongoing. This is justified by the report's finding that unclear boundaries weaken enforcement and by community proposals to restore and enforce lake buffer zones.
- III. Fund practical alternative livelihoods for wetland-dependent households:** Programming should include realistic livelihood options that reduce dependence on wetland cultivation, grazing, charcoal burning, and fishing pressure. This is supported by the high level of wetland dependence across the study area and by the fact that support for alternative livelihoods was one of the leading proposed measures around Lake Opeta.
- IV. Strengthen community wetland management committees:** Programmes should provide training, facilitation, and operational support to community wetland or lake management committees so they can monitor use, support restoration, and report violations. This is grounded in both the governance analysis and the community proposals from the Lake Opeta area.

- V. Invest in community sensitisation linked to action on the ground:** Programming should go beyond awareness campaigns and support practical sensitisation on boundaries, permitted uses, restoration responsibilities, and local rules. This is supported by the report's finding that increasing community sensitisation on lake protection was one of the most frequently proposed management measures.
- VI. Develop catchment-based implementation plans for priority areas:** Programmes should be organised at catchment level rather than site by site, so that upstream and downstream pressures are addressed together. This is consistent with community proposals for catchment management planning and with the report's wider finding that the wetland system is ecologically connected but institutionally fragmented.
- VII. Establish routine monitoring of water quality, biodiversity, and wetland change:** Programming should support regular monitoring of wetland condition, including land use change, water quality, and fisheries or biodiversity trends. This is justified by the report's findings on localised water quality stress, declining fish stocks, and weak monitoring and data systems.
- VIII. Support targeted control of damaging activities in the lake and wetland margins:** Programmes should include practical measures to regulate harmful human activities, including pressure from inappropriate fishing practices, encroachment into buffer areas, and wetland-edge use. This is supported by the fact that regulation of human activities and regulation of fishing gear and seasons were among the proposed Lake Opeta management measures.
- IX. Provide implementation support to district and sub-county environment structures:** Programming should include logistical and technical support for district and lower local government structures responsible for wetland management. The report shows that limited staffing, low financing, weak technical capacity, and inadequate transport are already constraining restoration, enforcement, and monitoring.

4.3 Entry points for implementation

- I. Start with inter-district coordination:** An immediate entry point is to convene the six districts under a joint coordination platform for the Lake Opeta wetland system. This is justified by the report's finding that the wetland functions as one connected ecosystem but is currently managed through fragmented district structures.
- II. Undertake boundary demarcation in priority hotspots:** Boundary demarcation should be one of the first field-level actions, especially in areas under active encroachment. The report identifies weak demarcation and unclear boundaries as practical barriers to enforcement and restoration.
- III. Target the most degraded areas first:** Implementation should begin in the most affected parts of Bukedea, Kumi, and Katakwi, where wetland conversion and degradation are more pronounced. This would allow early action to focus where ecological pressure is greatest.
- IV. Support community wetland management committee:** A practical early step is to establish or strengthen community wetland or lake management committees and link them to sub-county and district structures. This is supported by the report's emphasis on functional community committees as part of stronger wetland governance.

- V. Begin with sensitisation tied to clear local rules:** Early implementation should include community sensitisation on wetland boundaries, permitted uses, prohibited activities, and restoration responsibilities. This is grounded in the finding that community sensitisation on lake protection was among the leading proposed measures.
- VI. Pair protection with alternative livelihood support:** Implementation should not begin with enforcement alone. It should be accompanied by practical livelihood alternatives for wetland-dependent households, since the report shows that livelihood dependence is one of the main factors sustaining weak enforcement.
- VII. Launch buffer zone restoration and catchment planning together:** Restoration of lake or wetland buffer zones should be implemented alongside catchment-based planning so that local actions are not undermined by wider land use pressures. Both were identified in the report as key proposed management measures.
- VIII. Set up routine monitoring from the outset:** Implementation should include simple but regular monitoring of wetland condition, water quality, and compliance from the beginning. This is important because the report already documents water quality stress and highlights weak monitoring capacity as a governance constraint.
- IX. Deliberately include women and youth in early structures:** Women and youth should be deliberately included in committees, sensitisation activities, and restoration work from the start. This is necessary because current participation in restoration and sustainable wetland management remains uneven and heavily male-dominated.

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Annexes

Annex 1: Plant species abundance in Lake Opeta wetland system

District	Plant species	Family	Abundance	Growth form	IUCN Status
Kumi	Echinochloa pyramidalis	Poaceae	30	Herb	Least Concern
Bulambuli	Echinochloa pyramidalis	Poaceae	30	Herb	Least Concern
Nakapiripirit	Echinochloa pyramidalis	Poaceae	30	Herb	Least Concern
Bukedea	Hygrophila auriculata	Acanthaceae	13	Herb	Least Concern
Bukedea	Panicum repens	Poaceae	50	Herb	Least Concern
Bukedea	Echinochloa pyramidalis	Poaceae	15	Herb	Least Concern
Bukedea	Phragmites australis	Poaceae	10	Herb	Least Concern
Kumi	Phragmites australis	Poaceae	50	Herb	Least Concern
Kumi	Panicum repens	Poaceae	200	Herb	Least Concern
Katakwi	Panicum repens	Poaceae	50	Herb	Least Concern
Nabilatuk	Panicum repens	Poaceae	30	Herb	Least Concern
Bulambuli	Panicum repens	Poaceae	50	Herb	Least Concern
Nakapiripirit	Panicum repens	Poaceae	30	Herb	Least Concern
Nakapiripirit	Phragmites australis	Poaceae	200	Herb	Least Concern
Kumi	Hygrophila auriculata	Acanthaceae	23	Herb	Least Concern
Nabilatuk	Hygrophila auriculata	Acanthaceae	21	Herb	Least Concern
Bulambuli	Hygrophila auriculata	Acanthaceae	25	Herb	Least Concern

District	Plant species	Family	Abundance	Growth form	IUCN Status
Nakapiripirit	Hygrophila auriculata	Acanthaceae	9	Herb	Least Concern
Bukedea	Sesbania sesban	Fabaceae	3	Shrub	Least Concern
Bukedea	Euphorbia tirucalli	Euphorbiaceae	13	Shrub	Least Concern
Kumi	Phoenix reclinata	Arecaceae	11	Shrub	Least Concern
Kumi	Raphia farinifera	Arecaceae	21	Shrub	Least Concern
Kumi	Euphorbia tirucalli	Euphorbiaceae	18	Shrub	Least Concern
Katakwi	Sesbania sesban	Fabaceae	8	Shrub	Least Concern
Bulambuli	Zanthoxylum fagara	Rutaceae	5	Shrub	Least Concern
Bulambuli	Sesbania sesban	Fabaceae	7	Shrub	Least Concern
Bulambuli	Raphia farinifera	Arecaceae	6	Shrub	Least Concern
Bulambuli	Phoenix reclinata	Arecaceae	3	Shrub	Least Concern
Bulambuli	Urena lobata	Malvaceae	6	Shrub	Least Concern
Nakapiripirit	Zanthoxylum fagara	Rutaceae	3	Shrub	Least Concern
Nakapiripirit	Raphia farinifera	Arecaceae	4	Shrub	Least Concern
Nakapiripirit	Phoenix reclinata	Arecaceae	3	Shrub	Least Concern
Nakapiripirit	Grewia villosa	Malvaceae	5	Shrub	Least Concern
Nakapiripirit	Sesbania sesban	Fabaceae	6	Shrub	Least Concern
Bukedea	Vachellia nilotica	Fabaceae	1	Tree	Least Concern
Bukedea	Vachellia sieberiana	Fabaceae	8	Tree	Least Concern
Bukedea	Grevillea robusta	Proteaceae	3	Tree	Least Concern
Bukedea	Bauhinia purpurea	Fabaceae	1	Tree	Least Concern
Bukedea	Albizia zygia	Fabaceae	1	Tree	Least Concern
Kumi	Tamarindus indica	Fabaceae	5	Tree	Least Concern

District	Plant species	Family	Abundance	Growth form	IUCN Status
Kumi	Vachellia nilotica	Fabaceae	4	Tree	Least Concern
Kumi	Vachellia sieberiana	Fabaceae	19	Tree	Least Concern
Kumi	Albizia lebbeck	Fabaceae	3	Tree	Least Concern
Kumi	Casimiroa edulis	Rutaceae	3	Tree	Least Concern
Kumi	Albizia zygia	Fabaceae	2	Tree	Least Concern
Kumi	Albizia coriaria	Fabaceae	1	Tree	Least Concern
Kumi	Albizia amara	Fabaceae	1	Tree	Least Concern
Katakwi	Ficus sycomorus	Moraceae	2	Tree	Least Concern
Katakwi	Vachellia sieberiana	Fabaceae	2	Tree	Least Concern
Nabilatuk	Vachellia nilotica	Fabaceae	16	Tree	Least Concern
Nabilatuk	Vachellia sieberiana	Fabaceae	22	Tree	Least Concern
Nabilatuk	Gleditsia triacanthos	Fabaceae	1	Tree	Least Concern
Bulambuli	Vachellia nilotica	Fabaceae	11	Tree	Least Concern
Bulambuli	Vachellia sieberiana	Fabaceae	18	Tree	Least Concern
Nakapiripirit	Vachellia sieberiana	Fabaceae	9	Tree	Least Concern
Nakapiripirit	Vachellia nilotica	Fabaceae	2	Tree	Least Concern
Nakapiripirit	Vangueria infausta	Rubiaceae	1	Tree	Least Concern
Nakapiripirit	Casimiroa edulis	Rutaceae	4	Tree	Least Concern
Nakapiripirit	Albizia glaberrima	Fabaceae	2	Tree	Least Concern
Nakapiripirit	Ficus sycomorus	Moraceae	3	Tree	Least Concern
Kumi	Pergularia daemia	Apocynaceae	5	Climber	Not Evaluated
Kumi	Cissus quadrangularis	Vitaceae	3	Climber	Not Evaluated
Bulambuli	Desmodium uncinatum	Fabaceae	16	Climber	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Bulambuli	Stephania abyssinica	Menispermaceae	5	Climber	Not Evaluated
Bulambuli	Ipomoea aquatica	Convolvulaceae	20	Climber	Not Evaluated
Nakapiripirit	Ipomoea alba	Convolvulaceae	5	Climber	Not Evaluated
Bulambuli	Coccinia rehmannii	Cucurbitaceae	6	Climber	Not Evaluated
Bulambuli	Momordica foetida	Cucurbitaceae	5	Climber	Not Evaluated
Nakapiripirit	Momordica foetida	Cucurbitaceae	4	Climber	Not Evaluated
Nakapiripirit	Diplocyclos palmatus	Cucurbitaceae	1	Climber	Not Evaluated
Bulambuli	Tinospora cordifolia	Menispermaceae	1	Climber	Not Evaluated
Nakapiripirit	Tinospora cordifolia	Menispermaceae	2	Climber	Not Evaluated
Bulambuli	Cissampelos pareira	Menispermaceae	8	Climber	Not Evaluated
Nakapiripirit	Smilax aspera	Smilacaceae	2	Climber	Not Evaluated
Kumi	Nelumbo nucifera	Nelumbonaceae	30	Herb	Not Evaluated
Kumi	Nymphaea lotus	Nymphaeaceae	6	Herb	Not Evaluated
Kumi	Nymphoides indica	Menyanthaceae	20	Herb	Not Evaluated
Katakwi	Potamogeton schweinfurthii	Potamogetonaceae	50	Herb	Not Evaluated
Katakwi	Nelumbo nucifera	Nelumbonaceae	40	Herb	Not Evaluated
Katakwi	Nymphaea lotus	Nymphaeaceae	6	Herb	Not Evaluated
Katakwi	Azolla pinnata	Salviniaceae	21	Herb	Not Evaluated
Katakwi	Pistia stratiotes	Araceae	30	Herb	Not Evaluated
Katakwi	Vallisneria spiralis	Hydrocharitaceae	30	Herb	Not Evaluated
Katakwi	Hydrilla verticillata	Hydrocharitaceae	30	Herb	Not Evaluated
Katakwi	Nymphoides indica	Menyanthaceae	25	Herb	Not Evaluated
Katakwi	Ceratophyllum demersum	Ceratophyllaceae	30	Herb	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Kumi	Vossia cuspidata	Poaceae	200	Herb	Not Evaluated
Kumi	Sacciolepis africana	Poaceae	20	Herb	Not Evaluated
Katakwi	Vossia cuspidata	Poaceae	200	Herb	Not Evaluated
Katakwi	Echinochloa stagnina	Poaceae	30	Herb	Not Evaluated
Katakwi	Sacciolepis africana	Poaceae	20	Herb	Not Evaluated
Katakwi	Hymenachne amplexicaulis	Poaceae	10	Herb	Not Evaluated
Katakwi	Acroceras macrum	Poaceae	15	Herb	Not Evaluated
Nabilatuk	Setaria incrassata	Poaceae	20	Herb	Not Evaluated
Bulambuli	Dactyloctenium aegypticum	Poaceae	13	Herb	Not Evaluated
Bulambuli	Urochloa mozambicensis	Poaceae	30	Herb	Not Evaluated
Nakapiripirit	Cymbopogon nardus	Poaceae	5	Herb	Not Evaluated
Bukedea	Euphorbia hirta	Euphorbiaceae	8	Herb	Not Evaluated
Bukedea	Ageratum conyzoides	Asteraceae	9	Herb	Not Evaluated
Bukedea	Galinsoga parviflora	Asteraceae	7	Herb	Not Evaluated
Bukedea	Oryza sativa	Poaceae	200	Herb	Not Evaluated
Bukedea	Cyperus digitatus	Cyperaceae	5	Herb	Not Evaluated
Bukedea	Ludwigia palustris	Onagraceae	4	Herb	Not Evaluated
Bukedea	Bidens pilosa	Asteraceae	11	Herb	Not Evaluated
Bukedea	Sida cordifolia	Malvaceae	3	Herb	Not Evaluated
Bukedea	Triumfetta rhomboidea	Malvaceae	2	Herb	Not Evaluated
Bukedea	Conyza floribunda	Asteraceae	4	Herb	Not Evaluated
Bukedea	Cynodon dactylon	Poaceae	50	Herb	Not Evaluated
Bukedea	Conyza sumatrensis	Asteraceae	2	Herb	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Bukedea	<i>Digitaria abyssinica</i>	Poaceae	50	Herb	Not Evaluated
Bukedea	<i>Panicum maximum</i>	Poaceae	20	Herb	Not Evaluated
Bukedea	<i>Cyperus odoratus</i>	Cyperaceae	3	Herb	Not Evaluated
Bukedea	<i>Kyllinga pumila</i>	Cyperaceae	20	Herb	Not Evaluated
Bukedea	<i>Amaranthus spinosus</i>	Amaranthaceae	14	Herb	Not Evaluated
Bukedea	<i>Cymbopogon citratus</i>	Poaceae	25	Herb	Not Evaluated
Bukedea	<i>Imperata cylindrica</i>	Poaceae	50	Herb	Not Evaluated
Bukedea	<i>Alternanthera sessilis</i>	Amaranthaceae	25	Herb	Not Evaluated
Bukedea	<i>Sonchus arvensis</i>	Asteraceae	6	Herb	Not Evaluated
Bukedea	<i>Centella asiatica</i>	Apiaceae	19	Herb	Not Evaluated
Bukedea	<i>Commelina diffusa</i>	Commelinaceae	30	Herb	Not Evaluated
Bukedea	<i>Commelina communis</i>	Commelinaceae	15	Herb	Not Evaluated
Bukedea	<i>Justicia flava</i>	Acanthaceae	16	Herb	Not Evaluated
Bukedea	<i>Vernonia brachycalyx</i>	Asteraceae	3	Herb	Not Evaluated
Bukedea	<i>Crotalaria ochroleuca</i>	Fabaceae	5	Herb	Not Evaluated
Bukedea	<i>Sphenoclea zeylanica</i>	Sphenocleaceae	14	Herb	Not Evaluated
Bukedea	<i>Solanum lycopersicum</i>	Solanaceae	16	Herb	Not Evaluated
Bukedea	<i>Sida acuta</i>	Malvaceae	14	Herb	Not Evaluated
Bukedea	<i>Cerastium glomeratum</i>	Caryophyllaceae	7	Herb	Not Evaluated
Bukedea	<i>Guizotia abyssinica</i>	Asteraceae	3	Herb	Not Evaluated
Bukedea	<i>Striga hermonthica</i>	Orobanchaceae	3	Herb	Not Evaluated
Bukedea	<i>Asystasia gigantea</i>	Acanthaceae	6	Herb	Not Evaluated
Bukedea	<i>Cleome viscosa</i>	Cleomaceae	8	Herb	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Bukedea	Potamogeton schweinfurthii	Potamogetonaceae	6	Herb	Not Evaluated
Kumi	Sida acuta	Malvaceae	24	Herb	Not Evaluated
Kumi	Sida cordifolia	Malvaceae	3	Herb	Not Evaluated
Kumi	Cyperus papyrus	Cyperaceae	20	Herb	Not Evaluated
Kumi	Heteropogon contortus	Poaceae	50	Herb	Not Evaluated
Kumi	Typha latifolia	Typhaceae	50	Herb	Not Evaluated
Kumi	Conyza sumatrensis	Asteraceae	11	Herb	Not Evaluated
Kumi	Juncus effusus	Juncaceae	30	Herb	Not Evaluated
Kumi	Themeda triandra	Poaceae	40	Herb	Not Evaluated
Kumi	Setaria sphacelata	Poaceae	30	Herb	Not Evaluated
Kumi	Imperata cylindrica	Poaceae	50	Herb	Not Evaluated
Kumi	Cynodon dactylon	Poaceae	200	Herb	Not Evaluated
Kumi	Paspalum scrobiculatum	Poaceae	50	Herb	Not Evaluated
Kumi	Digitaria abyssinica	Poaceae	30	Herb	Not Evaluated
Kumi	Kyllinga pumila	Cyperaceae	20	Herb	Not Evaluated
Kumi	Cyperus odoratus	Cyperaceae	6	Herb	Not Evaluated
Kumi	Cyperus digitatus	Cyperaceae	13	Herb	Not Evaluated
Kumi	Cyperus dives	Cyperaceae	17	Herb	Not Evaluated
Kumi	Schoenoplectus corymbosus	Cyperaceae	12	Herb	Not Evaluated
Kumi	Achyranthes aspera	Amaranthaceae	22	Herb	Not Evaluated
Kumi	Senna occidentalis	Fabaceae	8	Herb	Not Evaluated
Kumi	Vernonia brachycalyx	Asteraceae	2	Herb	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Kumi	Aloe vera	Asphodelaceae	1	Herb	Not Evaluated
Katakwi	Leersia hexandra	Poaceae	25	Herb	Not Evaluated
Katakwi	Cyperus imbricatus	Cyperaceae	25	Herb	Not Evaluated
Katakwi	Ischaemum afrum	Poaceae	15	Herb	Not Evaluated
Katakwi	Setaria sphacelata	Poaceae	20	Herb	Not Evaluated
Katakwi	Schoenoplectus lacustris	Cyperaceae	15	Herb	Not Evaluated
Katakwi	Bidens pilosa	Asteraceae	5	Herb	Not Evaluated
Katakwi	Leonotis nepetifolia	Lamiaceae	4	Herb	Not Evaluated
Katakwi	Panicum maximum	Poaceae	15	Herb	Not Evaluated
Nabilatuk	Setaria sphacelata	Poaceae	30	Herb	Not Evaluated
Nabilatuk	Themeda triandra	Poaceae	15	Herb	Not Evaluated
Nabilatuk	Kyllinga pumila	Cyperaceae	20	Herb	Not Evaluated
Nabilatuk	Cenchrus ciliaris	Poaceae	20	Herb	Not Evaluated
Nabilatuk	Panicum maximum	Poaceae	20	Herb	Not Evaluated
Nabilatuk	Cynodon dactylon	Poaceae	50	Herb	Not Evaluated
Nabilatuk	Digitaria abyssinica	Poaceae	30	Herb	Not Evaluated
Nabilatuk	Juncus effusus	Juncaceae	30	Herb	Not Evaluated
Nabilatuk	Heteropogon contortus	Poaceae	25	Herb	Not Evaluated
Nabilatuk	Panicum virgatum	Poaceae	20	Herb	Not Evaluated
Nabilatuk	Gossypium herbaceum subsp. africanum	Malvaceae	3	Herb	Not Evaluated
Nabilatuk	Trichodesma zeylanicum	Boraginaceae	22	Herb	Not Evaluated
Nabilatuk	Hyparrhenia rufa	Poaceae	25	Herb	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Nabilatuk	Chloris gayana	Poaceae	30	Herb	Not Evaluated
Nabilatuk	Pennisetum purpureum	Poaceae	50	Herb	Not Evaluated
Nabilatuk	Eragrostis ciliaris	Poaceae	30	Herb	Not Evaluated
Nabilatuk	Triumfetta rhomboidea	Malvaceae	4	Herb	Not Evaluated
Bulambuli	Amaranthus hybridus	Amaranthaceae	6	Herb	Not Evaluated
Bulambuli	Leonotis nepetifolia	Lamiaceae	5	Herb	Not Evaluated
Bulambuli	Cynodon dactylon	Poaceae	50	Herb	Not Evaluated
Bulambuli	Hyparrhenia rufa	Poaceae	25	Herb	Not Evaluated
Bulambuli	Digitaria abyssinica	Poaceae	30	Herb	Not Evaluated
Bulambuli	Imperata cylindrica	Poaceae	30	Herb	Not Evaluated
Bulambuli	Themeda triandra	Poaceae	20	Herb	Not Evaluated
Bulambuli	Clinopodium vulgare	Lamiaceae	13	Herb	Not Evaluated
Bulambuli	Commelina diffusa	Commelinaceae	15	Herb	Not Evaluated
Bulambuli	Commelina erecta	Commelinaceae	10	Herb	Not Evaluated
Bulambuli	Commelina communis	Commelinaceae	19	Herb	Not Evaluated
Bulambuli	Ludwigia palustris	Onagraceae	13	Herb	Not Evaluated
Bulambuli	Achyranthes aspera	Amaranthaceae	26	Herb	Not Evaluated
Bulambuli	Pennisetum purpureum	Poaceae	50	Herb	Not Evaluated
Bulambuli	Heteropogon contortus	Poaceae	30	Herb	Not Evaluated
Bulambuli	Panicum maximum	Poaceae	30	Herb	Not Evaluated
Bulambuli	Setaria sphacelata	Poaceae	30	Herb	Not Evaluated
Bulambuli	Eragrostis ciliaris	Poaceae	30	Herb	Not Evaluated
Bulambuli	Oryza sativa	Poaceae	200	Herb	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Bulambuli	<i>Bidens pilosa</i>	Asteraceae	17	Herb	Not Evaluated
Bulambuli	<i>Galinsoga parviflora</i>	Asteraceae	11	Herb	Not Evaluated
Bulambuli	<i>Conyza sumatrensis</i>	Asteraceae	8	Herb	Not Evaluated
Bulambuli	<i>Cyperus dives</i>	Cyperaceae	9	Herb	Not Evaluated
Bulambuli	<i>Cyperus odoratus</i>	Cyperaceae	7	Herb	Not Evaluated
Bulambuli	<i>Cyperus digitatus</i>	Cyperaceae	8	Herb	Not Evaluated
Bulambuli	<i>Vernonia brachycalyx</i>	Asteraceae	7	Herb	Not Evaluated
Bulambuli	<i>Ageratum conyzoides</i>	Asteraceae	12	Herb	Not Evaluated
Bulambuli	<i>Setaria pumila</i>	Poaceae	15	Herb	Not Evaluated
Bulambuli	<i>Echinochloa colona</i>	Poaceae	20	Herb	Not Evaluated
Bulambuli	<i>Cyperus difformis</i>	Cyperaceae	15	Herb	Not Evaluated
Bulambuli	<i>Sphenoclea zeylanica</i>	Sphenocleaceae	20	Herb	Not Evaluated
Bulambuli	<i>Eleusine indica</i>	Poaceae	20	Herb	Not Evaluated
Bulambuli	<i>Echinochloa crus-galli</i>	Poaceae	20	Herb	Not Evaluated
Bulambuli	<i>Centella asiatica</i>	Apiaceae	16	Herb	Not Evaluated
Bulambuli	<i>Cyperus esculentus</i>	Cyperaceae	7	Herb	Not Evaluated
Bulambuli	<i>Cyperus rotundus</i>	Cyperaceae	20	Herb	Not Evaluated
Bulambuli	<i>Cyperus javanicus</i>	Cyperaceae	15	Herb	Not Evaluated
Bulambuli	<i>Hibiscus cannabinus</i>	Malvaceae	4	Herb	Not Evaluated
Bulambuli	<i>Chloris gayana</i>	Poaceae	30	Herb	Not Evaluated
Bulambuli	<i>Triumfetta rhomboidea</i>	Malvaceae	5	Herb	Not Evaluated
Bulambuli	<i>Digitaria sanguinalis</i>	Poaceae	30	Herb	Not Evaluated
Nakapiripirit	<i>Ludwigia palustris</i>	Onagraceae	8	Herb	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Nakapiripirit	Cynodon dactylon	Poaceae	30	Herb	Not Evaluated
Nakapiripirit	Heteropogon contortus	Poaceae	30	Herb	Not Evaluated
Nakapiripirit	Abutilon indicum	Malvaceae	5	Herb	Not Evaluated
Nakapiripirit	Senna occidentalis	Fabaceae	6	Herb	Not Evaluated
Nakapiripirit	Trichodesma zeylanicum	Boraginaceae	8	Herb	Not Evaluated
Nakapiripirit	Sorghum halepense	Poaceae	15	Herb	Not Evaluated
Nakapiripirit	Digitaria abyssinica	Poaceae	20	Herb	Not Evaluated
Nakapiripirit	Cyperus odoratus	Cyperaceae	12	Herb	Not Evaluated
Nakapiripirit	Cyperus dives	Cyperaceae	7	Herb	Not Evaluated
Nakapiripirit	Ageratum conyzoides	Asteraceae	9	Herb	Not Evaluated
Nakapiripirit	Amaranthus spinosus	Amaranthaceae	7	Herb	Not Evaluated
Nakapiripirit	Amaranthus hybridus	Amaranthaceae	6	Herb	Not Evaluated
Nakapiripirit	Cyperus digitatus	Cyperaceae	7	Herb	Not Evaluated
Nakapiripirit	Alternanthera sessilis	Amaranthaceae	13	Herb	Not Evaluated
Nakapiripirit	Leersia hexandra	Poaceae	20	Herb	Not Evaluated
Nakapiripirit	Achyranthes aspera	Amaranthaceae	16	Herb	Not Evaluated
Nakapiripirit	Verbesina encelioides	Asteraceae	7	Herb	Not Evaluated
Nakapiripirit	Sida cordifolia	Malvaceae	6	Herb	Not Evaluated
Nakapiripirit	Sida rhombifolia	Malvaceae	9	Herb	Not Evaluated
Nakapiripirit	Eleusine indica	Poaceae	20	Herb	Not Evaluated
Nakapiripirit	Echinochloa colona	Poaceae	20	Herb	Not Evaluated
Katakwi	Pycnus mundii	Cyperaceae	30	Herb	Not Evaluated
Katakwi	Cyperus nudicaulis	Cyperaceae	20	Herb	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Katakwi	Scirpus cubensis	Cyperaceae	15	Herb	Not Evaluated
Bulambuli	Scirpus maritimus	Cyperaceae	6	Herb	Not Evaluated
Kumi	Nymphaea caerulea	Nymphaeaceae	50	Herb	Not Evaluated
Kumi	Salvinia molesta	Salviniaceae	20	Herb	Not Evaluated
Kumi	Salvinia nymphaeula	Salviniaceae	20	Herb	Not Evaluated
Kumi	Potamogeton pectinatus	Potamogetonaceae	30	Herb	Not Evaluated
Kumi	Pontederia cordata	Pontederiaceae	50	Herb	Not Evaluated
Kumi	Justicia flava	Acanthaceae	16	Herb	Not Evaluated
Kumi	Aspilia africana	Asteraceae	9	Herb	Not Evaluated
Kumi	Asystasia gigantea	Acanthaceae	5	Herb	Not Evaluated
Kumi	Chenopodium vulvaria	Amaranthaceae	9	Herb	Not Evaluated
Kumi	Glinus lotoides	Molluginaceae	5	Herb	Not Evaluated
Kumi	Cycnium tubulosum	Orobanchaceae	5	Herb	Not Evaluated
Kumi	Chrozophora brocchiana	Euphorbiaceae	3	Herb	Not Evaluated
Katakwi	Salvinia molesta	Salviniaceae	18	Herb	Not Evaluated
Katakwi	Nymphaea caerulea	Nymphaeaceae	50	Herb	Not Evaluated
Katakwi	Salvinia nymphaeula	Salviniaceae	20	Herb	Not Evaluated
Katakwi	Potamogeton pectinatus	Potamogetonaceae	50	Herb	Not Evaluated
Katakwi	Pontederia cordata	Pontederiaceae	30	Herb	Not Evaluated
Katakwi	Pontederia crassipes	Pontederiaceae	6	Herb	Not Evaluated
Katakwi	Ludwigia peploides	Onagraceae	6	Herb	Not Evaluated
Katakwi	Emilia abyssinica	Asteraceae	6	Herb	Not Evaluated
Nabilatuk	Sphaeranthus africanus	Asteraceae	13	Herb	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Nabilatuk	Chenopodium spp.	Amaranthaceae	3	Herb	Not Evaluated
Nabilatuk	Persicaria affinis	Polygonaceae	4	Herb	Not Evaluated
Nabilatuk	Conyza floribunda	Asteraceae	2	Herb	Not Evaluated
Nabilatuk	Crotalaria spectabilis	Fabaceae	4	Herb	Not Evaluated
Bulambuli	Sphaeranthus africanus	Asteraceae	30	Herb	Not Evaluated
Bulambuli	Persicaria odorata	Polygonaceae	27	Herb	Not Evaluated
Bulambuli	Persicaria minor	Polygonaceae	16	Herb	Not Evaluated
Bulambuli	Persicaria longiseta	Polygonaceae	9	Herb	Not Evaluated
Bulambuli	Persicaria barbata	Polygonaceae	18	Herb	Not Evaluated
Bulambuli	Sida acuta	Malvaceae	7	Herb	Not Evaluated
Bulambuli	Justicia flava	Acanthaceae	22	Herb	Not Evaluated
Bulambuli	Aristolochia elegans	Aristolochiaceae	1	Herb	Not Evaluated
Bulambuli	Hyptis spicigera	Lamiaceae	14	Herb	Not Evaluated
Bulambuli	Ludwigia peploides	Onagraceae	7	Herb	Not Evaluated
Bulambuli	Ludwigia stolonifera	Onagraceae	5	Herb	Not Evaluated
Bulambuli	Emilia abyssinica	Asteraceae	16	Herb	Not Evaluated
Bulambuli	Aspilia africana	Asteraceae	14	Herb	Not Evaluated
Bulambuli	Ipomoea carica	Convolvulaceae	4	Herb	Not Evaluated
Bulambuli	Enhydra fluctuans	Asteraceae	50	Herb	Not Evaluated
Nakapiripirit	Persicaria barbata	Polygonaceae	13	Herb	Not Evaluated
Nakapiripirit	Persicaria glabra	Polygonaceae	5	Herb	Not Evaluated
Nakapiripirit	Sphaeranthus africanus	Asteraceae	9	Herb	Not Evaluated
Nakapiripirit	Aspilia africana	Asteraceae	8	Herb	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Nakapiripirit	Xanthium strumarium	Asteraceae	12	Herb	Not Evaluated
Nakapiripirit	Justicia flava	Acanthaceae	13	Herb	Not Evaluated
Nakapiripirit	Justicia procumbens	Acanthaceae	5	Herb	Not Evaluated
Bukedea	Manihot esculenta	Euphorbiaceae	30	Shrub	Not Evaluated
Bukedea	Lantana camara	Verbenaceae	15	Shrub	Not Evaluated
Bukedea	Chromolaena odorata	Asteraceae	11	Shrub	Not Evaluated
Bukedea	Xanthium strumarium	Asteraceae	7	Shrub	Not Evaluated
Bukedea	Abutilon guineense	Malvaceae	3	Shrub	Not Evaluated
Bukedea	Thelypteris palustris	Thelypteridaceae	4	Shrub	Not Evaluated
Kumi	Solanum incanum	Solanaceae	18	Shrub	Not Evaluated
Kumi	Euphorbia candelabrum	Euphorbiaceae	7	Shrub	Not Evaluated
Kumi	Dracaena trifasciata	Asparagaceae	2	Shrub	Not Evaluated
Kumi	Maytenus senegalensis	Celastraceae	1	Shrub	Not Evaluated
Kumi	Scutia myrtina	Rhamnaceae	1	Shrub	Not Evaluated
Kumi	Opuntia vulgaris	Cactaceae	2	Shrub	Not Evaluated
Katakwi	Agave sisalana	Asparagaceae	6	Shrub	Not Evaluated
Katakwi	Cyphostemma digitatum	Vitaceae	1	Shrub	Not Evaluated
Nabilatuk	Solanum incanum	Solanaceae	19	Shrub	Not Evaluated
Nabilatuk	Solanum nigrum	Solanaceae	4	Shrub	Not Evaluated
Nabilatuk	Buddleja salviifolia	Scrophulariaceae	1	Shrub	Not Evaluated
Bulambuli	Rhoicissus digitatus	Vitaceae	2	Shrub	Not Evaluated
Bulambuli	Salix ceasia	Salicaceae	9	Shrub	Not Evaluated

District	Plant species	Family	Abundance	Growth form	IUCN Status
Bulambuli	Cyphostemma digitatum	Vitaceae	3	Shrub	Not Evaluated
Bulambuli	Vernonia amygdalina	Asteraceae	8	Shrub	Not Evaluated
Bulambuli	Solanum nigrum	Solanaceae	6	Shrub	Not Evaluated
Nakapiripirit	Solanum incanum	Solanaceae	14	Shrub	Not Evaluated
Kumi	Azima tetracantha	Salvadoraceae	6	Shrub	Not Evaluated
Bulambuli	Asparagus africanus	Asparagaceae	2	Shrub	Not Evaluated
Bulambuli	Azima tetracantha	Salvadoraceae	4	Shrub	Not Evaluated
Bulambuli	Ricinus communis	Euphorbiaceae	9	Shrub	Not Evaluated
Bulambuli	Lantana camara	Verbenaceae	9	Shrub	Not Evaluated
Nakapiripirit	Ricinus communis	Euphorbiaceae	6	Shrub	Not Evaluated
Bukedea	Vachellia hockii	Fabaceae	5	Tree	Not Evaluated
Kumi	Senna spectabilis	Fabaceae	7	Tree	Not Evaluated
Kumi	Vachellia hockii	Fabaceae	11	Tree	Not Evaluated
Kumi	Ziziphus mauritiana	Rhamnaceae	3	Tree	Not Evaluated
Katakwi	Vachellia hockii	Fabaceae	1	Tree	Not Evaluated
Nabilatuk	Vachellia hockii	Fabaceae	11	Tree	Not Evaluated
Bulambuli	Vachellia hockii	Fabaceae	9	Tree	Not Evaluated
Nakapiripirit	Vachellia hockii	Fabaceae	4	Tree	Not Evaluated
Nakapiripirit	Albizia julibrissin	Fabaceae	1	Tree	Not Evaluated
Bukedea	Eucalyptus camaldulensis	Myrtaceae	30	Tree	Near Threatened
Kumi	Eucalyptus camaldulensis	Myrtaceae	3	Tree	Near Threatened



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Extracting Sustainability

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