

The Association of Wetland Utilization on Community Livelihoods Near the Peri-Urban Wetland: A Case of Kyetinda and Mabamba Wetlands

Petrolina Mukasa Athieno¹, Ronald Twongyirwe¹, John Bosco Nkurunungi²

¹Faculty of Interdisciplinary Studies, Mbarara University of Science and Technology, Mbarara, Uganda

²Faculty of Biology, Mbarara University of Science and Technology, Mbarara, Uganda

Email: athienoton@gmail.com

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Abstract

The study examined the association of wetland utilization on community livelihoods around Kyetinda and Mabamba wetlands in Uganda. A cross-sectional mixed-methods approach was applied, incorporating regression, correlation, ANOVA, and chi-square tests to assess the relationship between wetland utilization and community livelihoods. Quantitative data were obtained from 209 respondents in Kyetinda and 161 in Mabamba, and analysed at the 5% significance level using SPSS. Findings revealed a weak but positive and statistically significant relationship between wetland utilization and community livelihoods in Kyetinda Wetland ($r = 0.171$, $p = 0.013$; $\beta = 0.171$, and $p\text{-value} = 0.13$). The regression model ($R^2 = 0.029$) indicated that wetland utilization explains 2.9% of livelihood variation, with an F-value of 6.264 ($p = 0.013$), confirming model significance. The chi-square test ($\chi^2 = 99.316$, $p = 0.000$) reinforced this relationship, suggesting that wetland-based activities contribute modestly but significantly to household welfare. Conversely, results from Mabamba Wetland showed a weak negative and statistically insignificant relationship ($r = -0.047$, $r^2 = 0.002$, $\beta = -0.047$ and $p\text{-value} = 0.555$), implying that wetland utilization does not substantially have a perceived association with livelihoods in this area despite a significant chi-square association ($\chi^2 = 74.000$, $p = 0.000$). Structural Equation Modelling (SEM) was done to check the complex relationship between variables (wetland utilization on community livelihood). Overall, wetland utilization significantly enhances community livelihoods in Kyetinda but not in Mabamba. These differences highlight the perceived association of localised socio-economic dynamics, levels of dependency, and management practices on how wetlands contribute to house-

hold welfare. The findings suggest that sustainable and context-specific utilization strategies are essential to maximize livelihood benefits while maintaining ecological balance.

Keywords

Wetland Utilization, Community Livelihoods, Socio-Economic Dynamics

1. Introduction

Wetlands are vital ecosystems that provide a broad array of ecosystem services such as water purification, flood regulation, carbon sequestration, and biodiversity conservation. Globally, wetlands are estimated to cover 570 million hectares (5.7 million km²) about 6% of the Earth's surface [1]. Wetlands play an essential role in sustaining biodiversity by supporting various plant and animal species, particularly migratory birds, while mitigating climate change by absorbing and storing carbon [2] [3]. Despite their global significance, wetlands worldwide have been subject to extensive degradation over the past century, driven by human activities such as agricultural expansion, urbanisation, and industrial development [3].

In Europe and Asia, wetlands face significant threats from human activities such as pollution, land reclamation, and unsustainable agriculture, yet countries have made notable efforts to conserve these vital ecosystems. In Europe, wetlands like the Danube Delta are crucial for biodiversity and local economies [4] but have been associated with agricultural expansion, pollution, and land reclamation [5]. In response, the European Union has implemented conservation initiatives such as the Nature 2000 network and policies focused on wetland restoration. Similarly, according to [6], wetlands like the Mekong Delta support millions of people through fishing and agriculture but are threatened by industrial expansion, dam construction, and pollution. Despite these challenges, countries in both regions have adopted policies and frameworks for sustainable wetland management, underscoring the need for effective conservation strategies that balance ecological protection with the socio-economic needs of local communities.

In Africa, wetlands are integral to the socio-economic fabric of many local communities. Wetlands support livelihoods through activities like fishing, farming, and the collection of wetland resources such as papyrus and medicinal plants, water balance, groundwater recharge, flood mitigation, storm protection, cultural and social functions like sacred and religious significance, recreation and tourism, and soil formation and sediment retention [7]-[10]. Reports indicate that wetlands have been converted into farmland to increase food thus solving the food challenges within this region [11] [12], while other reports state that wetland conversions for farming, settlement brick making provide more monetary benefits, [13]. Wetlands are home to diverse and ecologically significant ecosystems, providing critical services to millions of people. However, African wetlands are

increasingly threatened by anthropogenic pressures, including population growth, land conversion, and climate change associations [14]. For example, in the Niger Delta of Nigeria, the extensive exploitation of wetlands for oil extraction has led to environmental and socio-economic consequences, affecting both the environment and local livelihoods [12] [15]. Similarly, in Kenya, Lake Naivasha's wetlands have faced challenges due to horticultural activities that have resulted in habitat loss and water pollution [16]. African countries have recognized the importance of wetland conservation, with many wetlands designated as Wetlands of International Importance under the Ramsar Convention. While [17] note that even though the wetland is utilised for the community's livelihood, it develops changes ie grazing will affect the vegetation structure and composition, which will also disturb the wetland's hydrology, and settlement will cause the disappearance of the wetland ecosystem.

In Uganda, wetlands cover approximately 13% of the country's total land area, amounting to about 30,105 square kilometres [18]. These wetlands are crucial for sustaining biodiversity, supporting agriculture, and providing water resources [19], socio-cultural assets, playing a role in climate change mitigation [20], recreation and ecotourism [21]. However, wetlands in Uganda, just like elsewhere, have faced significant challenges, primarily due to agricultural expansion, urban development, and unsustainable resource extraction [19] [22]. Wetland degradation in Uganda has been notable, with a significant decline in wetland coverage, from 15.5% in 1994 to 8.4% by 2019 [23]. The loss of wetland ecosystems threatens the livelihoods of communities that rely on these wetlands for fishing, farming, and the collection of products such as papyrus reeds and medicinal plants [24]. Despite policies and regulations aimed at conserving wetlands, there is a gap in understanding the socio-economic association of wetland degradation on local communities as noted by these authors [25] [26]. The Ugandan government has initiated several policies, like [27] [28], Wetlands still face several challenges.

The study focused specifically on Kyetinda and Mabamba Wetlands, located in Central Uganda. These wetlands play an essential role in supporting the livelihoods of surrounding communities, who rely on them for agriculture, fishing, and the harvesting of wetland resources [29]. The communities living near Kyetinda and Mabamba Wetlands are heavily dependent on the resources these ecosystems provide, which include water for irrigation, food from fishing, and materials for construction and handicrafts. However, increasing pressures from agricultural expansion, urbanization, and unregulated resource extraction have resulted in the degradation of these wetlands, diminishing the resources available to local people and threatening their livelihoods [26] [30].

Kyetinda and Mabamba Wetlands have historically supported the local economy, but as human activities increase, the wetlands face mounting threats. The balance between utilizing these ecosystems for sustenance and ensuring their long-term conservation has become increasingly difficult to maintain. Wetland degradation is manifesting in the form of habitat loss, reduced water quality, and

a decline in biodiversity, which directly affects the livelihoods of the local populations [30]. There is an urgent need to understand how these wetlands can be utilized sustainably while also preserving their ecological functions.

This study assessed wetland utilization around Kyetinda and Mabamba Wetlands in Central Uganda, highlighting the significant role of wetlands in supporting local community livelihoods. Wetlands are crucial for biodiversity but are threatened by human activities such as urbanization, agriculture, and infrastructure expansion, which lead to encroachment and habitat degradation. By 2000, Uganda had approximately 30,000 km² of wetlands, but due to human activities, wetlands have decreased by 25%, with an estimated 30,105 km² now covering 10.9% of the country's total area [18] [31]. The [23] reported that Uganda loses an average of 50,000 hectares of wetlands annually. Wetland cover declined from 15.5% in 1994 to 8.4% in 2019 [23]. The study revealed that wetland utilization in the region was generally moderate to positive, with a mean score of 3.15 and a median of 3.10, reflecting the importance of wetlands for community livelihoods. The standard deviation of 0.448 and variance of 0.201 suggested consistency in responses, while the slight positive skewness (0.066) and low kurtosis (0.040) indicated a nearly normal distribution of responses. The range of responses (1.60 to 4.60) and a mode of 3.00 further indicated a clustering of opinions around the average, suggesting a common understanding of the role of wetlands in supporting local economic activities. Despite the critical dependence on wetland resources, concerns about sustainability necessitate the implementation of conservation measures to prevent further environmental degradation. This study aligns with Ramsar's 4th Strategic Plan (2016-2024), Sustainable Development Goals 6 and 14 and National Wetland Policies (1995 and 2017), highlighting the need for urgent action to balance wetland utilization, conservation, and community livelihoods [27] [28].

To investigate the perceived Association of Wetland Utilization on Community Livelihoods near the peri-urban wetland: A Case of Kyetinda and Mabamba Wetlands.

This study looked at the association of wetland utilisation with the agricultural and fishing activities of communities around Kyetinda and Mabamba Wetlands. This study had a comprehensive 33-year period from 1990 to 2023, providing a substantial timeframe to assess and analyze the long-term associations of various activities on the Kyetinda and Mabamba Wetlands. The extended duration allowed for a thorough examination of how these wetlands have been affected by human activities and conservation efforts over the past three decades, enabling a clear determination of whether the association was positive or negative. The study was limited to two wetlands around Lake Victoria, which include: Mabamba and Kyetinda wetlands. Mabamba wetland is located partly in Wakiso district, approximately 9 Km southwest of Kasanje Trading Centre. It's accessible through the road that leaves Kasanje Trading Centre towards the Bunjo canoe ferry. Mabamba wetland covers an area of 55.1 Km², and is a permanent swamp, set in its setting a

rural area. In the Mabamba wetland, the study was carried out in Zziba and Bussi parishes. While Kyetinda Wetland is located in Kampala Capital City, Makindye Division, approximately 9 Km southeast of Kampala City Centre, it's accessible on Gaba and Salaama roads. The nearby villages include Katuuso, Kirudu, Gaba, and Salaama, and all these were included in the study. Kyetinda wetland covers an area of 1.43 Km², it's a permanent and seasonal swamp and is in its setting, an urban area. The study in Kyetinda (Ggaba wetland) has eleven zones, but the study was limited to two zones that are nearest to the wetland: the Katongo (Katogo) Zone and the Sendanwula Zone.

1.1. Justification

This study is crucial as it highlights the essential role of Kyetinda and Mabamba Wetlands in supporting the livelihoods of local communities, particularly through activities such as agriculture, fishing, and other resource-based practices. However, rapid urbanization, agricultural encroachment, pollution, and over-exploitation of wetland resources have created growing concerns about the future of these wetlands and their ability to continue providing vital ecosystem services. This research aims to fill the gap in knowledge regarding the association of wetland utilisation with the socio-economic conditions of surrounding communities. The outcomes will provide critical data to inform policies, enhance wetland management, and promote sustainable conservation practices that protect these ecosystems while supporting the communities that depend on them for their livelihoods.

1.2. Study Significance

This study will be significant in the following ways: a) it establishes the uniform wetland dependence between the two wetlands, Kyetinda wetland (urban area), which acts as a primary survival mechanism for the urban poor, while Mabamba wetland (Rural area), whose traditional functions have been limited because of its status as a Ramsar site. b) The study quantified that minimal wetland utilisations explained city livelihood variation, which showed that a margin that could prevent absolute poverty in the informal settlement by close to 2.9%. c) By a time span from 1990-2023 (33 years), this study provided new data on how rapid urbanisation near Lake Victoria has changed the functional value of the wetland from ecosystems to space for survival.

2. Literature Review

Wetlands in Uganda play a pivotal role in enhancing community livelihoods through various economic activities, notably agriculture and aquaculture. Utilizing wetlands for crop farming, especially paddy rice cultivation, significantly contributes to the local economy, providing a staple food source and income for many households. The fertility of wetland soils offers opportunities for year-round cultivation, bolstering food security and economic stability. However, the use of agrochemicals in these areas poses environmental risks, necessitating regulated

farming practices to preserve the ecological balance [17] [31].

Beyond agriculture, wetlands offer resources such as grass mulch, vital for moisture retention and soil fertility in banana plantations. This practice not only enhances agricultural productivity but also supports livestock farming by providing fodder, particularly during drought periods, thereby contributing to food security [32]. Nevertheless, overgrazing in wetlands leads to soil compaction and vegetation loss, highlighting the need for sustainable grazing practices to maintain wetland health [33] [34].

Wetlands also serve as crucial water sources for livestock, especially during dry seasons. However, uncontrolled livestock watering can cause bank destabilization and increased erosion, adversely affecting water quality [35]. Implementing alternative watering facilities and controlled grazing can mitigate these negative associations, ensuring the sustainability of wetland ecosystems [36] [37]. The economic value of wetlands extends to the extraction of natural resources like timber and non-timber forest products (NTFPs) [38] [39]. highlighted sustainable harvesting practices provide income and employment opportunities for local communities, fostering economic development while maintaining ecological integrity. However, overexploitation poses threats to wetland ecosystems, necessitating balanced resource management strategies [32].

Ecotourism is another avenue through which wetlands bolster community livelihoods. Activities such as birdwatching, boating, and nature walks attract visitors, generating revenue and creating employment opportunities as highlighted by the following authors [40] [35]. This economic activity raises awareness about wetland conservation, fostering a sense of stewardship among tourists and locals alike. However, unregulated tourism can lead to habitat disturbance, underscoring the importance of sustainable tourism practices [41]-[43].

Recognizing the multifaceted value of wetlands, the Ugandan government has officially gazetted all wetlands, committing to their protection and sustainable use as noted by [44] [45]. This legal recognition aims to prevent encroachment, pollution, and unsustainable exploitation, ensuring that wetlands continue to provide essential services such as water purification, flood regulation, and biodiversity conservation [19]. This initiative aligns with global environmental goals, demonstrating that environmental protection and economic prosperity can coexist [46].

3. Methodology

This study adopted a cross-sectional mixed research design where quantitative and qualitative data was collected at single points of time in the communities near Kyetinda and Mabamba wetlands. Although the study mentions a period of 1990 to 2023, these were used as a contextual background, for the sake of longitudinal observations. positivism and pragmatism research philosophies.

3.1. Study Area

Kyetinda Wetland is situated in Makindye Division, approximately 9 Km southeast

of Kampala's city center. It can be reached via Ggaba and Salaam roads and is near the villages of Katuuso, Kirudu, Ggaba, and Salaam. The Mabamba wetland system, designated as a Ramsar site, is located in the Wakiso and Mpigi districts of Central Uganda, at coordinates 00°07'N 032°21'E. It lies 55 Km from Kampala, accessible via the Nateete-Nakawuka road, Kyetinda wetland, covering an area of 1.43 square kilometres, which includes both permanent and seasonal wetlands (see **Figure 1**).

3.1.1. Map of Kyetinda and Mabamba Wetlands and Their Location

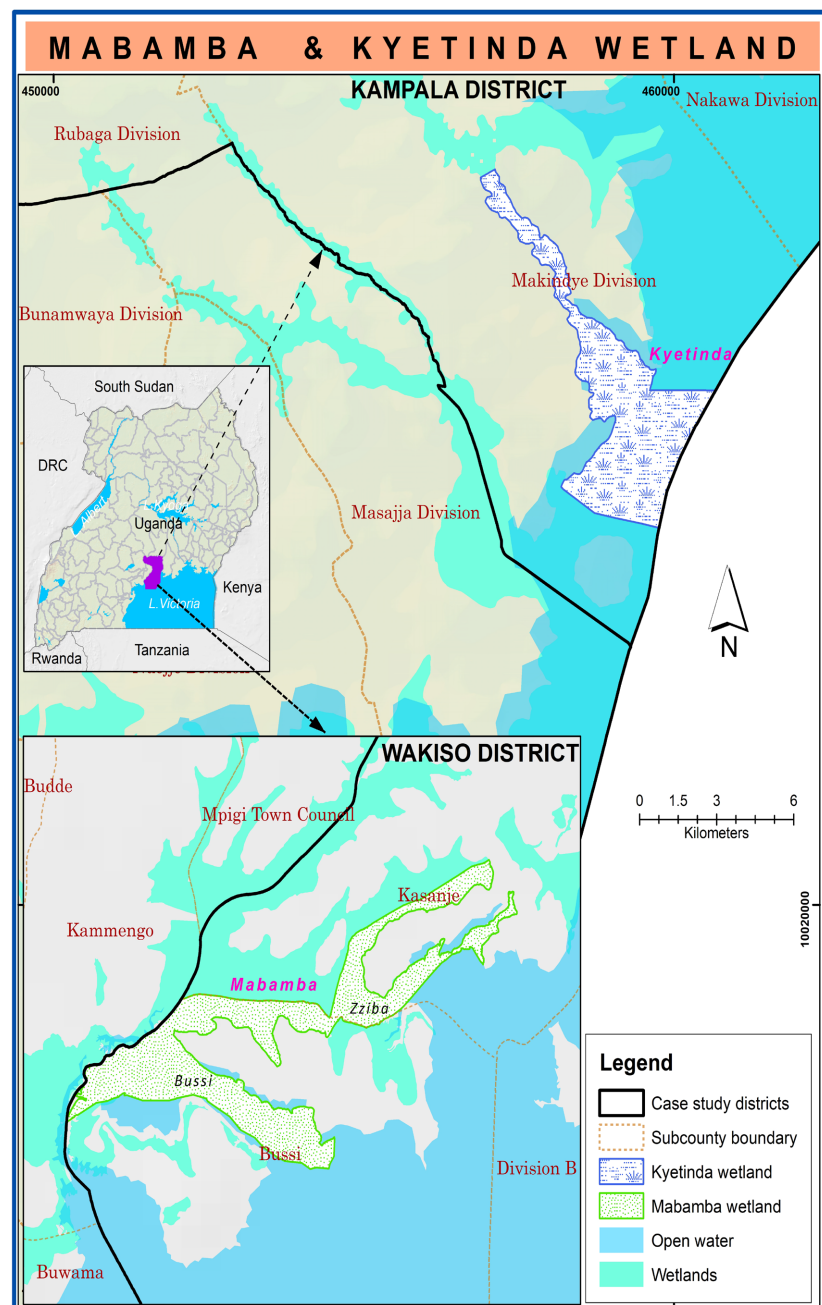


Figure 1. Study locations (Mabamba and Kyetinda Wetlands). [Source; Primary Data from GIS @2023]

3.1.2. Study Area Characteristics

The study area was characterized using spatial information from Kyetinda and Mabamba wetlands, including wetland extent, proximity to settlements, accessibility (e.g., road networks and island locations such as Bussi), land use patterns (agriculture, fishing, and settlement), and surrounding environmental features such as open water bodies and vegetation. The analytical framework was adapted to reflect the study context, integrating spatial characteristics of Kyetinda and Mabamba wetlands with socio-economic data on wetland utilization and livelihoods. This study employed statistical and comparative analyses to examine how spatial and institutional differences influence livelihood outcomes.

3.2. Study Population

According to the Area Chairpersons Local Council 1 in 2023, the population of the Kyetinda wetland (Kitogo and Ssedawula Zones) was 2000 individuals, while the Mabamba wetland 600 individuals. Therefore, the study used Taro Yamane's formula for sample determination expressed as $n = N/(1 + N * e^2)$, where “ n ” represents the sample size, “ N ” the population size, and “ e ” the desired margin of error. Sample size determination for Kyetinda, considering the population of 2000 people living within a radius of 250 meters from the water catchment area.

$$n = \frac{N}{1 + Ne^2}$$

The study, therefore, sampled 540 respondents with a Kyetinda Wetland sample population of 310 and Mabamba Wetland, with a population of 240 out of a total population of 2600 (Kyetinda Wetland, 2000 and Mabamba Wetland, 600).

3.2.1. Summary of the Participants

Participants summarised that Kyetinda wetland (Katongo and Ssendawula Zones) had a population of 2000 individuals when calculated 310, while Mabamba wetland (Zziba and Bussi) had 600 individuals, as calculated by the Yamane sampling, 240 were expected. And the 13 key respondents who included Ministry of Water and Environment (Wetland Department Officials -Luzira) (5), Local council staff (6), Catholic Church (2).

The study initially planned a spatial sampling of households within a 250-meter buffer of Kyetinda and Mabamba wetlands, selecting one knowledgeable adult per household. However, unexpected flooding, restricted access, fenced properties, poor transport, and security measures disrupted the planned framework. Consequently, the study adopted a non-probability approach, combining convenience and purposive sampling, targeting accessible and willing adult residents knowledgeable about wetland use and livelihoods. The final sample included 209 respondents in Kyetinda (planned 310) and 161 in Mabamba (planned 240), reduced due to flooding, temporary migration, and seasonal constraints. Despite deviations from the original design, the approach was appropriate given field challenges, ensuring safety and feasible data collection, though it may limit full representation of all households within the buffer zones.

3.2.2. Data Collection Tools and Analysis

This study employed a cross-sectional mixed-methods approach to examine wetland utilization and its effects on community livelihoods in Kyetinda and Mabamba peri-urban wetlands. Data were collected via structured questionnaires, semi-structured interviews, and field observations, enabling methodological triangulation. Wetland utilization was assessed through dominant activities, spatial analysis, and composite indices, while livelihood outcomes included income, food security, and employment. Quantitative data were analyzed using descriptive (frequencies, means, SDs) and inferential statistics (correlation, regression), and qualitative data underwent thematic analysis. Structural Equation Modelling (SEM) in SPSS and AMOS captured complex relationships, modeling wetland utilization and community livelihoods as latent constructs (WU2-WU10; CL1-CL10), with measurement and structural models validated and fit assessed via χ^2 , CFI, TLI, RMSEA, and SRMR.

4. Results

This section presents the results of the study that was analyzed from the data collected in the field. The data was collected using both quantitative and qualitative methods.

4.1. Quantitative Analysis

Table 11. Descriptive statistics for wetland utilization on the livelihoods of communities surrounding Kyetinda and Mabamba Wetlands.

Variable Description	SD	D	NS	A	SA	Means
The intensity of wetland resource utilization by my household is large	41 (11.1%)	35 (9.5%)	15 (4.1%)	85 (23.0%)	194 (52.4%)	3.96
Agricultural activities in wetlands contribute significantly to the community's livelihood	60 (16.2%)	60 (16.2%)	35 (9.5%)	98 (26.5%)	117 (31.6%)	3.41
Access to water from wetlands is crucial for meeting the basic needs of the community	101 (27.3%)	116 (31.4%)	20 (5.4%)	80 (21.6%)	53 (14.3%)	2.64
My household utilizes wetland resources and activities with high frequency	200 (54.1%)	70 (18.9%)	12 (3.2%)	50 (13.5%)	38 (10.3%)	2.07
Thoughtful infrastructure development in wetlands can enhance the overall well-being of the community	27 (7.3%)	56 (15.1%)	25 (6.8%)	190 (51.4%)	72 (19.5%)	3.61
I am aware of infrastructure or development projects in the wetlands that have positively association our community	133 (35.9%)	89 (24.1%)	30 (8.1%)	54 (14.6%)	64 (17.3%)	2.53
I have witnessed infrastructure or development projects in the wetlands that have hurt our community	124 (33.5%)	90 (24.3%)	12 (3.2%)	62 (16.8%)	82 (22.2%)	2.70
The balance between agricultural activities and wetland conservation efforts greatly influences the community's long-term prosperity	54 (14.6%)	46 (12.4%)	33 (8.9%)	97 (26.2%)	140 (37.8%)	3.60

Continued

Conserving wetlands as a water source enhances the resilience of the community to climate variability	84 (22.7%)	60 (16.2%)	25 (6.8%)	86 (23.2%)	115 (31.1%)	3.24
Community involvement in wetland management fosters a sense of ownership and benefits for all	29 (7.8%)	62 (16.8%)	18 (4.9%)	130 (35.1%)	131 (35.4%)	3.74

Key: (SD) = Strongly Disagree, (D) = Disagree, (NS) = Not Sure, (A) = Agree, and (SA) = Strongly Agree.

Comparative Analysis of Study Sites

Descriptive statistics (**Table 1**) show that respondents perceive wetlands as important for livelihoods (mean = 2.86; SD = 0.402), though spatial differences exist. Kyetinda, near Kampala, has higher accessibility and intensive use (mean = 3.96), while remote Mabamba, including Bussi Island and Zziba, shows lower utilization due to distance and conservation restrictions. Daily use is limited in both sites (mean = 2.07), with agriculture contributing more in Kyetinda (mean = 3.41) than in Mabamba, where environmental constraints reduce its impact. Wetland water access is low (mean = 2.64), infrastructure is better perceived in Kyetinda (mean = 3.61 vs. 2.53), and climate resilience benefits are moderately recognized (mean = 3.24). Community participation is valued in both sites (mean = 3.74). Overall, accessibility, remoteness, flooding, and conservation priorities shape utilization and livelihood outcomes, highlighting the need for site-specific management strategies.

Table 2. Regression model summary for the association of wetland utilization on community livelihoods in Kyetinda and Mabamba wetlands.

Regression Model Summary (Kyetinda Wetland)					Regression Model Summary (Mabamba Wetland)				
Model	R	R Square	Adjusted R-Square	Std. Error of the Estimate	Model	R	R Square	Adjusted R-Square	Std. Error of the Estimate
1	0.171 ^a	0.029	0.025	4.920	1	0.047 ^a	0.002	−0.004	4.63784
^a . Predictors: (Constant), Wetland Utilization					^a . Predictors: (Constant), Wetland Utilization				

Source: Primary Data, 2023.

The regression model (**Table 2**) above examined the relationship between wetland utilization and community livelihoods in Kyetinda Wetland and Mabamba Wetland, showing weak associations in both sites.

In Kyetinda, a weak positive relationship is observed ($R = 0.171$; $R^2 = 0.029$; Adj. $R^2 = 0.025$), indicating that wetland utilization explains only 2.9% of livelihood variation. In Mabamba, the relationship is negligible ($R = 0.047$; $R^2 = 0.002$; Adj. $R^2 = -0.004$), showing no meaningful predictive power.

Comparatively, Kyetinda's proximity to Kampala increases accessibility and resource use, while Mabamba's remoteness, conservation zoning, and areas such as Bussi Island limit utilization. Standard errors (4.920; 4.638) indicate moderate

variation but weak prediction.

Overall, wetland utilization has a weak influence on livelihoods, slightly stronger in Kyetinda and negligible in Mabamba suggesting other socio-economic and environmental factors are more important.

Table 3. ANOVA results for the association of wetland utilisation on community livelihoods in Kyetinda and Mabamba Wetlands.

ANOVA ^a (KYETINDA WETLAND)						ANOVA ^a (MABAMBA WETLAND)					
MODEL	Sum of Squares	Df	Mean Square	F	p-value	Model	Sum of Squares	df	Mean Square	F	p-value.
Regression	151.649	1	151.649	6.264	0.013b	Regression	7.541	1	7.541	0.351	0.555 ^b
N1 Residual	5011.595	207	24.211			N1 Residual	3420.024	159	21.510		
Total	5163.244	208				Total	3427.565	160			
^a . dependent variable: community livelihoods						^a . Dependent Variable: Community Livelihoods					
^b . predictors: (constant), wetland utilization						^b . Predictors: (Constant), Wetland Utilization					

Source: Primary Data 2023.

Comparative ANOVA Analysis of Wetland Utilization and Livelihoods

ANOVA tested whether differences in wetland utilization affected community livelihoods. In Kyetinda Wetland, the model was significant ($F = 6.264$, $p = 0.013$; $R^2 = 0.029$), indicating that wetland use influences livelihoods modestly. In Mabamba Wetland, the model was not significant ($F = 0.351$, $p = 0.555$; $R^2 = 0.002$), showing minimal predictive power, as seen in **Table 3** above. Comparatively, Kyetinda's higher accessibility and economic integration support measurable livelihood effects, whereas Mabamba's remoteness, conservation zones, and island locations (e.g., Bussi Island) limit wetland influence. These findings highlight the role of spatial context: wetland utilization is significant but weak in peri-urban Kyetinda and negligible in remote, conservation-sensitive Mabamba, emphasizing the need for site-specific resource management.

Table 4. Regression coefficients for the association of wetland utilization on community livelihoods in Kyetinda and Mabamba wetlands side by side.

TABLE 4: REGRESSION COEFFICIENTS (KYETINDA WETLAND)						REGRESSION COEFFICIENTS (MABAMBA WETLAND)					
MODEL	Unstandardized Coefficients		Standardized Coefficients	t	Sig	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std. Error	Beta				B	Std. Error	Beta		
1	(Constant)	21.980	2.475	8.882	0.000	(Constant)	33.049	2.532		13.052	0.000
	Wetland Utilization	0.196	0.078	0.171	2.503	0.013	Wetland Utilization	-0.047	0.079	-0.047	-0.592
A. DEPENDENT VARIABLE: WETLAND UTILIZATION						a. Dependent Variable: Community Livelihoods					

Source: Primary Data, 2023.

Linear Regression Analysis of Wetland Utilization and Livelihoods

Linear regression (Table 4) examined the effect of wetland utilization on community livelihoods in Kyetinda Wetland and Mabamba Wetland.

In Kyetinda, wetland utilization positively influenced livelihoods ($B = 0.196$; $\beta = 0.171$; $t = 2.503$; $p = 0.013$), indicating that a one-unit increase in utilization raises livelihood outcomes by 0.196 units. The effect is weak but statistically significant, reflecting modest contributions to household and community welfare. In Mabamba, the relationship was negative and non-significant ($B = -0.047$; $\beta = -0.047$; $t = -0.592$; $p = 0.555$), showing negligible influence of wetland use on livelihoods. The null hypothesis of no effect could not be rejected.

Comparatively, Kyetinda's proximity to Kampala and dense settlements enhance resource access and utilization, translating into measurable livelihood benefits. Mabamba's remoteness, conservation zones, and areas such as Bussi Island limit resource extraction, explaining the lack of significant association.

These results indicate that wetland utilization's predictive power is context-dependent: modestly significant in peri-urban Kyetinda and negligible in remote, conservation-sensitive Mabamba. The findings align with correlation and ANOVA results, emphasizing the importance of site-specific management strategies. From a natural resource perspective, sustainable utilization in Kyetinda can support livelihoods without degrading wetlands, while Mabamba requires conservation-compatible strategies that minimize direct resource extraction. Overall, the regression analysis underscores the spatially differentiated role of wetlands in community welfare.

Table 5. Pearson correlation between wetland utilization and community livelihoods in Kyetinda and Mabamba Wetlands.

PEARSON CORRELATION BETWEEN WETLAND UTILIZATION AND COMMUNITY LIVELIHOODS IN KYETINDA WETLAND				PEARSON CORRELATION BETWEEN WETLAND UTILIZATION AND COMMUNITY LIVELIHOODS IN (MABAMBA WETLAND)			
		Wetland Utilization	Community Livelihoods			Wetland Utilization.	Community Livelihoods.
WETLAND UTILIZATION	<i>Pearson Correlation</i>	1	0.171*	Wetland Utilization.	Pearson Correlation	1	-0.047
	<i>Sig. (2-tailed)</i>		0.013		Sig. (2-tailed)		0.555
	<i>N</i>	209	209		<i>N</i>	161	161
COMMUNITY LIVELIHOODS	<i>Pearson Correlation</i>	0.171*	1	Community Livelihoods.	Pearson Correlation	-0.047	1
	<i>Sig. (2-tailed)</i>	0.013			Sig. (2-tailed)	0.555	
	<i>N</i>	209	209		<i>N</i>	161	161
*. CORRELATION IS SIGNIFICANT AT THE 0.05 LEVEL (2-TAILED).				*. Correlation is significant at the 0.05 level (2-tailed).			

Source: Primary Data 2023.

Pearson correlation (**Table 5**) assessed the link between wetland utilization and community livelihoods in Kyetinda Wetland and Mabamba Wetland.

In Kyetinda, results show a weak but positive and significant association ($r = 0.171$, $p = 0.013$), indicating that increased wetland use is modestly linked to improved livelihoods. The low correlation suggests that other factors also influence outcomes. In Mabamba, the relationship is very weak and negative ($r = -0.047$, $p = 0.555$), showing negligible impact of wetland utilization on livelihoods.

Comparatively, Kyetinda's proximity to Kampala, higher accessibility, and intensive resource use translate into modest livelihood gains. Mabamba's remoteness, conservation zones, and areas such as Bussi Island limit resource extraction and benefits. These findings highlight the role of spatial and contextual factors: peri-urban wetlands like Kyetinda support livelihoods through accessible resource use, while remote, protected wetlands like Mabamba show minimal direct benefits.

Wetland utilization is a weak but significant contributor to livelihoods in Kyetinda and negligible in Mabamba. This underscores the need for site-specific management: sustainable use in Kyetinda can enhance welfare, whereas Mabamba requires conservation-compatible strategies. The results also suggest that other socio-economic and environmental factors are more influential in shaping livelihoods, particularly in remote or protected wetlands. In conclusion, Pearson correlation confirms that wetland utilization modestly supports livelihoods in peri-urban areas but has limited impact in remote, conservation-focused sites, emphasizing context-specific planning for resource management.

Table 6. Chi-square test of the relationship between wetland utilization and community livelihoods in Kyetinda and Mabamba Wetlands.

TEST STATISTICS									
Chi-square Test of the relationship between Wetland Utilization and community Livelihoods in Kyetinda Wetland			Wetland Utilization	Community Livelihoods	Chi-Square Test of the Relationship between Wetland Utilization and Community Livelihoods in Mabamba Wetland			Wetland Utilization	Community Livelihoods
Chi-square			99.316 ^a	150.928 ^c	Chi-Square			74.000 ^a	65.149 ^c
Df			21	24	Df			22	21
Asymp. sig.			0.000	0.000	Asymp. Sig.			0.000	0.000
Sig			0.000 ^b	Monte Carlo Sig.	Sig			0.000 ^b	0.000 ^b
Monte carloCSig.	95% Confidence Interval	Lower Bound	0.000	0.000	Monte Carlo Sig.	95% Confidence Interval	Lower Bound	0.000	0.000
		Upper Bound	0.000	0.0			Upper Bound	0.000	0.000
^a . 0 cells (0.0%) have expected frequencies less than 5. the minimum expected cell frequency is 9.5.					^a . 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 7.0.				

Continued

^b. based on 10000 sampled tables with starting seed 2000000.^b. **BASED ON 10000 SAMPLED TABLES WITH STARTING SEED 1502173562.**^c. 0 cells (0.0%) have expected frequencies less than 5. the minimum expected cell frequency is 8.4.^c. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 7.3.

Source: Primary Data 2023.

Chi-Square tests (**Table 6**) examined associations between categorical wetland utilization (low, moderate, high) and community livelihoods.

In Kyetinda Wetland, wetland utilization ($\chi^2 = 99.316$, $df = 21$, $p < 0.001$) and livelihoods ($\chi^2 = 150.928$, $df = 24$, $p < 0.001$) were significant, confirmed by Monte Carlo simulations (95% CI: 0.000 - 0.000). These results align with correlation ($r = 0.171$, $p = 0.013$) and regression ($\beta = 0.171$, $p = 0.013$) analyses, showing that wetland use modestly supports livelihoods. The null hypothesis (H_0) of no association is rejected. In Mabamba Wetland, Chi-Square results also show statistical significance (wetland: $\chi^2 = 74.000$, $df = 22$, $p < 0.001$; livelihoods: $\chi^2 = 65.149$, $df = 21$, $p < 0.001$) with robust Monte Carlo support. However, regression ($\beta = -0.047$, $p = 0.555$) and ANOVA ($F = 0.351$, $p = 0.555$) indicate no meaningful effect on livelihoods. Thus, H_0 cannot be rejected, and wetland utilization alone does not substantially influence community welfare.

Comparatively, Kyetinda shows a modest positive influence of wetland use on livelihoods due to higher accessibility, a peri-urban setting, and intensive resource use. Mabamba shows negligible impact, reflecting restricted access, conservation zoning, and spatial constraints such as remoteness and Bussi Island. Overall, hypothesis testing confirms that wetland utilization modestly supports livelihoods in Kyetinda but not in Mabamba, emphasizing the importance of socio-economic context and the need for site-specific management strategies.

4.2. Qualitative Analysis

This is for qualitative data collected through the interviews and texts collected from the key respondents in the association of wetland utilization and community livelihood. Themes were generated and used accordingly.

Table 7. Thematic content analysis of qualitative results for Wetland utilization and community livelihood.

Themes	Narrative	Inference
Biodiversity Association	<i>Wetland degradation affects the development of organisms forming the food web and biodiversity.</i>	Wetland degradation is directly associated with the development and diversity of organisms essential to the wetland's food web. Declines in biodiversity within wetlands signify potential disruptions to ecosystem functions and resilience. Protecting wetland habitats is important to maintaining a balanced and diverse ecosystem for various species to thrive.

Continued

Water Pollution and Quality	<i>Increased pollutants in water, changes in color indicating pollution</i>	Elevated levels of pollutants and noticeable changes in water colour signal deteriorating water quality, posing threats to aquatic life and human use.
Ecosystem Health Degradation	<i>Wetland degradation affects ecosystem health, leading to increased flooding.</i>	Degraded wetland health contributes to ecosystem instability, manifested by increased flooding events, disrupting the natural equilibrium.
Association on Wetland Functions	<i>Deterioration of wetland ecosystem health affects, functions like carbon sequestration, flood control, and habitat sources.</i>	The decline in wetland health compromises essential functions such as carbon sequestration, flood regulation, and habitat provision, associated ecosystem resilience and sustainability.
Government Legislation and Policies	<i>Mention of the National Environment Act 5, 2019, restricting wetland reclamation, drainage, and construction.</i>	The National Environment Act 5, 2019, reflects government efforts to preserve wetlands by regulating activities like reclamation, drainage, and construction, aiming to safeguard these vital ecosystems.
Effectiveness of Policies	<i>Mixed adherence to policies by communities hinders effective implementation.</i>	The mixed adherence to policies among communities suggests challenges in effectively implementing and enforcing wetland conservation regulations, requiring enhanced awareness and enforcement mechanisms.
Community-led Wetland Management Plans	<i>Mention of specific community-based wetland management plans</i>	Community-led wetland management plans highlight the importance of local engagement and collaboration in conserving and sustainably managing wetland resources, and perceived influence or association with community knowledge and commitment.
Future Projections for Wetland Utilization	<i>Conservation or transformation of wetlands into ecological parks for tourism to reduce encroachment.</i>	Future projections indicate a shift towards conservation-oriented approaches, considering the transformation of wetlands into ecological parks for tourism as a strategy to mitigate encroachment and promote eco-friendly utilization.

Source: Primary data 2023.

Thematic analysis reinforced quantitative findings, **Table 7** above shows that wetland utilization and conservation influence livelihoods through ecological, social, and policy dimensions. Respondents highlighted degradation effects, including biodiversity loss, water pollution, increased flooding, and reduced ecosystem services such as carbon sequestration and habitat provision, which undermine livelihood sustainability. Governance issues were noted, with mixed adherence to the National Environment Act (No. 5 of 2019) limiting policy effectiveness, while community-led management plans promoted local ownership and sustainable practices. Participants also envisioned future eco-parks and tourism initiatives as strategies to balance conservation with livelihood enhancement.

4.3. Structural Equation Modelling

This was done to check the complex relationship between the wetland utilisation and community livelihood.

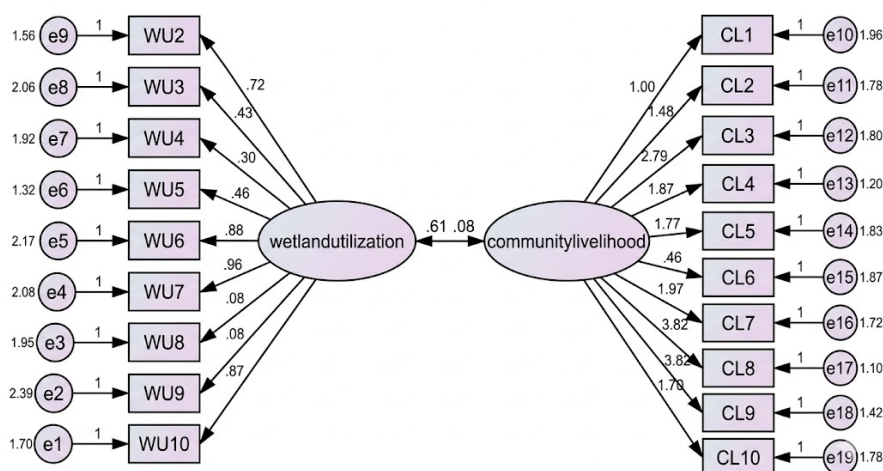


Figure 2. Structural equation modelling (SEM) for wetland utilisation and community livelihood.

Figure 2 shows the factor loading revealed that only five items out of ten that measured the construct of wetland Utilization loaded above the threshold value of 0.5. The five items (WU2, WU6, WU7, WU8, and WU10), however, the four items (WU3, WU4, WU5 and WU9) out of ten were below 0.5 but retained as their deviation away from 0.5 was small.

Only one item (WU1) was removed from the factor loading since it greatly deviated from the threshold of 0.5. For Community Livelihood, all items measured with the same loadings were above the minimum value of 0.5. Therefore, all the items that were retained in this model were valid measures of the respective constructs. Based on the SEM results, the study proposes a conceptual model illustrating the relationship between wetland utilization and community livelihoods. The model demonstrates that wetland utilization, measured through multiple observed indicators (WU2 - WU10), has a weak positive association with community livelihoods (CL1 - CL10). However, this relationship is influenced by contextual factors, including accessibility, conservation regulations, and availability of alternative income sources. In Kyetinda, relatively higher accessibility strengthens the relationship, whereas in Mabamba, conservation restrictions and spatial limitations weaken the association. The model, therefore, highlights that wetland utilization alone is not a strong determinant of livelihoods but operates within a broader socio-economic and environmental system.

5. Discussion

The study assessed how wetland utilization influences livelihoods around Kyetinda and Mabamba Wetlands, revealing context-dependent outcomes. In Kyetinda, wetlands support livelihoods through agriculture, fishing, livestock grazing, mulching, and water provision, reflecting findings that wetlands contribute significantly to rural incomes and resilience [3] [47]-[49]. However, high dependence poses ecological risks, as intensive use can degrade ecosystems and undermine long-term

livelihood sustainability [50].

In Mabamba, Ramsar designation and protected bird habitats limit resource extraction, reducing direct livelihood benefits [47] [51]. This illustrates the utilization-conservation paradox, where biodiversity protection may restrict economic opportunities but enhances ecological stability and tourism potential [52] [53]. Local governance, land tenure, and policy enforcement further shape the balance between conservation and socioeconomic welfare [54] [25].

Wetlands provide multiple ecological services critical to livelihoods: nutrient-rich sediments improve soil fertility for crops; fisheries, including lungfish essential to the Shoebill diet, support over 400 fishers and tourism [55]-[57]; and grazing sustains 25,778 livestock units, reducing feed costs [58]-[60]. Mulching supports sustainable agriculture, while wetland-based water transport facilitates trade and generates significant income [60] [61].

The conclusion therefore, shows that Kyetinda demonstrates modest livelihood gains alongside ecological pressures, whereas Mabamba prioritizes conservation-compatible use. These findings underscore the dual role of wetlands as livelihood sources and ecological assets, emphasizing the need for integrated, context-specific management strategies that support both community welfare and ecosystem integrity.

6. Conclusion

This study examined the association between wetland utilization and community livelihoods in Kyetinda and Mabamba wetlands, revealing important context-specific differences. The findings show a weak but statistically significant positive association in Kyetinda, suggesting that wetland-based activities contribute modestly to livelihoods, while in Mabamba the relationship was very weak and statistically insignificant, reflecting the influence of stricter conservation controls, limited access, and alternative income sources such as tourism. However, given the cross-sectional design and low R^2 values, the results should be interpreted as associations rather than causal effects, with much of the variation in livelihoods explained by other factors such as household characteristics, market access, and economic conditions. Despite these limitations, the study highlights the need for context-sensitive and participatory wetland governance approaches that balance conservation with livelihood needs, promote sustainable resource use, and support diversified income opportunities to enhance community wellbeing.

7. Recommendation

Policy & Practice Recommendations

- 1) Encourage regulated and sustainable utilization practices (e.g., controlled farming, fishing, and harvesting) to support livelihoods while preventing environmental degradation (Kyetinda Wetland).
- 2) Expand inclusive livelihood opportunities beyond wetland extraction, particularly in ecotourism and small enterprises, ensuring broader community par-

ticipation (Mabamba Wetland).

3) Involve local communities in wetland management decision-making to balance conservation goals with livelihood needs (Local Community).

4) Address physical access challenges (e.g., flooding, transport barriers) to support equitable resource use and economic engagement (Government).

5) Recognise that livelihoods are influenced by multiple factors beyond wetland utilization, including education, markets, and economic conditions (Government).

Disclaimer

The views expressed in this manuscript are those of the authors and do not necessarily reflect the official policies or positions of Mbarara University of Science and Technology.

Author Contributions

1) *Athieno Petrolina* Mukasa: Conceptualization, study design, data collection, data analysis, and manuscript drafting.

2) Twongyirwe Ronald, supervised the study and provided expert guidance in study design and methodology, data analysis support, and manuscript review.

3) Nkurunungi John Bosco, did the co-supervision, contribution to manuscript review, and intellectual input during the research process.

All authors have read and approved the final version of the manuscript.

Ethical Considerations

Ethical approval for this study was obtained from Mbarara University of Science and Technology. Participation in the study was voluntary, and informed consent was obtained from all respondents. Confidentiality and anonymity of participants were maintained throughout the study.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Sinthumule, N.I. (2021) An Analysis of Communities' Attitudes Towards Wetlands and Implications for Sustainability. *Global Ecology and Conservation*, **27**, e01604. <https://doi.org/10.1016/j.gecco.2021.e01604>
- [2] Craft, C.B., Vymazal, J. and Kröpfelová, L. (2017) *Creating and Restoring Wetlands: From Theory to Practice*. Elsevier.

- [3] Mitsch, W.J. and Gosselink, J.G. (2015) *Wetlands*. 5th Edition, John Wiley & Sons, Inc.
- [4] Topa, C., Murariu, G., Calmuc, V., Calmuc, M., Arseni, M., Serban, C., *et al.* (2024) A Spatial-Seasonal Study on the Danube River in the Adjacent Danube Delta Area: Case Study—Monitored Heavy Metals. *Water*, **16**, Article 2490. <https://doi.org/10.3390/w16172490>
- [5] Bănăduc, D., Afanasyev, S., Akeroyd, J.R., Năstase, A., Năvodaru, I., Tofan, L., *et al.* (2023) The Danube Delta: The Achilles Heel of Danube River-Danube Delta-Black Sea Region Fish Diversity under a Black Sea Impact Scenario Due to Sea Level Rise—A Prospective Review. *Fishes*, **8**, Article 355. <https://doi.org/10.3390/fishes8070355>
- [6] Ballut-Dajud, G.A., Sandoval Herazo, L.C., Fernández-Lambert, G., Marín-Muñiz, J.L., López Méndez, M.C. and Betanzo-Torres, E.A. (2022) Factors Affecting Wetland Loss: A Review. *Land*, **11**, Article 434. <https://doi.org/10.3390/land11030434>
- [7] Ahmad, Z., Hussain, A. and Shakeel, A. (2019) Economic Importance of Wetlands, Their Benefits and Values: Case of Pakistan (MPRA Paper No. 95260). Pakistan Institute of Development Economics.
- [8] Sherren, K., Ellis, K., Guimond, J.A., Kurylyk, B., LeRoux, N., Lundholm, J., *et al.* (2021) Understanding Multifunctional Bay of Fundy Dykelands and Tidal Wetlands Using Ecosystem Services—A Baseline. *Facets*, **6**, 1446-1473. <https://doi.org/10.1139/facets-2020-0073>
- [9] Camacho, A., Russi, D., Custodio, E. and Manzano, M. (2019) Assessment and Valuation of Wetlands Services for Their Consideration into Decision Making. United Nations Educational, Scientific and Cultural Organization (UNESCO).
- [10] Ong'anya, O.D. (2023) The Economic Benefits of Yala Wetland Resources in the Lake Victoria Basin, Threats and Management Strategies for Sustainable Development. *African Journal of Education, Science and Technology*, **7**, 65-75.
- [11] Rebelo, L.M., McCartney, M.P. and Finlayson, C.M. (2009) Wetlands of Sub-Saharan Africa: Distribution and Contribution of Agriculture to Livelihoods. *Wetlands Ecology and Management*, **18**, 557-572. <https://doi.org/10.1007/s11273-009-9142-x>
- [12] National Environment Management Authority (NEMA) (2019) Wetland Protection Guidelines for Uganda. NEMA Publications.
- [13] Chuma, G.B., Mondo, J.M., Karume, K., Mushagalusa, G.N. and Schmitz, S. (2021) Factors Driving Utilization Patterns of Marshlands in the Vicinity of South-Kivu Urban Agglomerations Based on Rapid Assessment of Wetland Ecosystem Services (RAWES). *Environmental Challenges*, **5**, Article ID: 100297. <https://doi.org/10.1016/j.envc.2021.100297>
- [14] Acreman, M., Arthington, A.H., Colloff, M.J., Couch, C., Crossman, N.D., Dyer, F., *et al.* (2014) Environmental Flows for Natural, Hybrid, and Novel Riverine Ecosystems in a Changing World. *Frontiers in Ecology and the Environment*, **12**, 466-473. <https://doi.org/10.1890/130134>
- [15] Sam, K. and Zabbey, N. (2018) Contaminated Land and Wetland Remediation in Nigeria: Opportunities for Sustainable Livelihood Creation. *Science of The Total Environment*, **639**, 1560-1573. <https://doi.org/10.1016/j.scitotenv.2018.05.266>
- [16] Njiru, J., Waithaka, E. and Aloo, P.A. (2017) An Overview of the Current Status of Lake Naivasha Fishery: Challenges and Management Strategies. *The Open Fish Science Journal*, **10**, 1-11. <https://doi.org/10.2174/1874401x01710010001>
- [17] Musasa, T. and Marambanyika, T. (2020) Threats to Sustainable Utilization of Wetland Resources in ZIMBABWE: A Review. *Wetlands Ecology and Management*, **28**,

- 681-696. <https://doi.org/10.1007/s11273-020-09732-1>
- [18] Ministry of Water and Environment (MWE) (2014) The State of Wetlands in Uganda: Trends, Challenges, and Opportunities. Government of Uganda.
 - [19] Ogwal, H., Luyiga, S. and Nori, W. (2024) Assessment of Wetland Ecosystem Services in Uganda: A Narrative Review. *International Journal of Academic Multidisciplinary Research (IJAMR)*, **8**, 117-125. <https://www.ijeais.org/ijamr>
 - [20] Van Coppenolle, R., Schwarz, C. and Temmerman, S. (2018) Contribution of Mangroves and Salt Marshes to Nature-Based Mitigation of Coastal Flood Risks in Major Deltas of the World. *Estuaries and Coasts*, **41**, 1699-1711. <https://doi.org/10.1007/s12237-018-0394-7>
 - [21] Alikhani, S., Nummi, P. and Ojala, A. (2023) Modified, Ecologically Destroyed, and Disappeared—History of Urban Wetlands in Helsinki Metropolitan Area. *Wetlands*, **43**, Article No. 33. <https://doi.org/10.1007/s13157-023-01671-w>
 - [22] Kabiri, S., Allen, M., Okuonzia, J.T., Akello, B., Ssabaganzi, R. and Mubiru, D. (2022) Detecting Wetland Encroachment and Urban Agriculture Land Classification in Uganda Using Hyper-Temporal Remote Sensing. *Open Research Africa*, **3**, Article 18. <https://doi.org/10.12688/aasopenres.13040.2>
 - [23] Business Focus Reporter (2020) Uganda Likely to Lose All Wetlands by 2040—Report. Business Focus. <https://businessfocus.co.ug/uganda-likely-to-lose-all-wetlands-by-2040-report/>
 - [24] Balwan, W.K. and Kour, S. (2021) Wetland—An Ecological Boon for the Environment. *East African Scholars Journal of Agriculture and Life Sciences*, **4**, 38-48. <https://doi.org/10.36349/easjals.2021.v04i03.001>
 - [25] Barakagira, A. and de Wit, A.H. (2019) The Role of Wetland Management Agencies within the Local Community in the Conservation of Wetlands in Uganda. *Environmental & Socio-Economic Studies*, **7**, 59-74. <https://doi.org/10.2478/environ-2019-0006>
 - [26] Samuel, T. (2024) Analyzing the Implications of Wetland Degradation on Livelihoods in River Rwizi Middle Catchment Area, South Western Uganda. Ph.D. Thesis, Makerere University.
 - [27] National Environment (Wetlands, River Banks and Lake Shores Management) Regulations (2000) Uganda Gazette.
 - [28] The National Environment Act (2019) Laws of Uganda.
 - [29] Akoth, B. (2021) Potential of Amaranthus in Improving Urban Farmers' Livelihoods in Kampala. Master's Thesis, Stellenbosch University.
 - [30] Lwanyaga, J.D., Kasedde, H. and Kirabira, J.B. (2019) Effect of Temperature on Mineral Precipitation Sequence of Lake Katwe Brine during Evaporation. *Current Journal of Applied Science and Technology*, **33**, 1-12. <https://doi.org/10.9734/cjast/2019/v33i630104>
 - [31] Dixon, J. and Wood, A. (2013) Wetlands and Poverty Reduction: The Value of Wetlands for the Poor. Wetlands International.
 - [32] Tulu, D., Gadissa, S., Hundessa, F. and Kebede, E. (2023) Contribution of Climate-Smart Forage and Fodder Production for Sustainable Livestock Production and Environment: Lessons and Challenges from Ethiopia. *Advances in Agriculture*, **2023**, Article ID: 8067776. <https://doi.org/10.1155/2023/8067776>
 - [33] Food and Agriculture Organization of the United Nations (FAO) (2015) Wetlands and Agriculture: A Review of the Issues and Opportunities. FAO. <http://www.fao.org/3/a-i4890e.pdf>

- [34] Guo, Y. and Chen, Y. (2024) Grazing and Grassland Ecosystems. *Advances in Resources Research*, **4**, 455-473.
- [35] Mwanake, H., Mehdi-Schulz, B., Schulz, K., Kitaka, N., Olang, L.O., Lederer, J., *et al.* (2023) Agricultural Practices and Soil and Water Conservation in the Transboundary Region of Kenya and Uganda: Farmers' Perspectives of Current Soil Erosion. *Agriculture*, **13**, Article 1434. <https://doi.org/10.3390/agriculture13071434>
- [36] Flett, D., Cuddy, S.M., Thompson, R.M., *et al.* (2022) Basin-Scale Evaluation of 2020-21 Commonwealth Environmental Water. CEWO.
- [37] Skovlin, J.M. (1985) Grazing Impacts. In: Koppal, M., Ed., *Developing Strategies for Rangeland Management*, CRC Press.
- [38] Usman, A.U. (2024) Assessment of Livelihood Sustenance and Non-Timber Forest Product Availability of Hadeja-Nguru Wetlands Inhabitants. *International Journal of Agricultural and Veterinary Science*, **5**, 223-240. <https://mediterraneanpublications.com/mejavs/article/view/448>
- [39] Barman, A., Rajak, F. and Jha, R. (2025) Integrating Traditional Knowledge Systems for Wetland Conservation and Management: A Critical Analysis. *Nature Environment and Pollution Technology*, **24**, B4212. <https://doi.org/10.46488/nept.2025.v24i01.b4212>
- [40] Refat, N., Ador, M.A.H., Sagor, P.S., Raihan, F. and Joarder, M.A.M. (2024) Linkages among Biodiversity, Ecotourism and Livelihood of Wetland Communities: A Case Study of Ratargul Swamp Forest, Bangladesh. *Environment, Development and Sustainability*, **27**, 16525-16548. <https://doi.org/10.1007/s10668-024-04577-7>
- [41] Mutanga, C.N., Gondo, R., Kolawole, O.D. and Mbaiwa, J.E. (2024) Nature-based Tourism-Induced Pressures Contributing to Biodiversity Disturbance and Loss in Sub-Saharan Africa. In: Hambira, W.L., Abdeta, A.A., Moalafhi, D.B., Muposhi, V.K. and Mosepele, K., Eds., *Environmental Change and Biodiversity Conservation in sub-Saharan Africa*, Springer, 19-37. https://doi.org/10.1007/978-3-031-73136-5_2
- [42] Kadoma, A. (2023) Understanding Stakeholder Perceptions of Wetland Ecosystem Services to Support Conservation and Restoration Activities in Wakiso District, Uganda. Ph.D. Thesis, University of Glasgow. <https://theses.gla.ac.uk/83936/>
- [43] Matovu, B., Sarfo, I., Darko, G. and Bi, S. (2019) Loss of Wetland Resources in Uganda. *International Research Journal of Public and Environmental Health*, **6**, 170-190. <https://doi.org/10.15739/irjpeh.19.021>
- [44] Tumusiime, T.R. (2021) Legal Frameworks in Uganda's Petroleum Industry. Ph.D. Thesis, Nottingham Trent University.
- [45] Kakuba, S.J. and Kanyamurwa, J.M. (2021) Management of Wetlands and Livelihood Opportunities in Kinawataka Wetland, Kampala-Uganda. *Environmental Challenges*, **2**, Article ID: 100021. <https://doi.org/10.1016/j.envc.2020.100021>
- [46] United Nations Development Programme (UNDP) (2025) UNDP Uganda Annual Report 2024. <https://www.undp.org/uganda/publications/undp-uganda-annual-report-2024>
- [47] Kakuru, W., Turyahabwe, N. and Mugisha, J. (2013) Total Economic Value of Wetlands Products and Services in Uganda. *The Scientific World Journal*, **2013**, Article ID: 192656. <https://doi.org/10.1155/2013/192656>
- [48] Mukasa, A.P., Ronald, T. and Bosco, N.J. (2024) Effect of Wetlands Conservation on People's Livelihood around Kyetinda and Mabamba Wetlands, Central Uganda. *Current Journal of Applied Science and Technology*, **43**, 37-53. <https://doi.org/10.9734/cjast/2024/v43i84419>

- [49] Vesselly, K., Opio, A., Mwanjalolo, M. and Kansiime, F. (2020) Seasonal Variability of Water Quality and Nutrient Removal Efficiency of a Restored Wetland. *Environment, Earth and Ecology*, **4**, 50-61. <https://doi.org/10.24051/eee/130741>
- [50] Kameri Ochoko, J., Luyiga, S. and Barasa, B. (2023) Wetland Restoration Dilemma in Uganda: Investigation of Alternative Livelihood Options for Restoring Limoto Wetland in Eastern Uganda. *American Journal of Environment Studies*, **6**, 74-92. <https://doi.org/10.47672/ajes.1462>
- [51] Nyumah, D.S. and Brambilla, M. (2025) Balancing Habitat Conservation and Community Livelihoods: An Evaluation of Community-Based Wetlands Management in the Lake Piso Multiple-Use Nature Reserve. *Journal of Environmental Management*, **386**, Article ID: 125740. <https://doi.org/10.1016/j.jenvman.2025.125740>
- [52] Cashore, B., Mukherjee, I., Virani, A. and Wijedasa, L.S. (2024) Policy Design for Biodiversity: How Problem Conception Drift Undermines “Fit-For-Purpose” Peatland Conservation. *Policy and Society*, **43**, 351-380. <https://doi.org/10.1093/polsoc/puae019>
- [53] King, S.L., Laubhan, M.K., Tashjian, P., Vradenburg, J. and Fredrickson, L. (2021) Wetland Conservation: Challenges Related to Water Law and Farm Policy. *Wetlands*, **41**, Article No. 54. <https://doi.org/10.1007/s13157-021-01449-y>
- [54] Businge, Z. (2017) Drivers of Wetland Degradation in Western Uganda and Iceland, and How They Are Addressed in Current Policies and Legal Frameworks. United Nations University Land Restoration Training Programme [Final Project] <http://www.unulrt.is/static/fellows/document/businge2017.pdf>
- [55] Nyadoi, P., Ogola, L.S., Kyakyo, H., Tayebwa, G., Okullo, J.B.L. and Aramu, T. (2020) Grey Crowned Crane and Shoebills Conservation Status and Linkage to Livelihoods of Lake Victoria Shores Adjacent Communities in Mayuge District, Eastern Uganda. *Journal of Geoscience and Environment Protection*, **8**, 175-191. <https://doi.org/10.4236/gep.2020.810013>
- [56] Zelasney, J., Ford, A., Westlund, L., Ward, A. and Riego Peñarubia, O. (2020) Securing Sustainable Small-Scale Fisheries: Showcasing Applied Practices in Value Chains, Post-Harvest Operations and Trade (Vol. 652). Food and Agriculture Organization of the United Nations. <https://www.fao.org/publications/card/en/c/CB0121EN>
- [57] Abbott, J.K., Lew, D.K., Whitehead, J.C. and Woodward, R.T. (2022) The Future of Fishing for Fun: The Economics and Sustainable Management of Recreational Fisheries. *Review of Environmental Economics and Policy*, **16**, 262-281.
- [58] Cresswell, K.A., Little, L.R., Hartmann, K., Gardner, C., Keane, J.P., Ling, S.D., *et al.* (2025) When Overfishing Is the Sustainable Option. *Nature Sustainability*, **8**, 498-507. <https://doi.org/10.1038/s41893-025-01526-8>
- [59] Marambanyika, T., Mupfiga, U.N., Musasa, T. and Ngwenya, K. (2021) Local Perceptions on the Impact of Drought on Wetland Ecosystem Services and Associated Household Livelihood Benefits: The Case of the Driefontein Ramsar Site in Zimbabwe. *Land*, **10**, Article 587. <https://doi.org/10.3390/land10060587>
- [60] Iqbal, R., Raza, M.A.S., Valipour, M., Saleem, M.F., Zaheer, M.S., Ahmad, S., *et al.* (2020) Potential Agricultural and Environmental Benefits of Mulches—A Review. *Bulletin of the National Research Centre*, **44**, Article No. 75. <https://doi.org/10.1186/s42269-020-00290-3>
- [61] Odaro, D.O. (2023) Integrated Environmental Planning of Wetland Ecosystems for Sustainability: The Case of Okana Wetland in the Lower Nyando River Basin, Kenya. Ph.D. Thesis, University of Eldoret.