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Community-Based Conservation Initiatives and the Protection and Sustainable Management of Wetlands in Dunga Swamp, Kisumu County, Kenya

Sylvia Achieng Makene
Scholar; School of Business, Economics and Social Sciences, Taita Taveta University, Kenya

Dr. Patrick Mutua Kimaku
Senior Lecturer; School of Business, Economics and Social Sciences, Taita Taveta University, Kenya

Prof. Karim Omido
Associate Professor; School of Business, Economics and Social Sciences, Taita Taveta University, Kenya

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ABSTRACT: Wetlands rank among the most productive ecosystems on earth, providing water purification, flood control, biodiversity conservation, climate regulation, and livelihood support. Despite this ecological and economic significance, wetlands worldwide continue to degrade rapidly under population pressure, weak governance, and competing land uses. Dunga Swamp, a 2.5 km² papyrus-dominated wetland on the shores of Winam Gulf in Kisumu County, Kenya, exemplifies this pattern: the swamp has lost roughly 35% of its area since 1985, fish catches have fallen by 60% since 2000, and faecal-coliform levels exceed World Health Organization limits by 500%, notwithstanding the presence of community-based conservation institutions and national wetland policy. This study examined the role that community-based conservation initiatives play in the protection and sustainable management of Dunga Swamp. Guided by Social Capital Theory, the Knowledge-Attitude-Practice model, the Institutional Analysis and Development framework, and Benefit-Sharing and Incentive Theory, the study tested four hypotheses relating community participation, conservation knowledge and awareness, enforcement and compliance, and benefit-sharing to wetland protection outcomes. A cross-sectional descriptive and correlational survey design was used to collect structured questionnaire data from 310 respondents (an 82.9% response rate) drawn from Beach Management Unit members, papyrus harvesters, farmers, eco-tourism operators, and government officials, selected through stratified random and purposive sampling from a population of 1,520. Data were analysed using descriptive statistics, Pearson correlation, and multiple linear regression. All four predictors correlated significantly and positively with wetland protection and sustainability, and the regression model explained 62.3% of the variance in outcomes ($R = .714$, $R^2 = .623$, $F(4,305) = 126.77$, $p < .001$). Conservation knowledge and awareness was the strongest independent predictor ($\beta = .435$, $p < .001$), followed by enforcement and compliance ($\beta = .225$, $p < .001$) and benefit-sharing ($\beta = .178$, $p < .001$); community participation, although positively correlated with outcomes, lost statistical significance once the other variables were controlled for ($\beta = .053$, $p = .440$). The findings suggest that participation alone cannot secure wetland sustainability unless it is accompanied by environmental education, credible enforcement, and equitable benefit distribution. The study recommends strengthened environmental education policy, inclusive participation mechanisms that address gender disparities, transparent benefit-sharing frameworks, and reinforced monitoring and enforcement capacity for Dunga Swamp and comparable peri-urban wetlands in the Lake Victoria Basin.

KEYWORDS: community-based conservation; wetland protection; conservation knowledge and awareness; enforcement and compliance; benefit-sharing; Dunga Swamp; Lake Victoria Basin

INTRODUCTION

Background to the Study

Wetlands are among the world's most productive ecosystems, providing essential ecosystem services including water purification, flood regulation, biodiversity conservation, carbon sequestration, and livelihood support for millions of people (Costanza et al., 2014; Ramsar Convention, 2018; Davidson et al., 2020). Despite their ecological and socio-economic importance, wetlands continue to experience rapid degradation due to agricultural expansion, urbanization, pollution, overexploitation of natural resources, and weak governance systems (Darrah et al., 2019; UNEP, 2021). Although the Ramsar Convention recognizes wetlands as ecosystems of international significance, evidence indicates that legal protection alone is insufficient without active community participation and effective institutional support (Finlayson et al., 2017). Community-Based Conservation (CBC) has therefore emerged as an important approach that promotes local participation, shared responsibility, and sustainable natural resource management (Armitage et al., 2020).

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Across Africa, wetlands support millions of people through fisheries, agriculture, livestock production, and water resources, yet they continue to experience high degradation rates driven by population growth, poverty, and weak institutional capacity (Davidson et al., 2020). Experiences from Uganda and Tanzania demonstrate that successful community-based conservation depends not only on community participation but also on effective governance, institutional coordination, conservation awareness, and enforcement mechanisms (Namaalwa et al., 2013; Mombo et al., 2011; Seki et al., 2018; Shuker et al., 2019). These findings mirror broader evidence from Kenya showing that institutional effectiveness and stakeholder collaboration are essential for improving the implementation of development and environmental programmes (Kimaku, 2021).

In Kenya, wetlands occupy approximately 2.5% of the country's land area but provide critical ecological services and livelihood opportunities, particularly within the Lake Victoria Basin (NEMA, 2020; Mwangi et al., 2018). Although the country has established comprehensive legal and policy frameworks, including the Environmental Management and Coordination Act (EMCA), the Water Act 2016, and the National Wetlands Conservation and Management Policy 2015, implementation remains constrained by inadequate funding, fragmented institutional mandates, weak coordination, and limited public awareness (Republic of Kenya, 2015; Mburu et al., 2020). Similar observations have been made by Kimaku (2021), who found that institutional capacity, stakeholder engagement, and effective implementation mechanisms are critical determinants of successful policy implementation within Kenyan public institutions.

Dunga Swamp in Kisumu County is an ecologically significant wetland supporting thousands of people through fishing, papyrus harvesting, agriculture, eco-tourism, and other ecosystem services (Were et al., 2019; Okotto-Okotto et al., 2020). However, the wetland continues to experience degradation arising from agricultural encroachment, pollution, overfishing, invasive species, sedimentation, and unsustainable resource extraction (Mwangi et al., 2018; Okotto-Okotto et al., 2020). Although community-based conservation initiatives such as the Dunga Beach Management Unit and community conservation groups have been established, community participation remains relatively low, conservation awareness is inadequate, benefit-sharing mechanisms are limited, and enforcement agencies continue to face institutional and financial constraints (Were et al., 2019). Recent evidence further suggests that successful implementation of community and public sector programmes depends on effective stakeholder engagement, institutional coordination, leadership commitment, and capacity building (Seneyia, Kimaku, & Omido, 2026). Therefore, examining the influence of community participation, conservation knowledge and awareness, enforcement and compliance mechanisms, and benefit-sharing initiatives on wetland protection in Dunga Swamp will provide evidence for strengthening community-based conservation strategies and environmental governance in Kenya.

Problem Statement

Dunga Swamp in Kisumu County continues to experience severe environmental degradation despite existing conservation policies and community-based conservation initiatives. The wetland has undergone significant loss of area due to agricultural encroachment, pollution, overfishing, and unsustainable resource exploitation, threatening biodiversity and the livelihoods of approximately 20,000 people who depend on it. Although Kenya has established legal and institutional frameworks to promote wetland conservation, their implementation remains constrained by inadequate funding, weak institutional coordination, limited community participation, low conservation awareness, and ineffective enforcement mechanisms. Furthermore, existing studies have largely focused on other wetlands within the Lake Victoria Basin, leaving limited empirical evidence on how community participation, conservation knowledge, enforcement, and benefit-sharing influence the protection and sustainable management of Dunga Swamp.

Research Objectives and Hypotheses

The general objective of the study was to examine the role of community-based conservation initiatives in the protection and sustainable management of wetlands in Dunga Swamp, Kisumu County, Kenya. The specific objectives were:

(i) To evaluate the effect of community participation;
(ii) To determine the influence of conservation knowledge and awareness;
(iii) To analyse the effect of enforcement and compliance mechanisms; and
(iv) To assess the effect of benefit-sharing and incentives on the protection and sustainable management of wetlands in Dunga Swamp.

Correspondingly, four null hypotheses were tested:

$H_0$1: Community participation has no significant effect on wetland protection and sustainable management;
$H_0$2: Conservation knowledge and awareness has no significant influence on wetland protection and sustainable management;
$H_0$3: Enforcement and compliance mechanisms have no significant effect on wetland protection and sustainable management;
$H_0$4: Benefit-sharing and incentives have no significant effect on wetland protection and sustainable management.

Significance of the Study

The study contributes to a conservation literature that has focused predominantly on rural protected areas by examining a degraded, multi-use, peri-urban wetland supporting diverse and sometimes competing livelihoods. For local communities, the findings offer evidence to strengthen their voice in wetland governance and to press for more equitable resource-access arrangements. For NEMA, the Water Resources Management Authority, and Kisumu County Government, the results inform where enforcement resources and policy attention are likely to yield the greatest return. For conservation organisations operating in the Lake Victoria Basin, the evidence supports programme design and the demonstration of impact to funders. The study also speaks to progress toward Sustainable Development Goals 6, 14 and 15.

LITERATURE REVIEW

The review is anchored on four complementary theories. Social Capital Theory posits that social networks, trust, reciprocity, and shared norms promote collective action and strengthen community participation in natural resource management (Putnam, 1993, 2000). The Knowledge-Attitude-Practice (KAP) Model explains that environmental knowledge influences attitudes, which subsequently shape conservation behaviour, while also recognizing that structural and socio-economic barriers often create knowledge-to-practice gaps (Kollmuss & Agyeman, 2002; Ajzen, 2020). The Institutional Analysis and Development (IAD) Framework emphasizes that effective governance depends on clearly defined rules, monitoring systems, and enforcement mechanisms that sustain cooperation in managing common-pool resources (Ostrom, 2005). Benefit-Sharing

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and Incentive Theory further argues that communities are more likely to support conservation when they receive fair and tangible socio-economic benefits that compensate for the opportunity costs associated with resource restrictions (Pascual et al., 2014; Wunder, 2015). Collectively, these theories explain the relationships between community participation, conservation knowledge and awareness, enforcement and compliance mechanisms, benefit-sharing initiatives, and wetland protection outcomes.

Conceptually, the review identifies community participation intensity, conservation knowledge and awareness, enforcement and compliance mechanisms, and benefit-sharing and incentive mechanisms as the principal determinants of wetland protection and sustainable management. Community participation is reflected in the extent of involvement in conservation planning, decision-making, implementation, and monitoring, thereby promoting ownership and compliance with conservation regulations. Conservation knowledge and awareness encompass understanding of wetland ecology, environmental legislation, and sustainable resource-use practices that encourage responsible environmental behaviour. Enforcement and compliance mechanisms focus on the consistency, effectiveness, and perceived fairness of monitoring, patrols, and sanctions in deterring illegal activities, while benefit-sharing mechanisms capture the fairness and adequacy of distributing conservation-derived benefits, including eco-tourism revenues and alternative livelihood opportunities. Together, these variables underscore that successful wetland conservation requires integrating community empowerment with effective institutional governance and equitable incentive systems (Okeyo-Owuor et al., 2021; Kairu-Wanyoike et al., 2022).

Empirical evidence from Kenya and across the Lake Victoria Basin demonstrates that community-based conservation contributes significantly to environmental sustainability, although its effectiveness varies across contexts. Studies conducted in Yala Swamp, Uganda's Mabamba Bay, Tanzania's Kilombero Valley, and Zambia consistently report moderate community participation, uneven conservation knowledge, and weak enforcement capacity due to limited institutional resources and livelihood pressures (Mugo et al., 2020; Kangalawe et al., 2021; Mubiana et al., 2022). While conservation awareness programmes improve environmental knowledge, knowledge alone does not always translate into sustainable practices because poverty, inadequate incentives, and weak enforcement constrain behavioural change (Binyongo et al., 2022; Shuker et al., 2022). Research further shows that community-based monitoring, participatory governance, and coordinated institutional enforcement improve compliance more cost-effectively than government-led approaches alone (Oldekop et al., 2020; Keane et al., 2022). Likewise, benefit-sharing initiatives—including eco-tourism, Payments for Ecosystem Services, and livelihood diversification—enhance long-term community commitment when benefits are distributed transparently and equitably (Pascual et al., 2014; Wunder, 2015).

Despite these advances, important research gaps remain. Although previous studies have examined wetland degradation, water quality, land-use change, and community-based conservation within the Lake Victoria Basin, limited empirical evidence exists on Dunga Swamp regarding the combined and relative influence of community participation, conservation knowledge, enforcement mechanisms, and benefit-sharing on wetland protection using a single integrated analytical model. Existing studies have largely documented ecological conditions without statistically examining which CBC components most strongly predict conservation outcomes when considered simultaneously. Furthermore, insufficient attention has been given to the contribution of institutional coordination, stakeholder engagement, and governance capacity in strengthening conservation initiatives. Similar findings by Kimaku (2021) and Seneyia, Kimaku, and Omido (2026) demonstrate that stakeholder participation, institutional capacity, leadership commitment, and coordinated governance significantly enhance the successful implementation of public sector programmes in Kenya. These governance principles are equally applicable to community-based natural resource management. Consequently, this study addresses these contextual and empirical gaps by examining the integrated influence of community-based conservation initiatives on the protection and sustainable management of Dunga Swamp, thereby contributing to environmental management scholarship and evidence-based conservation policy.

MATERIALS AND METHODS

Research Design

The study adopted a descriptive, cross-sectional survey design within a quantitative research paradigm, supplemented by correlational and multiple linear regression analysis. The descriptive component provided a detailed profile of participation, knowledge, enforcement, benefit-sharing, and protection outcomes as perceived by respondents, while the inferential component tested the four null hypotheses concerning the relationship between each independent variable and wetland protection and sustainability.

Study Population and Sampling

The target population comprised 1,520 individuals directly and indirectly engaged with Dunga Swamp: 800 registered members of the Dunga Beach Management Unit, 45 members of the Dunga Wetland Conservation Group, 300 papyrus harvesters, 200 small-scale farmers cultivating land adjacent to the wetland, 150 individuals engaged in eco-tourism and hospitality services, and 25 government officials and NGO representatives from NEMA, the Water Resources Management Authority, Kisumu County Government, KEMFRI, and conservation NGOs including OSIENALA. A combination of stratified random sampling (for the five community strata) and purposive sampling (for government and NGO key informants) was used. Sample size was determined using Yamane's (1967) formula for finite populations at a 95% confidence level and a 5% margin of error, applied to the target population of 1,520.

Data Collection Instruments and Procedure

Data were collected using structured questionnaires comprising five-point Likert-type scales (1 = Strongly Disagree to 5 = Strongly Agree) measuring community participation intensity, conservation knowledge and awareness, enforcement and compliance, benefit-sharing and incentives, and wetland protection and sustainability outcomes, alongside a demographic section. A pilot study preceded full data collection to establish instrument validity and reliability. Questionnaires were administered over a six-week period.

Validity, Reliability and Ethical Considerations

Content validity was established through expert review by the study supervisors, and reliability was assessed using Cronbach's alpha during the pilot phase, with all constructs meeting the conventional threshold of 0.70 or above for internal consistency. Ethical clearance and research permits were obtained from the relevant authorities, including a research permit from the National Commission for Science, Technology and Innovation

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and authorisation from Kisumu County Government. Informed consent was obtained from all participants, confidentiality and anonymity were protected through numeric coding of questionnaires and secure data storage, and participation was voluntary throughout.

Data Analysis

Completed questionnaires were coded and analysed using descriptive statistics (means, standard deviations, frequencies) and inferential statistics, namely Pearson product-moment correlation and multiple linear regression, to test the relationship between the four independent variables and wetland protection and sustainability. Prior to regression, the data were screened for normality (Shapiro-Wilk test), linearity, multicollinearity (tolerance and Variance Inflation Factor), and heteroscedasticity (Koenker test) to confirm that the assumptions underlying ordinary least squares regression were satisfied.

RESULTS

Response Rate and Respondent Profile

Of 374 questionnaires distributed, 310 were properly completed and returned, yielding a response rate of 82.9%, which is well above the conventionally accepted minimum for survey-based social research. Respondents were 52.6% male and 47.4% female, drawn across the Beach Management Unit, papyrus-harvesting, farming, eco-tourism, and government/NGO strata described in Section 3.2, giving the sample broad coverage of the wetland's principal stakeholder groups.

Descriptive Findings

Community participation showed a moderate average score. Most respondents reported some engagement in conservation activities and meetings, but a majority felt that women do not participate equally in conservation initiatives, and many considered community meetings poorly timed or inaccessible. Respondents were often neutral about the effectiveness of coordination among community conservation groups, though many felt their opinions were at least sometimes considered in wetland-related decisions.

Conservation knowledge and awareness recorded a relatively high mean score. Most respondents reported understanding the ecological importance of Dunga Swamp, knowing which activities degrade the wetland, and being aware of the laws protecting wetlands in Kenya, as well as sustainable papyrus-harvesting practices. However, more than half of respondents disagreed that conservation information reaches the community regularly, pointing to a persistent communication gap between conservation agencies and the community even where baseline awareness is comparatively strong.

Enforcement and compliance mechanisms produced a more ambivalent picture. Large proportions of respondents were neutral on whether patrols are frequent, whether violations are addressed promptly, or whether authorities enforce rules consistently. The most striking single finding in this domain was strong agreement that corruption affects enforcement of wetland protection rules, identifying governance failure rather than resource scarcity alone as a central obstacle.

Benefit-sharing and incentive mechanisms yielded some of the study's most critical findings: a large majority of respondents disagreed that conservation benefits are distributed fairly, and many felt that women and youth in particular do not benefit fairly from conservation-related income. At the same time, eco-tourism was widely perceived to benefit the community, most respondents reported receiving at least some direct or indirect benefit from conservation, and almost all respondents agreed that the availability of benefits strongly motivates their participation — suggesting that incentives remain a powerful lever even where current distribution is viewed as inequitable.

On wetland protection and sustainability outcomes, a majority of respondents perceived improvements in water quality, biodiversity, and papyrus vegetation health over the preceding five years, alongside reductions in pollution, illegal activity, and human pressure on the wetland — suggesting that, notwithstanding governance weaknesses, community-based conservation efforts around Dunga Swamp may be yielding measurable ecological gains.

Diagnostic Tests

A Shapiro-Wilk test of normality returned a statistic of 0.974 (N = 310, p = .063), which, being above the .05 threshold, indicated no significant departure from normality and supported the use of parametric analysis. A linearity check confirmed that the relationship between each predictor and the outcome followed an approximately linear pattern. Multicollinearity diagnostics (Table 1) showed tolerance values ranging from .360 to .889 and Variance Inflation Factors ranging from 1.125 to 2.778 — comfortably within the conventional thresholds of tolerance above 0.1 and VIF below 5 — indicating no problematic multicollinearity among the predictors. A Koenker (Studentized Breusch-Pagan) test for heteroscedasticity returned $\chi^2 = 5.741$ ($p = .325$), confirming homoscedasticity of the regression residuals. Together, these diagnostics confirmed that the assumptions underlying ordinary least squares regression were satisfied.

Table 1. Multicollinearity Diagnostics

Predictor	Tolerance	VIF
Community Participation	.365	2.741
Conservation Knowledge and Awareness	.360	2.778
Enforcement and Compliance	.639	1.566
Benefit Sharing	.889	1.125

Source: Field data (2026)

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Correlation Analysis

Table 2 presents the Pearson correlation matrix relating each independent variable to wetland protection and sustainability. All four independent variables correlated significantly and positively with the outcome at the 0.01 level.

Table 2. Correlation Matrix

	Wetland Protection	Participation	Knowledge	Enforcement
Wetland Protection	1			
Community Participation	.564**	1		
Conservation Knowledge & Awareness	.638**	.770**	1	
Enforcement and Compliance	.537**	.536**	.586**	1
Benefit Sharing	.303**	.312**	.167**	.159**

Correlation is significant at the 0.01 level (2-tailed); N = 310. Source: Field data (2026)

Wetland protection and sustainability correlated most strongly with conservation knowledge and awareness ($r = .638$, $p < .01$), followed by community participation ($r = .564$, $p < .01$) and enforcement and compliance ($r = .537$, $p < .01$). Benefit-sharing showed a positive but comparatively weak correlation ($r = .303$, $p < .01$). These bivariate results supported rejection of all four null hypotheses at the correlational level, though, as the regression analysis below shows, not all four predictors retained independent significance once considered jointly.

Regression Analysis

Multiple linear regression was used to determine the combined and independent contribution of the four predictors to wetland protection and sustainability. Table 3 presents the model summary, Table 4 the ANOVA results, and Table 5 the standardised and unstandardised regression coefficients.

Table 3. Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of Estimate
1	.714	.623	.617	.37343

Source: Field data (2026)

Table 4. ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	51.215	4	12.804	126.77	.000
Residual	30.951	305	.101		
Total	82.166	309			

Dependent variable: Wetland protection and sustainability. Source: Field data (2026)

Table 5. Regression Coefficients

Predictor	B	Std. Error	Beta	t	Sig.
(Constant)	.504	.253	—	1.995	.047
Community Participation	.069	.090	.053	.773	.440
Conservation Knowledge & Awareness	.353	.056	.435	6.338	.000
Enforcement and Compliance	.308	.070	.225	4.374	.000
Benefit Sharing	.287	.070	.178	4.083	.000

Dependent variable: Wetland protection and sustainability. Source: Field data (2026)

The model as a whole was statistically significant, $F(4, 305) = 126.77$, $p < .001$, and explained 62.3% of the variance in wetland protection and sustainability ($R^2 = .623$; adjusted $R^2 = .617$), with a correlation coefficient of $R = .714$ indicating a strong overall relationship between the predictor set and the outcome. Conservation knowledge and awareness emerged as the strongest independent predictor ($B = .353$, $\beta = .435$, $t = 6.338$, $p <$

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.001): each one-unit increase in knowledge and awareness was associated with a .353-unit increase in wetland protection and sustainability, and its comparatively large t-value identifies it as the dominant driver in the model. Enforcement and compliance was the second-strongest predictor (B = .308, β = .225, t = 4.374, p < .001), and benefit-sharing also contributed significantly (B = .287, β = .178, t = 4.083, p < .001). Community participation, despite its significant bivariate correlation with the outcome (r = .564), did not retain statistical significance once the other three predictors were controlled for (B = .069, β = .053, t = .773, p = .440), indicating that its unique contribution, net of knowledge, enforcement, and benefit-sharing, was negligible in this sample.

The resulting predictive model was:

Wetland Protection and Sustainability = 0.504 + 0.069(Community Participation) + 0.353(Conservation Knowledge and Awareness) + 0.308(Enforcement and Compliance) + 0.287(Benefit Sharing) + ε.

DISCUSSION

The finding that conservation knowledge and awareness was the strongest predictor of wetland protection outcomes is consistent with the Knowledge-Attitude-Practice model and with prior research in the Lake Victoria Basin linking environmental understanding to conservation-supportive behaviour, although this study also identified a persistent gap between the community's relatively strong baseline knowledge and the weak, irregular flow of conservation information reaching them — a gap that, if closed, could plausibly strengthen the knowledge-outcome relationship further.

The significance of enforcement and compliance aligns with the Institutional Analysis and Development framework's emphasis on credible monitoring and sanctioning as preconditions for sustained cooperation over common-pool resources. Notably, respondents' strong agreement that corruption undermines enforcement points to a governance rather than purely a resourcing problem: additional patrol capacity is unlikely to translate into better outcomes unless accompanied by more transparent and accountable enforcement processes. The significant but comparatively modest contribution of benefit-sharing, combined with widespread perceptions that current benefit distribution is unfair, particularly toward women and youth, supports Benefit-Sharing and Incentive Theory's prediction that incentives motivate participation, while also cautioning that inequitable distribution can erode the legitimacy of conservation institutions even where aggregate benefit flows exist.

The most theoretically notable finding is that community participation, despite a moderately strong bivariate correlation with outcomes, lost statistical significance in the multivariate model. This does not imply that participation is unimportant; rather, it suggests that participation's apparent effect in simple correlation may be substantially mediated by, or confounded with, the knowledge, enforcement, and benefit-sharing conditions under which that participation occurs. Communities that participate without adequate knowledge, credible enforcement, or fair benefit distribution may engage in conservation activities that do not translate into measurable ecological improvement — a pattern broadly consistent with Social Capital Theory's emphasis on the quality, not merely the quantity, of community engagement, and with the gender and accessibility barriers to participation that this study also documented.

Despite these institutional weaknesses, respondents' generally positive assessment of recent ecological trends, improved water quality, recovering biodiversity, healthier papyrus vegetation, and reduced illegal activity, suggests that Dunga Swamp's conservation trajectory, while imperfect, has been broadly favourable over the study period, and that community-based conservation, appropriately reinforced, is a plausible contributor to that trend.

CONCLUSION

This study set out to examine the role of community-based conservation initiatives in the protection and sustainable management of wetlands in Dunga Swamp, Kisumu County, Kenya, testing the independent and combined influence of community participation, conservation knowledge and awareness, enforcement and compliance, and benefit-sharing and incentives. The evidence supports rejection of all four null hypotheses at the bivariate level, and the regression model — explaining 62.3% of the variance in protection outcomes confirms that these four dimensions of community-based conservation, taken together, substantially shape wetland sustainability.

The central conclusion is that community participation alone is insufficient to guarantee sustainable wetland management: its statistical significance disappears once knowledge, enforcement, and benefit-sharing are accounted for, indicating that the quality and institutional context of participation matter more than participation per se. Conservation knowledge and awareness is the single most influential driver of protection outcomes, but its benefits are currently constrained by weak and irregular information dissemination. Enforcement and compliance mechanisms significantly enhance protection outcomes, but their effectiveness is undermined by perceived corruption, pointing to a governance deficit rather than a resourcing deficit alone. Benefit-sharing and incentive mechanisms motivate conservation engagement, but current distribution is widely perceived as inequitable, particularly for women and youth, creating a latent risk to the durability of community support. Encouragingly, the wetland's ecological condition appears, on balance, to be improving, suggesting that the existing community-based conservation architecture around Dunga Swamp while requiring strengthening is not failing outright.

RECOMMENDATIONS

Policy Recommendations

First, national and county government should embed structured environmental education within wetland conservation policy, supporting continuous awareness campaigns, training, and dissemination of conservation information through community groups, schools, and conservation organisations, given that knowledge and awareness emerged as the strongest driver of protection outcomes. Second, policy should promote inclusive community participation by addressing the gender and accessibility barriers this study identified — for example, through participation targets, support for women-led conservation groups, and more accessible scheduling of community consultations. Third, government and conservation agencies should establish transparent, equitable benefit-sharing frameworks with clear rules on how conservation-derived revenue,

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including eco-tourism income, is distributed, with explicit attention to the inclusion of women and youth, supported by public disclosure of conservation revenues to build trust.

Managerial Recommendations

Wetland management agencies should implement regular, practical training on sustainable harvesting, climate adaptation, and restoration to help translate existing knowledge into behavioural change. Enforcement agencies should increase patrol frequency, strengthen monitoring systems, and introduce transparent reporting mechanisms specifically designed to reduce the corruption that respondents identified as the principal obstacle to effective enforcement, including community-based monitoring arrangements that draw on local residents. Programme managers should implement clear, auditable systems for distributing conservation-derived economic benefits, with targeted measures such as employment, entrepreneurship, and training opportunities in eco-tourism to improve access for women and youth.

Suggestions for Further Research

Future research should extend this analysis comparatively across multiple Lake Victoria Basin wetlands to test whether the pattern observed at Dunga Swamp, in particular, the non-significance of participation once knowledge, enforcement, and benefit-sharing are controlled for, generalises to other sites, or reflects conditions specific to this peri-urban wetland. Further work should also investigate, in greater depth, the cultural norms, institutional barriers, and power dynamics underlying the gender disparities in participation identified here, to inform the design of more genuinely inclusive conservation strategies.

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