REVIEWED JOURNAL of INTERNATIONAL SOCIAL SCIENCE & HUMANITIES
[ISSN 2663-127X]

Vol. 6, Iss.1 (2025), pp 103 – 112, April 17, 2025. www.reviewedjournals.com, ©Reviewed Journals

EXPLORING THE EFFECTIVENESS OF ENFORCEMENT STRUCTURES IN BIODIVERSITY CONSERVATION IN LAIKIPIA COUNTY, KENYA

Francis Lopeyok Charles Lenantiri [1] & Dr. Wilson Muna, PhD [2]

[1] Student, Department of Public Policy and Administration, Kenyatta University, Kenya
[2] Lecturer, Department of Public Policy and Administration, Kenyatta University, Kenya

Accepted: April 4, 2025

ABSTRACT

Local communities and biodiversity conservation are closely interconnected. While community enforcement structures play an integral role in ensuring compliance, safeguarding and monitoring illegal activities that are detrimental to natural ecosystems, limited attention has been drawn in research particularly on their effectiveness in the broader conservation frameworks. This study examined the effects of enforcement structures on biodiversity conservation in the context of Laikipia County in Kenya. Stakeholder theory and sustainability theory anchored the study. Descriptive survey was used to guide the data collection and analysis. The study targeted a population of 2,035 consisting of 6 Government Environment Officers, 29 managers of conservancies and 2,000 community land representatives in Laikipia County, Kenya. Sample size of 327 was obtained through Krejcie and Morgan (1970) table of sample determination. Structured questionnaires, interviews and observation guide were data collection instruments. Pilot-testing of the instruments was conducted in Samburu County to a sample size of 33. Reliability of the instruments was determined through split-half method. Data was analyzed through content analysis, descriptive statistics, Pearsons's correlation and regression analysis. F statistical test was used in testing hypothesis at 95% confidence interval. It was revealed that enforcement structures had strong positive relationship with biodiversity conservation in Laikipia County (r=0.75) and accounted for 56% variation in the conservation of biodiversity in Laikipia County (R-Square=0.56). Government was recommended to institute relevant policies that will build the capacity of local enforcement teams through training and resource allocation so as to strengthen their effectiveness in biodiversity conservation efforts.

Keywords: *Community enforcement structures, Biodiversity Conservation, Laikipia County in Kenya*

CITATION: Lenantiri, F. L. C. & Muna, W. (2025). Exploring the effectiveness of enforcement structures in biodiversity conservation in Laikipia County, Kenya. *Reviewed Journal of Social Science & Humanities*, 6 (1), 103 – 112.

INTRODUCTION

Biodiversity conservation is a global concern due to its immense contribution to the environmental health, human well-being and planet's sustainability. Owing to the imperative role of the balanced ecosystem in supporting human life, biodiversity conservation is recognized as a precursor towards attaining sustainable development goals (SDG). In particular, the SDG number 15 focuses on promoting biodiversity conservation on land and water by protecting, restoring, and promoting sustainable use of terrestrial ecosystems, managing forests sustainably, halting biodiversity loss and combating desertification (Santos et al., 2022). Amongst the strategies being adopted to realize this includes formation of various international agencies and consortiums like United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN), Global Environment Facility (GEF) at global level. There is also growing rate of adoption of community land management systems in biodiversity conservation (Danielle et al., 2022). This approach recognizes the interconnectedness nature between humans and the environment and aims to ensure that the well-being of both the community and the ecosystem is preserved.

Kenya has put into place robust environmental protection policies, legislation and strategies focusing on community involvement in biodiversity protection efforts. The recognition of community land rights in sustainable conservation of natural resources, biodiversity and ecosystem is emphasized in the environmental act of 2015, forest conservation and management act of 2016 and community land act of 2016 which recognizes and protection and provides the procedure for registration of community land rights. The community land act of 2016 provides the framework for management and administration of community land and the role of county governments in relation to unregistered community land. Despite these progressive policies, Kenya like other regions globally, faces significant challenges in curbing biodiversity loss while balancing conservation efforts with local community involvement (Muigua, 2022). In Laikipia County, community-based conservation initiatives focus on sustainable land use, wildlife conservation and community development. To enhance their effectiveness in protecting biodiversity, these initiatives integrate local community structures to monitor and address threats to natural ecosystems, ensuring greater participation and accountability. However, their effectiveness has been questions due to continuous reporting of human-wildlife conflict leading to the loss of biodiversity, habitat degradation and strained relationships between local communities and conservation stakeholders.

There is evidence from literature indicating that enforcement structures within a community play a crucial role in shaping how land is managed and how biodiversity conservation efforts are implemented and delivered (Huang et al., 2018; Chen et al., 2019; Atuo et al., 2020). However, enforcement structures vary across different communities and regions. This implies that effectiveness of biodiversity conservation may depending on the economic pressures, community dynamics and cultural practices, which these studies have not adequately addressed. Past studies focused on formal enforcement structures and ignored informal enforcement mechanisms like local norms, customary laws and traditional leadership which play critical role in enforcement outcomes. In addressing these limitations, this study sought to examine the effects of enforcement structures on biodiversity conservation in Laikipia County, Kenya.

Statement of the Problem

Laikipia County, renowned for its biodiversity conservation efforts, faces challenges in balancing enforcement of conservation laws with biodiversity preservation. In recognizing this, government has increased adoption of community-based approaches with an aim to empowering locals in monitoring and promoting sustainable land use while fostering stewardship of biodiversity. Despite the interventions, challenges such as human-wildlife conflicts, poaching and illegal logging persist, undermining conservation efforts. For instance, in 2022, at least 130 incidences of human-wildlife conflicts were reported in Laikipia County (Mwangi, 2022). These conflicts between wildlife and human settlements ended up with damaging of crop (50% of reported incidences), attacks on humans (27.3 % of reported incidences) and livestock depredation (17.6 % of reported incidences)

as reported by Malesi (2023). Other challenges include poaching and illegal wildlife trade and illegal tree logging resulting into overexploitation and imbalance of limited species living on the planet. While Kenya`s Vision 2030 recognizes the integral nature of community-driven conservation in conserving biodiversity and ecosystem services, the persistent question is why enforcement structures remain ineffective in addressing these challenges and fostering sustainable biodiversity practices.

The finding from an empirical study by Kaua (2023) focusing on pastoralist socioecological trends for the case of Laikipia County in Kenya found that customary governate structures were effective in controlling pressure on pastoral resources and ecological pressure. However, the research methodology used by Kaua (2023) was biased to pastoralist community only and underrepresented the farming community. Another study assessing the influence of community values, rules and knowledge on biocultural conservation in Lebanon by Baydoun et al. (2023) found that participatory decision-making enhanced conservation strategy in protecting biodiversity. But contextually, the generalization of the finding was limited to Lebanon rather than in Kenya. Cheng et al. (2019) explored the effects of law enforcement and community outreach on mammal diversity in a biodiversity hotspot in China and the findings revealed that community law enforcement and outreach programmes were found to have no directly relationship with abundance of biodiversity. Conceptually, the dependent variable was narrowly confined to abundance of biodiversity which limited greater characterization of the phenomena from wider aspects. Additionally, the finding many not be generalized to Kenyan settings due to cultural differences. In overcoming the methodological, conceptual, contextual and generalization limitations, this study examined the influence of enforcement structures on biodiversity conservation in Laikipia County, Kenya.

LITERATURE REVIEW

Empirical Review

In China, biodiversity conservation of mammal diversity is empirically found not to related with law enforcement (Chen et al., 2019). Chen et al. (2019) was evaluating how law enforcement related to mammal diversity in a biodiversity hotspot in China whereby descriptive survey, simple random sampling of 374 community members, structured questionnaires and observation, descriptive, correlational and regression analysis were used. Nevertheless, the concept of law enforcement was so broad and failed to reflect the contextual characteristics across different geographical settings. The finding by Chen et al. (2019) contracts that of Atuo et al. (2020) while assessing the link between law enforcement and community regulation and biodiversity conservation in Nigeria and found that community-level sanctions and sanctions played important roles that fear of arrest by rangers in influencing behaviors and compliance in conservation efforts. Atuo et al. (2020) used survey, a sample size of 334 villagers, simple random sampling, semi-structured questionnaires, descriptive statistics, regression analysis and ANOVA. Nevertheless, the generalization of the findings by Chen et al., (2019) and Atuo et al. (2020) could not be generalized in Kenyan settings due to contextual and sociodemographic differences. The study used a narrower concept and definition of law enforcement structures and carried out the study in Kenya settings.

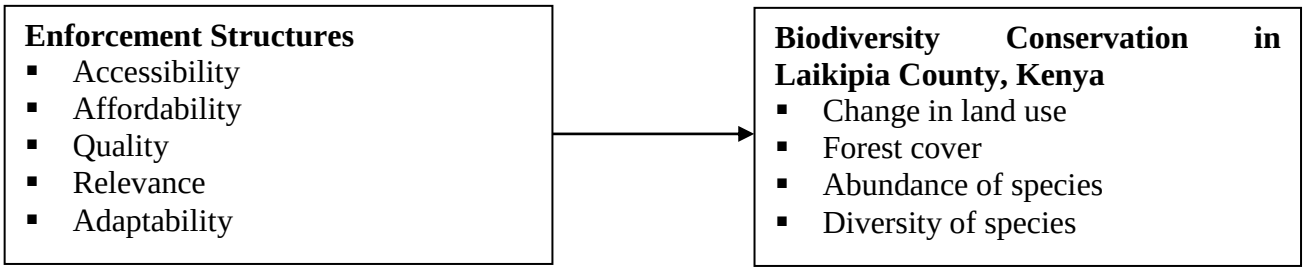
In Ethiopia, Gulte et al. (2023) did a survey focusing on the local communities' commitment on protected areas in Bale Mountains National Park whereby descriptive survey, multistage sampling of 379 respondents, key informant interviews, focused group discussion, factor analysis, inferential and regression analysis were used. The study revealed that community-built enforcement mechanisms provide incentives for the local people to participate, own and commit their efforts in conserving biodiversity. While neither pilot-testing of instruments nor hypothesis was tested, the findings were not anchored on any theory and the generalization of findings was limited to Ethiopian settings. This study pilot-tested instruments for validity and reliability, anchored the study on stakeholder theory, theory of change and sustainability theory and tested hypothesis on effects of enforcement structures on biodiversity conservation in Laikipia County in Kenya settings.

In Kenya, Chepkonga, Ramesh and Kapyask (2022) did research exploring on community forest associations and sustainable forest utilization in North Nandi whereby mixed research design, simple random sampling of 156 respondents, questionnaires and focus group discussion and descriptive statistics were used. It was found that joint enforcement of forest management while involving indigenous people enhances sustainable utilization of forest resources. But reliance on descriptive statistics limited inferencing of the findings. findings were contextually limited to Nandi North. This study overcame the limitation by integrating both descriptive and inferential analytical methods so as to generate generalizable findings on the effects of enforcement structures on biodiversity conservation in Kenya settings.

Theoretical Framework

Stakeholder theory and sustainability theory anchored the study. Stakeholder theory was proposed by Freeman Edward in 1980s to emphasize on the recognition of concerns of peoples interested or affected by development discourse to enhance effectives of the interventions. It states that participatory decision-making is imperative in understanding and integrating the needs, expectations and interests of stakeholders and shareholders increases chance of attaining organizational success and sustainability (Freeman et al., 2010). This theory assumes that value is created after consideration of the interdependent and interconnected needs of all players. In this study, stakeholder theory was the founding theoretical basis for recognizing the diverse interests and perspectives of stakeholders involved in enforcing laws and rules on biodiversity conservation. Developed by Meadows Donella in 1970s, sustainability theory aimed to advocate to practices and principles that enhance long-term well-being of live while promoting preservation and responsible use of natural resources for the benefit of present and upcoming generations. It thus states that the wellbeing of current and future generations depends on the practices and actions of the prevailing generation (Zhu, 2019). Sustainability theory is anchored on the principle of environmental responsibility, social inclusivity and equity and economic viability. This theory is built on the assumption of system thinking and understanding the relationships and dynamics a community is crucial for addressing sustainability challenges (Meehan & John, 2019). Sustainability theory is useful in policy integration by embedding sustainability principles into local policies, regulations and governance structures to ensure long-term commitment and support. Also, it is useful to create sustainable collaborations and continuous learning and adaptations. This study viewed integration of sustainability principles into enforcement of biodiversity preservation laws as useful in achieving sustainable biodiversity conservation efforts.

Conceptual Framework



Independent Variable **Dependent Variable**

METHODOLOGY

A descriptive survey design was employed to guide data collection and analysis. The study targeted a population of 2,035, comprising 6 Government Environment Officers, 29 conservancy managers, and 2,000 community land representatives in Laikipia County, Kenya. A sample size of 327 was determined using the Krejcie and Morgan (1970) table for sample size determination. Data collection instruments included structured questionnaires, interviews, and observation guides. Pilot testing of these instruments was conducted in Samburu County with a sample size of 33. The reliability of the instruments was assessed using the split-

half method. Numerical data collected by means of structured questionnaires was analyzed through descriptive statistics (means, frequencies, percentages, and standard deviations) and inferential statistics (coefficients of correlation and determination and Beta coefficients). Relationship between variables was determined via Pearson`s Product Moment Correlation Method. Regression analysis was used to predict the biodiversity conservation given community land management systems using F=test at 95% confidence interval.

FINDINGS AND DISCUSSIONS

The study sought to determine the effects of enforcement structures on biodiversity conservation in Laikipia County, Kenya. This was important because enforcement structures, such as laws, regulations, and monitoring systems, play a crucial role in ensuring compliance with conservation policies. Effective enforcement can prevent illegal activities like poaching, deforestation, and land encroachment, which threaten biodiversity. Enforcement Structures was another independent variable whose indicators were: monitoring, incentives and accountability. Respondents rated seven statements in the scale whereby: 1 represented Strongly Disagree, 2 represented Disagree, 3 represented None, 4 represented Agree and 5 represented Strongly Agree. Table 1 presents the descriptive data. In brackets are percentages.

Table 1: Descriptive Data for Enforcement Structures and Biodiversity Conservation in Laikipia County (n = 220)

Items	1	2	3	4	5	Mean	SD
Monitoring of enforcement structures enhanced land use and biodiversity conservation	0(0.0)	8(3.6)	12(5.5)	169(76.8)	31(14.1)	4.01	0.59
People were given incentives in promoting biodiversity conservation	0(0.0)	0(0.0)	5(2.3)	188(85.5)	27(12.3)	4.10	0.37
Every community member was accountable for the land use in promoting biodiversity	0(0.0)	3(1.4)	16(7.3)	183(83.2)	18(8.2)	3.98	0.46
The legal framework for community land management for biodiversity conservation was enforceable	0(0.0)	9(4.1)	40(18.2)	163(74.1)	8(3.6)	3.77	0.58
Mechanisms existed to ensure compliance with conservation-oriented land management practices within registered community land	0(0.0)	4(1.8)	20(9.1)	172(78.2)	24(10.9)	3.98	0.52
Enforcement structures like penalties were effective in conservation of biodiversity	0(0.0)	1(0.5)	28(12.7)	166(75.5)	25(11.4)	3.97	0.55
There were no barriers to effective enforcement of conservation regulations within community land management	0(0.0)	0(0.0)	18(8.2)	172(78.2)	30(13.6)	4.05	0.46
Combined						**3.98**	**0.50**

Source: Research Data (2024)

Table 1 shows the descriptive statistics for the responses on the items describing enforcement structures and biodiversity conservation in Laikipia County, Kenya. In the first item, 8(3.6%), 12(5.5%), 169(76.8%) and 31(14.1%) respondents disagreed, neither agreed nor disagreed, agreed and strongly agreed with the statement respectively. This item had a mean score of 4.01 implying that majority of the respondents agreed that monitoring of enforcement structures enhanced land use and biodiversity conservation. The standard deviation of 0.59 implying that data had a moderate variation about the mean. The second item stated that people were

given incentives in promoting biodiversity conservation whereby 5(2.3%), 188(85.5%) and 27(12.3%) respondents neither agreed nor disagreed, agreed and strongly agreed with the item respectively. For the mean of 4.10, most of the respondents were in strong agreement that people were given incentives in promoting biodiversity conservation. The opinions of respondents were deemed stable since standard deviation was low (0.37). In the third item, 3(1.4%) respondents disagreed, 16(7.3%), respondents neither agreed nor disagreed 183(85.5%) respondents agreed and 18(8.2%) respondents strongly agreed that every community member was accountable for the land use in promoting biodiversity. The mean of 3.98 implied that majority of the respondents were in agreement with the item and their opinions had low variations as indicated by the moderate standard deviation of 0.45. In the fourth statement, 9 (4.1%) respondents were in disagreement, 40(18.2%) respondents were neutral, 163(74.1%) were in agreement and 8(3.6%) were in strong agreement that legal framework for community land management for biodiversity conservation was enforceable. For the mean score of 3.77, most of the respondents were in agreement that legal framework for community land management for biodiversity conservation was enforceable. The standard deviation of 0.58 implied a moderate variation of scores around the mean indicating data stability and reliability.

The next item stated that mechanisms existed to ensure compliance with conservation-oriented land management practices within registered community land whereby 4(1.8%), 20(9.1%), 172(78.2%) and 24(10.9%) respondents disagreed, neither agreed nor disagreed, agreed and strongly agreed with that statement respectively. The mean of 3.98 implied that most of the respondents were in agreement that mechanisms existed to ensure compliance with conservation-oriented land management practices within registered community land and their opinions were stable since the standard deviation was low (0.45). In the sixth statement, 1(0.5%) respondent disagreed, 28(12.7%) respondents were neutral, 166(75.5%%) respondents agreed and 25(11.4%) strongly greed that enforcement structures like penalties were effective in conservation of biodiversity respectively. However, most of the respondents were in agreement that enforcement structures like penalties were effective in conservation of biodiversity (mean = 3.97) and their opinions were deemed valid and indicated by moderate variation of scores around the mean (standard deviation = 0.55). The seventh statement stated that there were no barriers to effective enforcement of conservation regulations within community land management whereby: 18(8.2%), 172(78.2%) and 30(13.6%) respondents neither agreed nor disagreed, agreed and strongly agreed with the statement respectively. But most of the respondents were in strong agreement that there were no barriers to effective enforcement of conservation regulations within community land management (mean = 4.05). The standard deviation value of 0.50 indicated steadiness of this rating.

The overall rating of enforcement structures and biodiversity conservation in Laikipia County, Kenya was 3.98 implying that majority of the respondents were in agreement with the 7 items describing the phenomenon. This finding was supported by the moderate standard deviation of 0.50, indicating a relatively low variability in the opinions of the respondents. The quantitative findings were consistent with qualitative insights gathered from interviews with conservation managers and government representatives who emphasized on effective enforcement structures in safeguarding biodiversity in Laikipia County. They attributed the prevailing success in biodiversity conservation in Laikipia County to well-established and functioning enforcement mechanisms, which involved community-based ranger programs, regular monitoring and strict penalties for illegal activities. For example, when asked to explain the existing community enforcement structures on community land use with impacts on conservation of biodiversity in Laikipia county, the response was,

For instance, when asked to express their throughs about Enforcement Structures towards conservation of biodiversity in Laikipia county, the government officers and managers of the conservancy firms said that,

> "…the presence of functional community integrated mechanism for enforcing sustainable land use and protection of biodiversity … community-based ranger programs where trained local rangers patrol and

monitor the land, ensuring that conservation regulations are adhered to…. not only deters illegal activities like poaching and unauthorized land use but also fosters a culture of compliance and stewardship among community members, sanctions…. when enforcement is perceived as fair and consistent, it strengthens community trust in the conservation efforts, leading to greater cooperation and participation in biodiversity conservation initiatives…. however, laws are still broken indicating that more collaborative efforts are needed" (Key Informant Interviewers).

The findings reveal the importance of robust enforcement structures in monitoring, giving incentives and promoting accountability ensured continued success of biodiversity conservation initiatives in Laikipia County. The integration of local communities into these efforts was found to enhance the effectiveness and sustainability of biodiversity conservation efforts.

The relationship between community enforcement structures and conservation of biodiversity in Laikipia County was determined using Pearson`s Product Moment Correlation Analysis. Table 2 presents the correlational findings.

Table 2: Relationship between Community Enforcement Structures and Conservation of Biodiversity in Laikipia County

		Conservation of Biodiversity in Laikipia County
Community Enforcement Structures	Pearson Correlation	0.75**
	Sig. (2-tailed)	0.00
	n	220

Source: Research Data (2024)

Table 2 shows that the correlational coefficient for community enforcement structures and conservation of biodiversity in Laikipia County was 0.75 (for p=0.00 which was less than 0.05). It indicated that a strong positive relationship between community enforcement structures and conservation of biodiversity in Laikipia County. Hence an increase in community enforcement structures would lead to a strong positive increase in conservation of biodiversity in Laikipia County.

Conservation of biodiversity in Laikipia County was then regressed against community enforcement structures. Table 3 presents the regression results.

Table 3: Regression of Conservation of Biodiversity Against Community Enforcement Structures

Model Summary

Model.	R.	$R.^2$	Adjusted $R.^2$	Std. Error. of Estimate	Change-Statistics				Sig. Change
					$R.^2$ Change	F-Change	d.f1	d.f.2	
1	0.75[a]	0.56	0.56	0.18	0.55	267	1	218	0.00

a. Predictors: (Constant), Community Enforcement Structures

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.66	1	8.66	267	0.00[b]
	Residual	7.21	218	0.03		
	Total	15.72	219			

a. Dependent Variable: Conservation of biodiversity in Laikipia County
b. Predictors: (Constant), Community Enforcement Structures

Coefficients[a]

Model		Unstandardized--Coefficients		Standardized--Coefficients	t	Sig (p-value)
		B	Std. Error	Beta		
1	(Constant)	1.50	0.15		9.79	0.00
	community enforcement structures	0.63	0.04	0.75	16.35	0.00

a. Dependent Variable: Conservation of biodiversity in Laikipia County

Source: Research Data (2024)

In Table 3, the data shown in the model summary shows that $R^2 = 0.56$ which implies that community enforcement structures accounted for 56% variation in the conservation of biodiversity in Laikipia County. The rest 44% was due extraneous factors beyond the model. The ANOVA summary data indicates that F=267 for p=0.00. The model was thus deemed fit. The coefficient summary data shows that the constant 1.50. Holding other factors constant, a unit change in community enforcement structures would result into 0.63 change in conservation of biodiversity in Laikipia County. This resolves the model:

$Y = 1.50 + 0.63X_1 + \varepsilon$ where,

Y = Conservation of biodiversity in Laikipia County, X_1 = Community Enforcement Structures and ε is the error term.

The findings underscore the benefit of integrating local communities in enforcement efforts which led to effective and successful biodiversity conservation efforts. By involving community members in enforcement activities, the conservation efforts were reportedly gaining greater local support and ownership. These findings align with the findings from research by Atuo et al. (2020) on law enforcement and community regulation and biodiversity conservation in Nigeria whereby community sanctions were found to play an important role that influenced behaviors and compliance in conservation efforts. In similar vein, Gulte et al (2023) did a study to examine local communities' commitment on protected areas in Bale Mountains National Park, Ethiopia whereby community-built enforcement mechanisms was found to provide incentives for the local people to participate, own and commit their efforts in conserving biodiversity. Further support is derived from the findings from an empirical study by Chepkonga et al. (2022) focusing on community forest association and sustainable forest utilization in North Nandi, Kenya that joint enforcement and involving indigenous people enhanced sustainable utilization of forest resources. However, the findings from this study contradicted the findings from a related study by Chen et al. (2019), focusing on law enforcement and mammal diversity in a biodiversity hotspot in China whereby no significant link between community law

enforcement and increased mammal abundance and diversity. This indicates that the effectiveness of community involvement and enforcement structures in promoting sustainable resource utilization and biodiversity conservation may vary depending on the context, including regional environmental conditions, socio-cultural factors and the specific nature of the resources being managed.

The findings link to stakeholder theory which emphasize the importance of integrating local communities as key stakeholders in conservation effort (Freeman et al., 2010). By involving them in enforcement activities, the conservation projects gain local support, which is critical for success. This aligns with Stakeholder Theory's assertion that the inclusion of all relevant parties leads to more effective and sustainable outcomes. In this study, involvement of community members led to shared responsibility whereby the users themselves participate in monitoring and enforcing rules leading to greater and sustainable results as emphasized by the sustainability theory (Meehan & John, 2019). Thus, the integration of local communities not only enhances the effectiveness of conservation efforts are adaptable to the emerging needs and resilient to different environmental and socio-economic conditions.

CONCLUSION AND RECOMMENDATIONS

The objective of this study was to determine the effects of enforcement structures on biodiversity conservation in Laikipia County, Kenya. It was found that enforcement structures contribute to biodiversity conservation in Laikipia County, Kenya. Thus, an increase in community enforcement structures would lead to a strong positive increase conservation of biodiversity in Laikipia County. Additionally, community enforcement structures were found to be a good predictor of conservation of biodiversity. It is therefore concluded that community enforcement structures are crucial for biodiversity conservation in Laikipia County, Kenya.

Based on the findings and conclusions from this study, it is therefore recommended for the government to strengthen community enforcement structures through development of relevant policies to support fundings and capacity building to local enforcement teams and providing access to advanced monitoring tools. It is also important to strengthen legal frameworks to combat poaching, illegal logging and wildlife trade while enhancing community awareness and participation in enforcement activities is also crucial. Also, there is need to foster strong collaborations between enforcement agencies, community leaders and conservancy managers to improve coordination and address biodiversity threats effectively. Environmental conservationists and practitioners should integrate community enforcement structures into broader conservation frameworks by fostering inclusivity and participatory approaches.

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