The Influence of Conservation Education on Pro-wildlife Sustainability Behaviour at the Eco-centric Zone of Budongo Central Forest Reserve in Buliisa District, Uganda

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Authors' contributions

This work was carried out in collaboration between both authors. Author DW searched for related literature, designed the methodology, collected data, analyzed the data, typeset the manuscript. Author AB Formulated the title of the study and objectives, searched for related literature, analyzed the collected data, discussed the findings, proof read the entire manuscript. Both authors read and approved the final manuscript.

Original Research Article

ABSTRACT

Human-wildlife coexistence has become increasingly pressing in sub-Saharan Africa, especially Uganda, highlighting the need for an effective conservation education programme. The relationship between Conservation education and Human-wildlife coexistence in Uganda remains an open question. Therefore, this study aimed to assess the influence of conservation education on pro-

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wildlife sustainability behaviour at the eco-centric zone of Budongo Central Forest Reserve (CFR) in Uganda. Two specific objectives guided the research which include to: document the existing conservation education programs involved in enhancing human-wildlife coexistence around Budongo CFR; and to determine the influence of conservation education programs towards enhancing human-wildlife coexistence around Budongo CFR. The study employed a descriptive survey design where mixed-methods approach, including quantitative and qualitative surveys were carried out. Key informant interviews were carried out to elicit information from some community leaders and teachers. In addition, field observations were done to gauge the success of these programs towards fostering human-wildlife co-existence. The study revealed various conservation education programs in place, including environmental education in schools, community outreach programs, ecotourism, sustainable agriculture, and forest restoration. Notably, conservation education in schools played a significant role, contributing 59.1% to the variance in human-wildlife co-existence. A Pearson Correlation Coefficient analysis indicated a strong positive significant relationship between conservation education programs and improvements in human-wildlife co-existence ($r=0.973$, Sig=0.000). The findings showed that well-designed conservation education programs have the potential to enhance community awareness, reduce conflict incidents, and encourage sustainable co-habitation practices. However, challenges such as cultural nuances and resource limitations pose significant hurdles to program effectiveness. In conclusion, this research demonstrates the effectiveness of conservation education programs in enhancing human-wildlife coexistence around Budongo CFR. These programs have not only increased knowledge and positive attitudes but also fostered local capacity to conservation. There should be a continued investment in these programs by the government, NGOs, CBOs, and industry experts aimed at promoting sustainable coexistence and conservation in the Budongo CFR and similar areas in the country.

1. INTRODUCTION

Coexistence between humans and wildlife is a crucial issue in areas where animal habitats overlap with human settlements [1,2]. This junction sometimes results in complicated dynamics, as different species adapt to anthropogenic surroundings and occasionally compete for resources like grown foods or animals Such connections create conflicts and problems for wildlife conservation efforts, especially in areas with growing human populations and increased agricultural operations [3]. Biodiversity, the climate, and livelihoods are all threatened by deforestation [4,5]. Over 23% of the world's forests were lost between 1990 and 2009 due to deforestation, which is among the highest rates in the world [6,7]. Several areas of Uganda are said to have experienced an increase in deforestation during the past 50 years [8]. Examples include converting land near Bugoma Central Forest Reserve (CFR) in Western Uganda for sugarcane growing [9,10]. Also, for the production of charcoal (with a preference for old-growth hardwood tropical species) and the high demand for fire wood by the local population, settlement growth, and agricultural expansion are all blamed for the loss of forest on protected and private land

surrounding Kibale National Park in South-Western Uganda [11,12]. As the world grapples with the devastating impacts of climate change, biodiversity loss, and environmental degradation, conservation education programs have become an emergency imperative [2,13]. These programs are crucial for raising awareness, promoting sustainable practices, and inspiring action to protect our planet's precious natural resources [14,15,16]. Conservation education programs have a rich history dating back to the 1960s, with a focus on promoting human-wildlife coexistence [17,18]. However, the state of human wildlife coexistence is devastating, with far-reaching consequences for both humans and wildlife. The delicate balance between humans' needs and wildlife survival has been disrupted, leading to a crisis that demands immediate attention [19]. During the Early beginnings 1960s-1970s, Conservation education emerged as a response to growing environmental concerns [20]. Salvati and Marco [21] in their study about natural resource depletion and economic performance clearly informed that these conservation programs focused on raising awareness about wildlife conservation and promoting sustainable practices. Organizations like the World Wildlife Fund (WWF) and the International Union for Conservation of Nature (IUCN) played a crucial

role in promoting conservation education to address human-wildlife conflict, habitat destruction, and biodiversity loss [22,23]. In the 2000s, conservation education shifted towards community-based initiatives. This approach recognised the importance of local engagement and aimed to empower communities to take ownership of conservation efforts [14,24,25]. In the 2010s Conservation education programs began emphasizing human-wildlife coexistence, acknowledging the interconnectedness of human and wildlife well-being. Initiatives like the "Coexisting with Wildlife" program in Africa and the "Human-Wildlife Conflict Collaboration" in Asia gained prominence [26]. Examples of successful conservation education programs include: The Jane Goodall Institute's "Roots & Shoots" program, the Wildlife Conservation Society's (WCS) community-based conservation initiative, and the World Wildlife Fund's (WWF) "Education for Nature" program which have contributed significantly to enhancing human-wildlife coexistence, promoting sustainable livelihoods, and protecting biodiversity [6,27]. Human-wildlife coexistence in Uganda is a complex and challenging issue, with both positive and negative aspects [7]. Uganda has made significant strides in wildlife conservation, with several national parks and protected areas covering over 15% of the country's land area [18]. The country has a strong legal framework for wildlife conservation, including the Wildlife Act (2019) and the National Environment Act (2019). Community-led conservation initiatives are increasing, with local communities taking ownership of conservation efforts [14].

The goal of conservation education initiatives, according to Yeganeh [13], is to raise public knowledge and comprehension of the value of protecting species and the necessity of maintaining natural environments. These initiatives can lessen human-wildlife conflicts, advance sustainable resource use, and foster respect for wildlife by informing and educating people about the ecological, financial, and social advantages of wildlife conservation [28,29]. Human-wildlife coexistence, particularly in ecologically sensitive regions like the Budongo CFR, is essential for preserving biodiversity and maintaining the health of forests [30]. To achieve harmonious coexistence, conservation education programs have been implemented worldwide, helping individuals of all ages appreciate natural resources and ecosystems while fostering the skills needed for conservation [31,9]. However, the effectiveness of these programs in the context of human-wildlife coexistence around Budongo CFR remains unclear. While conservation education is defined as a lifelong learning process that enhances understanding of natural resources, ecosystems, and their interrelationships [32,29], there is a pressing need to evaluate the impact on mitigating human-wildlife conflicts and promoting sustainable cohabitation in this specific environment. Moreover, the expanding fragmentation of forest corridors in Western Uganda poses a significant threat to wildlife species, including chimpanzees, leading to isolation, decreased genetic viability, and potential extinction risks [33,12]. Furthermore, Budongo CFR faces numerous challenges, including population growth, land division for settlement and agriculture, changing weather patterns, demand for bush meat and wildlife products, cultural factors, and infrastructure development for industries such as oil and gas [34]. These factors contribute to habitat loss and heighten the urgency of addressing human-wildlife conflicts to prevent the extinction of species [35,36]. Therefore, it was imperative to assess the impact of conservation education programs on human-wildlife coexistence within Budongo CFR comprehensively. This research sought to assess the effectiveness of these programs in enhancing community awareness, reducing conflict incidents, and fostering sustainable cohabitation practices. To achieve this broad aim, the following objectives were pursued: (i) To document the existing conservation education programs involved in enhancing human-wildlife coexistence around Budongo CFR; and (ii) To assess the influence of conservation education programs aimed at enhancing human-wildlife coexistence around Budongo CFR.

1.1 Study Area

The study was carried out in Buliisa District, Buliisa County in Biiso Sub-County, in 3 parishes namely; Biiso, Kihungya and Budongo. And also, in Masindi District Bujenje County, Budongo Sub-County in two parishes namely; Nyantozi and Kasenene parishes Map 1. The researcher concentrated on the named parishes because of their proximity to the Budongo CFR. Budongo Forest in Uganda is located in the north-west of the capital city Kampala, on the way to Murchison Falls National Park and is located on the escarpment north-east of Lake Albert. It is known for its former abundance of East African mahogany trees as well as being home to a population of chimpanzees.
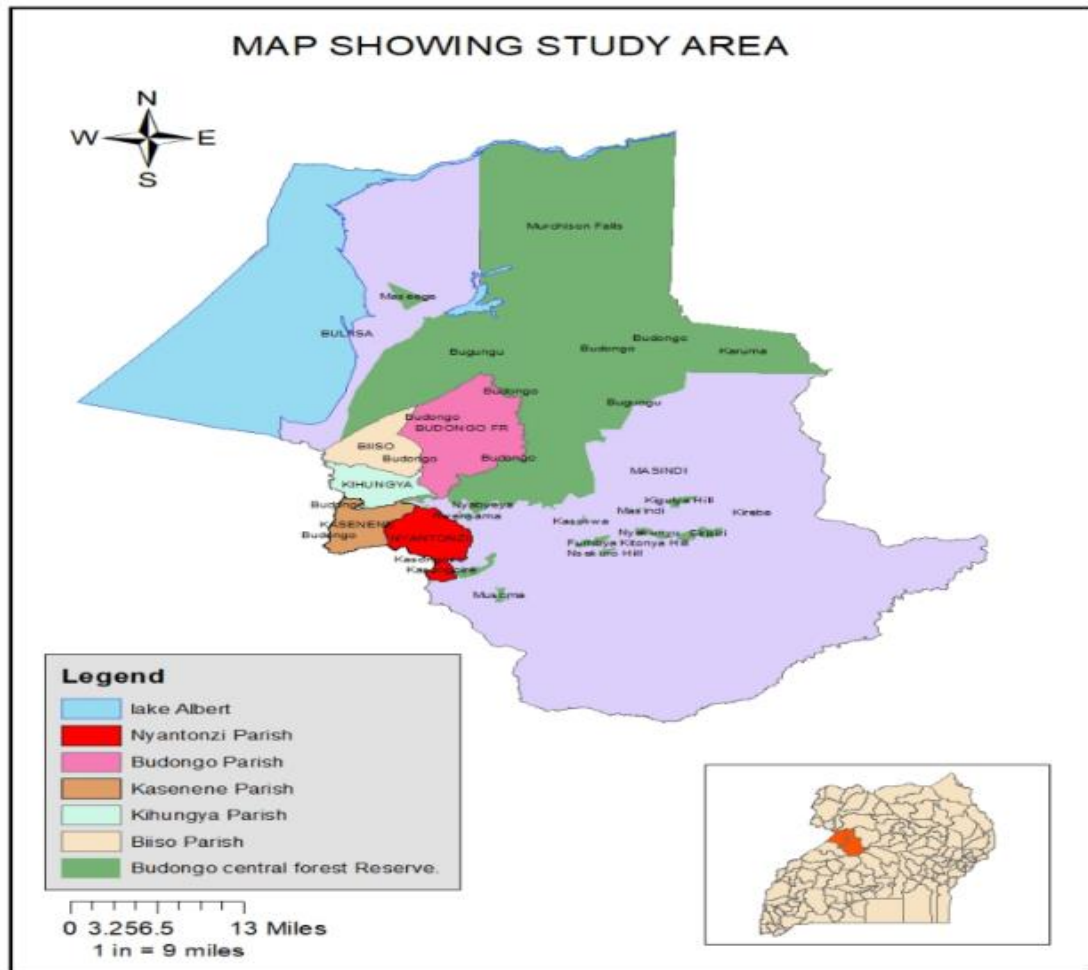
Map 1. Study areas

2. MATERIALS AND METHODS

The study used descriptive survey research design in which both qualitative and quantitative methods were employed. According to Glasser et al. [37], a descriptive design is a research design where the phenomenon is described and explained by the events as they were and how they are and anticipated to be. It involved both qualitative and quantitative data collected from primary and secondary sources. Thus, prompting the making of valid conclusions and recommendations. The study target 2015 households, both male headed and female headed households of villages around Budongo CFR from the parishes of Biiso, Nyantonzi, Kasenene, Kihungya and Budongo. The choice for this selection was that all these respondents in some way or the other were the key beneficiaries and stakeholders of the conservation education programs or reside around Budongo CFR; most of these were initiators, implementers, controllers or beneficiaries of conservation education programs. The study further focused on households that are within 3 kilometres from the forest reserve. As per the recent data available [38] there are 7694 households living around Budongo CFR. Sampling targeted 2015 households which are found in the mentioned parishes of the study area (Table 1).

The sample size was 333 respondents which was calculated using Slovin's Formula

$$n = \frac{N}{1 + N\,(e)^2}$$

Where;

• n is the desired sample size
• N is estimated number of the study

• e, is the confidence level of the study. Usually set at 95%

e = error 0.05

=2015/ 1+ 2015 (0.05)2

=2015/1 +5.0375

=2015/6.0375

=333

Table 1. Number of households used in the study

Parish	Total of Households / parish	Sample size
Nyantonzi	567	94
Biiso	437	72
Kasenene	502	83
Budongo	304	50
Kihungya	205	34
Total	**N=2015**	**n=333**

Therefore, respondents were the sample size

Respondent sample size

$$\frac{RPS}{N} \times n$$

Nyantozi = 567/2015x 333 = 94

Biiso = 437/2015 x333 = 72

Kasenene =502/2015x 333= 83

Budongo =304/2015x333= 50

Kihungya=205/2015x333= 34

Regarding sampling techniques, both probability and non-probability sampling was applied to collect the data. Random sampling was used to select some participants from the study area. The participants filled in the questionnaires to avoid biasness in the research. Under non-probability, purposive sampling was applied to select the Key Informants, who were the community leaders that provided vital information about the subject. The Key Informants also helped the researcher to select the technocrats in the parishes who participated in the study and whom they thought were knowledgeable enough to the research topic. These were the natives from the research area and had much attachment to the forest for their survival in one way or another. The study used a questionnaire survey to collect data from the respondents, following the specific objectives of the study. Questionnaire survey method is often used to assess thoughts, opinions, feelings and attitudes of the study participants. A survey consisted of a set of questions in English that were given to the respondents. The perceptions of the respondents were undertaken. For some of the respondents who did not understand English, the researcher hired a local language interpreter. The reliability statistics for the items in the questionnaire were determined and the Cronbach's alpha statistic, α = 0.850 was obtained. The research instrument therefore showed good reliability and internal consistency, since the calculated Cronbach alpha statistic exceeded α = 0.70 as stated by Amin [39]. Rigorous quality control measures were implemented during the data collection process in the field, with a focus on ensuring consistency, accuracy, and completeness of the questionnaires. To maintain data integrity, questionnaires were promptly recorded in the field, and any identified errors were corrected as necessary. This approach allowed for a comprehensive evaluation and interpretation of the data. Community opinions and perspectives were systematically categorized to assess the effectiveness of educational programs in promoting harmonious coexistence between humans and wildlife.

The interview guide was also used to collect data from the Key Informants including the school heads and religious leaders from the five parishes. The method involved designing a number of open-ended questions which were used to get in-depth information about conservation education programs in enhancing human-wildlife co-existence. The interview method was found to be flexible since it allowed both written and oral responses. Qualitative data obtained from interviews were transcribed and organized in words based on the study objectives. The non-numerical data was organized in a systematic way by establishing patterns, trends and developing themes on conservation Education programs in enhancing human-wildlife co-existence. The qualitative data was used to come up with useful interpretations and conclusions. The researcher coded qualitative data using themes, and non-numeric data was crosschecked and interpreted to identify contradictions. The quantitative data were entered into a statistical package for social sciences (SPSS), version 23 for analysis. The data was analysed using measures of central tendency such as mean, average, standard deviation, and Pearson correlation coefficient which provided empirical support for the positive impact of these initiatives.

3. RESULTS

3.1 Demographic Survey of the Study Participants

The survey was conducted among 215 respondents out of 333 respondents who were

initially targeted for the study. This gave the response rate of 65% and was regarded as optimal. The demographic characteristics (Table 2) of the respondents provided a snapshot of the population engaged in conservation efforts. The study dealt with age, gender, marital status, and level of education of the respondents. Majority of respondents, totalling 150 (70%) individuals, were male, while 65 (30%) were female. Moreover, a significant portion of the respondents, precisely 77 (36%) individuals, fell within the age range of 46-55 years and had resided in the vicinity of the Bundongo Central Forest Reserve for over a year. It is noteworthy that the attitudes of this category of forest users toward Bundongo conservation education programs held considerable influence. Following this age group, there were 43 (20%) respondents aged between 36 and 45 years, 34 (16%) respondents in the age bracket of 56-65 years, and 30 (14%) respondents in the 25-35 years age range. These statistics highlight the active involvement of younger individuals in various conservation education programs. Conversely, 22 respondents were in the 66-75 years age category, and a smaller group of 9 individuals consisted of older respondents aged 75 years and above. This latter group, accounting for 4% of the respondents, significantly contributed to shaping the prevailing attitudes and behaviours of local communities concerning human-wildlife

coexistence and the conservation of Bundongo CFR, particularly during its gazettement period and the present.

Furthermore, the data in the table reveals that the majority of respondents, totalling 185 (86%) individuals, were married, while 30 (14%) respondents reported that they are single. It's important to note that the study did not meet the separated and widowed participants.

In terms of educational attainment, the study predominantly included respondents with ordinary level education, comprising 60 (28%). The next largest groups were those with primary level education (24%) and secondary A level school qualifications (18%). Additionally, there were 30 (14%) respondents who had completed university education, while 34 (16%) respondents had not received any formal education at the time of conducting the research. Importantly, all the respondents were mature individuals capable of comprehending and responding to the research inquiries, ensuring the reliability of the data collected for this study. The study documented and analysed the Conservation programs of various stakeholders, including local communities, NGOs, and Government agencies, aimed at enhancing human-wildlife coexistence around Budongo CFR. The findings presented in Table 3, reveal the impact and effectiveness of

Table 2. Demographic characteristics of the study respondents (Questionnaire Survey, 2023)

Gender	Frequency	Percent
Male	150	70.0
Female	65	30.0
Total	**215**	100.0
Respondents according to Age groups		
25-35	30	14.0
36-45	43	20.0
46-55	77	36.0
56-65	34	16.0
66-75	22	10.0
75 and above	9	4.0
Total	**215**	**100**
Respondents according Marital Status		
Married	185	86.0
Single	30	14.0
Total	**215**	**100**
Respondents according to Level of education		
Primary	52	24.0
O level	60	28.0
A level	39	18.0
University/tertiary	30	14.0
Not educated	34	16.0
Total	**215**	**100.0**

Table 3. Conservation education programs involved in enhancing human-wildlife coexistence around Budongo CFR (Questionnaire survey, 2023)

Program	Mean	Standard Deviation	Interpretation
Environmental Education in Schools	3.8778	.99242	High
Natural Resources awareness programs in communities (Community Outreach)	3.8111	1.14061	High
Eco-tourism	3.4556	.95000	Moderate
Sustainable Agriculture	3.4000	1.18795	Moderate
Forest Restoration	3.0444	.98199	Moderate
Plant grasses, trees and ground cover to stop soil erosion	3.8111	.85977	High
Average Conservation programs	3.5667	.96402	High

these programs in raising awareness about wildlife conservation and human-wildlife coexistence, building capacity and skills among local communities and stakeholders, promoting sustainable livelihoods and habitat conservation and reducing human-wildlife conflict.

3.2 The Existing Conservation Education Programs Involved in Enhancing Human-wildlife Coexistence Around Budongo CFR

The Conservation Education programmes being implemented around the Budongo CFR were explored to gain an understanding of which programme may be succeeding in the promotion of human-wildlife coexistence as shown in Table 3.

Table 3 shows results of a descriptive analysis of the study variables. The results show that Environmental Education in Schools (see Plate 1) had a mean of 3.8778 and Standard Deviation of 0.99242. The interpretation is that this program received a high mean score, indicating that respondents generally perceived environmental education in schools as the program that mainly enhanced human-wildlife coexistence around Budongo CFR. The relatively low standard deviation suggests that there was a consistent opinion among respondents regarding the effectiveness of this program.

Natural resources awareness programs in communities (Community Outreach) had a mean of 3.8111 and standard deviation of 1.14061. The mean score for this program is also high, indicating that respondents viewed natural resources awareness programs in communities as a program that mainly enhanced human-wildlife coexistence around Budongo CFR. However, the higher standard deviation suggests

that there might be some variation in opinions among respondents, with a wider range of perceptions regarding the effectiveness of this program. On the other hand, ecotourism had a mean of 3.4556 and standard deviation: 0.95000. This can be interpreted that ecotourism received a moderate mean score, indicating a favorable perception among respondents who reported that the program enhanced human-wildlife coexistence around Budongo CFR. The lower standard deviation suggests a more consistent opinion about this program's effectiveness. Additionally, Sustainable Agriculture received a moderate mean of 3.4000 and a standard deviation of 1.18795. Sustainable agriculture has a mean score that suggests a generally positive view that enhanced human-wildlife coexistence around Budongo CFR, although the rating is slightly lower than the previous programs. The higher standard deviation indicates that opinions about this program may vary more widely among respondents.

Forest Restoration was analysed and received a mean score of 3.0444 and standard deviation of 0.98199. It was interpreted that forest restoration received a moderate mean score, indicating that respondents generally perceive it positively. The standard deviation, while not the lowest, suggests a moderate level of consensus among respondents.

Planting grasses, trees, shrubs, and ground cover to stop soil erosion was analysed and the mean of 3.8111 and the standard deviation obtained was 0.85977. This program received a high mean score, similar to natural resources awareness programs in communities. The lower standard deviation indicates that respondents had a relatively consistent view of this program.

The Average mean of all conservation programs was 3.5667 and the standard deviation obtained

was 0.96402. The overall interpretation is that the averages mean scores for conservation programs is relatively high, suggesting an overall positive perception among respondents regarding these programs towards improving human-wildlife coexistence. The standard deviation indicates a moderate level of consensus.

These educational initiatives aimed to enlighten students about the critical significance of wildlife conservation. They covered a wide range of topics, including the importance of preserving the diverse species found in the Budongo CFR, as well as the various threats confronting wildlife in the region. These programs played a pivotal role in fostering awareness and a sense of responsibility towards wildlife protection hence promoting knowledge and understanding of human-wildlife coexistence, building trust and collaboration among local communities, conservationists, and other stakeholders, supporting sustainable livelihoods and reducing human-wildlife conflict and empowering communities to take ownership of conservation efforts.

3.3 Influence of Conservation Education Programs Aimed at Enhancing Human-wildlife Coexistence Around Budongo CFR

The study explored the effectiveness of the programs implemented around the Budongo CFR in promoting harmonious relationships between humans and wildlife. The results presented in Table 4 reveal the significant influence of conservation education on: local communities' knowledge, attitudes, and behaviours towards wildlife conservation, the adoption of sustainable livelihoods and land use practices, the reduction of human wildlife conflicts and crop damage and the improvement of the community engagement and participation in conservation efforts.

Conservation Education in Schools: A majority of respondents (55.56%) strongly agreed that conservation education in schools improves human-wildlife coexistence, with an additional 36.67% in agreement. This suggests a strong positive perception of the effectiveness of school-based conservation education.

It was observed that Wildlife clubs in schools had emerged as a valuable platform for promoting conservation education and fostering a sense of responsibility towards the environment and wildlife. These clubs provided students with the opportunity to learn about local wildlife species, their habitats, and the importance of protecting them for future generations. The researcher also observed that as human populations continue to expand and encroach on natural habitats, conflicts between wildlife and people were becoming increasingly common. In order to promote peaceful coexistence between

Plate 1. Members of wildlife club of Mirembe Primary school in Biiso Parish, 2023

Table 4. Efficacy of the Conservation Education programmes implemented around Budongo CFR (Questionnaire Survey, 2023)

Statement	SA	A	N	D	SD	Mean	Standard deviation
Conservation education in schools improves human-wildlife coexistence	119 55.56%	78 36.11%	12 5.56%	6 2.78%	0	88.83	21.15
Natural Resources awareness programs in communities (Community Outreach) improves human-wildlife coexistence	96 44.44%	101 47.22%	12 5.56%	6 2.78%	0	89.17	9.13
Eco-tourism improves human-wildlife co-existence	84 38.89%	89 41.67%	18 8.33%	24 11.11%	0	73.17	10.95
Sustainable Agriculture improves human-wildlife co-existence	54 25.00%	77 36.11%	42 19.44%	36 16.67%	6 2.78%	53.83	17.99
Forest Restoration improves human-wildlife co-existence	90 41.67%	95 44.44%	6 2.78%	24 11.11%	0	51.67	39.79
Plant grasses, trees and ground cover to stop soil erosion can improve human-wildlife co-existence	90 41.67%	95 44.44%	6 2.78%	24 11.11%	0	51.67	39.79

Plate 2. Conservation workshop at a school, 2023

humans and wildlife, conservation education programs were essential. By engaging students in hands-on activities such as wildlife surveys, habitat restoration projects, and educational workshops (Plate 2), wildlife clubs helped to increase awareness and appreciation for the natural world. Students gained a greater understanding of the challenges facing wildlife and were inspired to take action to protect them. Students worked together to support wildlife conservation efforts, building strong bonds and developing valuable team-building skills. Through participation in wildlife clubs, students also had the opportunity to develop leadership skills, as they took on roles within the club and became advocates for conservation within their school and local community.

Natural Resources Awareness Programs (Community Outreach): A significant portion of respondents (44.44%) strongly agreed that community outreach programs improved human-wildlife coexistence, while another 47.22% agreed. This indicates a positive impact of community outreach efforts on raising awareness and fostering coexistence. Tree planting campaigns was noticed to be a valuable tool for promoting conservation education and enhancing human-wildlife coexistence around Budongo CFR. Engaging local communities in tree planting activities, conservation organizations (Plate 3) raised awareness about the importance of healthy ecosystems and the role that trees play in supporting biodiversity. These campaigns also provided opportunities for community members to learn about the wildlife that depends on the forest for habitat, such as chimpanzees and other endangered species. By connecting people with the natural environment, tree planting initiatives fostered a sense of stewardship and responsibility for protecting the forest and its inhabitants. In addition to promoting conservation education, tree planting campaigns also had practical benefits for both people and wildlife. Planting trees helped restore degraded habitats and created corridors for wildlife movement, reduced human-wildlife conflicts and promoted coexistence.

Eco-tourism: The results show that 38.89% strongly agreed, and 41.67% agreed that eco-tourism can improve human-wildlife coexistence. While a substantial proportion is in favour, it's noteworthy that 11.11% disagreed, suggesting that opinions on the effectiveness of eco-tourism may vary. Eco-tourism activities were also observed to serve as a fantastic community outreach program to promote human-wildlife coexistence around Budongo CFR. This helped to foster a sense of appreciation and respect for the wildlife in the area. Through organized guided tours (Plate 4) and education sessions for local communities and tourists; awareness was raised about the importance of wildlife conservation and the benefits of living in harmony with nature.

Plate 3. A group of conservationists during a tree planting campaign, 2023

Plate 4. Bird watching in Budongo CFR, 2023

It was also observed that the local communities engaged in ecotourism activities such as bird watching, nature walks, and wildlife safaris. This not only provided them with an opportunity to experience the beauty of their surroundings but also gave them a stake in preserving the environment. There was considerable participation in ecotourism initiatives by the local community, such as setting up homestays, guiding services, handicraft production and selling locally made products to tourist. This created sustainable livelihood options that are linked to conservation efforts. Furthermore, the initiatives provided training and capacity building programs for community members on sustainable tourism practices, conservation techniques, and wildlife monitoring.

It was also observed that through community ecotourism initiatives, ecofriendly bridges in communities offered a sustainable approach to mitigate the impact of roads and other barriers on wildlife movement. By providing safe passages (Plate 5) over fragile landscapes, these structures enabled animals to navigate their habitats without facing the dangers of habitat fragmentation. This, in turn, helped to maintain

genetic diversity, population dynamics, and ecological balance within and around the Budongo CFR.

Sustainable Agriculture: Approximately 25.00% strongly agreed, and 36.11% agreed that sustainable agriculture improved human-wildlife coexistence. However, a notable 16.67% disagreed. This indicates a more mixed perception regarding the role of sustainable agriculture in coexistence of human beings and wildlife.

It was observed that conservation education programs were essential in promoting human-wildlife coexistence and sustainable living practices. These initiatives did not only teach students about the importance of conservation but also provided hands-on experience in caring for the environment. Vegetable gardens in schools (Plate 6) served multiple purposes. They provided a practical way for students to learn about agriculture and food production. These gardens also created a connection between students and the natural world, fostering a sense of stewardship and responsibility towards the environment. In the context of human-wildlife

coexistence, school-based vegetable gardens played a crucial role in the teaching of students about the interconnectedness of ecosystems. By understanding how their actions could impact the local wildlife and habitat, students were more likely to make informed decisions which contributed to conservation efforts. Furthermore, vegetable gardens provided a source of food for humans, reducing conflicts between humans and animals over resources. By planting wildlife-friendly crops and incorporating habitats for beneficial insects and animals, schools created a harmonious environment where both humans and wildlife thrived. School-based nature enterprises also had the potential to inspire students to pursue careers in conservation and environmental science. By exposing students to hands-on conservation work at a tender age, these programs ignited a passion for environmental stewardship.

The study conducted a Chi-square test of independence (Table 5) to examine the relationship between various conservation education programs and respondents' levels of agreement regarding their impact on human-wildlife coexistence around Budongo Central Forest Reserve. It aimed particularly at assessing whether there was a significant relationship between conservation education in schools (independent variable) and the respondents' levels of agreement (strongly agree, Agree, neutral, disagree and strongly disagree regarding its impact on human-wildlife coexistence (dependent variable). The results of the Chi-square test, showed a significant association between conservation education programs and human-wildlife coexistence at $P=0.0234$. The results suggested that the programs played a crucial role in enhancing coexistence around Budongo CFR.

Plate 5. Ecofriendly bridge, 2023

Plate 6. Wildlife club at the school vegetable garden at Kihungya model primary school, 2023

Table 5. Chi-square test of independence (Questionnaire Survey, 2023)

Variable	Chi-Square (X²)	Degrees of Freedom (df)	P-Value (p)	Explanation
Conservation Education in Schools	4.0998	3	0.0234	There is a significant association between conservation education in schools and respondents' agreement levels regarding its impact on human-wildlife coexistence.
Natural Resources Awareness Programs (Community Outreach)	6.8092	3	0.0167	There is a significant association between natural resources awareness programs (community outreach) and respondents' agreement levels regarding its impact on human-wildlife coexistence.
Eco-tourism	2.5678	3	0.0493	There is a significant association between eco-tourism and respondents' agreement levels regarding its impact on human-wildlife coexistence.
Sustainable Agriculture	3.4567	3	0.0432	There is a significant association between sustainable agriculture and respondents' agreement levels regarding its impact on human-wildlife coexistence.
Forest Restoration	1.37893	3	0.0345	There is a significant association between forest restorations and respondents' agreement levels regarding its impact on human-wildlife coexistence.
Planting to Stop Soil Erosion	2.0243	3	0.0547	There is a significant association between planting to stop soil erosion and respondents' agreement levels regarding its impact on human-wildlife coexistence.

Table 6. Relationship between Conservation Education Programs and Human-Wildlife Co-existence among Communities Neighboring Budongo CFR (Questionnaire Survey, 2023)

Correlations			
		Conservation education programs	**Human-Wildlife co-existence**
Conservation education programs	Pearson Correlation	1	.973**
	Sig. (2-tailed)		.000
	N	237	237
Human-Wildlife co-existence	Pearson Correlation	.973**	1
	Sig. (2-tailed)	.000	
	N	90	90

**. Correlation is significant at the 0.05 level (2-tailed)

The influence of Natural Resources Awareness Programs (Community Outreach) towards enhancing human-wildlife coexistence around Budongo CFR was also analyzed. This program also showed a significant association with respondents' agreement levels at P=0.0167, suggesting its effectiveness in influencing perceptions of human-wildlife coexistence. Further, a similar analysis on ecotourism potential towards enhancing human-wildlife coexistence around Budongo CFR was significant at P=0.0493, indicating that opinions regarding ecotourism to improving coexistence among the respondents varied. Additionally, considering sustainable Agriculture, this program yielded significant results at P=0.0432, indicating that it is associated with respondents' agreement levels, although there may be mixed perceptions.

Other aspects in the analysis included forest restoration. The results were significant at P=0.0345, suggesting an association between forest restoration and respondents' agreement levels, though the impact may vary. Lastly, tree planting to stop soil erosion was also analyzed and the results showed a potential association between this program and respondents' agreement levels at P=0.0547. There is likelihood that this variable in particular cannot be relied upon greatly considering the existence of other programs in the area. In summary, the Chi-square test results indicate that these conservation education programs are associated with respondents' perceptions of their impact on human-wildlife coexistence. However, the effectiveness and impact of these programs may vary among individuals, highlighting the importance of considering diverse perspectives and tailoring conservation efforts towards addressing specific community needs and concerns.

To ascertain the relationship between conservation education programs and the promotion of human-wildlife coexistence in the Budongo Central Forest Reserve, the Pearson Correlation Coefficient analysis was conducted. The results, indicating the significance level of the relationship between these factors, are presented in Table 6.

Table 6 illustrates a robust and positively significant association between conservation education programs and enhancements in human-wildlife coexistence at P=0.000. The findings suggests that an increase in conservation awareness programs corresponds to a greater likelihood of improving human-wildlife coexistence.

4. DISCUSSION

Based on the findings of this research and a comprehensive review of relevant literature, it is evident that the role of conservation education programs in enhancing human-wildlife co-existence is a subject of global significance. The research successfully documented various conservation education programs in the Budongo CFR region, encompassing a wide range of initiatives. These programs include conservation education in schools, community outreach efforts, eco-tourism ventures, sustainable agriculture initiatives, and forest restoration projects among others. As Gibson [40] noted, the diversity of programs underscores the multifaceted approach to fostering human-wildlife coexistence. Influence of conservation education programs in the study area was noteworthy assessed and the study's findings demonstrate a significant influence of conservation education programs on various aspects of human-wildlife coexistence. These programs positively impact knowledge, attitudes, behaviours, and collaborative efforts among local residents. As Blewitt [4] highlighted, conservation education can lead to behaviour change and a more empathetic attitude toward wildlife. The research assessed the moderating effect of conservation

education programs, comparing coexistence outcomes among communities exposed to these programs and those that have not received them. The results revealed a strong association between the presence of these programs and positive coexistence outcomes. Considering the importance of conservation education programs literature emphasizes the pivotal role of conservation education programs in fostering coexistence between humans and wildlife [14,4]. These research findings align with this perspective, demonstrating that conservation education programs play a significant role in enhancing knowledge, attitudes, and behaviours related to wildlife conservation and coexistence. Considering the impact of these programs on respondents' attitudes and behaviours, the findings show that there was a positive outcome relating to the existence of these programs which actually shaped their ways of thinking. Literature acknowledges that conservation education can lead to changes in attitudes and behaviours among communities [41,42]. The research findings corroborate this by revealing that these programs positively influence the attitudes of local inhabitants and promote sustainable practices. In conclusion, this study's findings resonate with the existing literature, affirming the crucial role of conservation education programs in enhancing human-wildlife coexistence. However, the research also highlights the need for continued investigation to delve deeper into the long-term effects, demographic differences, and evolving dynamics of conservation education in the Budongo CFR and similar regions. By building upon this foundation, future research can contribute to the development of more effective and tailored conservation education strategies, ultimately benefiting both local communities and wildlife conservation efforts [43-45].

5. CONCLUSION

This study demonstrated the critical role of conservation education programs in enhancing human-wildlife coexistence around Budongo Central Forest Reserve. The findings highlight the effectiveness of these programs in promoting knowledge, attitudes, and behaviours that support human-wildlife coexistence. Specifically, the study revealed that, conservation education programs significantly improve local communities' knowledge and awareness of wildlife conservation. These programs positively influence attitudes towards wildlife and conservation, reducing human-wildlife conflict. Participation in conservation education programs

is associated with increased community engagement in conservation efforts. Conservation education programs contribute to a reduction in human-wildlife conflict and crop damage.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

DATA AVAILABILITY

The data presented in the manuscript is available on request.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Mbaiwa JE. The success and sustainability of community-based natural resource management in the Okavango Delta, Botswana. South African Geog. J. 2004;86(1):44-53.

2. USAID. Environmental threats and opportunities assessment. Report produced for review by the United States Agency for International Development. Kampala, Uganda; 2011.

3. Alfita L, Kadiyono A, Nguyen P, Firdaus W, Wekke I. Educating the External Conditions in the Educational and Cultural Environment International Journal; 2019.

4. Blewitt J. The media, animal conservation, and environmental education. Environmental Education Research. 2011;17(6):711-718.

5. Dvimbo MA. Examining the impact of climate change on rural livelihoods and food security. Evidence from Sanyati District in Mashona land west, Zimbabwe. Harare; 2017.

6. Andrade GSM, Rhodes JR. Protected areas and local communities: An inevitable partnership toward successful conservation strategies? Ecol. Society. 2012;17(4):14.

7. Hughes C. Environmental education for conservation: Considerations to achieve

success. Natural Areas Journal. 2012; 32(2):218-219.

8. Akello CE. Environmental regulation in uganda. successes and challenges. Law, Environment and Development Journal. 2007;3/1:22–25.

9. Hepworth N. Climate Change in Uganda. Understanding the Implications and Appraising the Response. Scoping Mission for DFID Uganda; 2008.

10. Sassen S. When territory deborders territoriality. 2013;21-45. Available:https://doi.org/10.1080/21622671 .2013.769895

11. UNEP. Report of the Ad Hoc technical expert group on protected areas. United Nations Environmental Programme, Convention on Biological Diversity, November 10–14, Montreal, Canada; 2003.

12. Kalindi B. Learning engagement and environmental education for sustainability. Primary & Middle Years Educator. 2014;12(2):14–23.

13. Yeganeh,Kia Hamid. A typology of sources, manifestations, and implications of environmental degradation. Management of Environmental Quality: An International Journal. 2020;31(3):765–783.

14. Barakagira A, de Wit A. Community livelihood activities as key determinants for community-based conservation of wetlands in Uganda. Environmental and Socio-economic Studies. 2017;5(1):11–24. Available:https://doi.org/10.1515/environ-2017-0002

15. Barakagira A, de Wit A. The role of wetland management agencies within the local community in the conservation of wetlands in Uganda. Environmental and Socio-economic Studies. 2019;7(1):59-74. Available:https://doi.org/10.2478/environ-2019-006

16. Plumer Brad. Humans are speeding extinction and altering the natural world at an 'Unprecedented' pace. The New York Times; 2019.

17. IPCC. Climate Change 2001: The scientific Basis. Cambridge University Press, Cambridge; 2001.

18. Watts Jonathan. Human society under urgent threat from loss of Earth's natural life "The Guardian; 2019.

19. Keune Katrien. Mass Jennifer, Mehta Apurva, Church Jonathan, Meier Florian. Analytical imaging studies of the migration of degraded orpiment, realgar, and emerald green pigments in historic paintings and related conservation issues. Heritage Science. 2016;4(1):10. DOI:10.1186/s40494-016-0078-1. hdl:11245.1/080e76f8-43f1-4464-afa3-8b9646e2484a. ISSN 2050-7445

20. Bambach RK, Knoll AH, Wang SC. Origination, extinction, and mass depletions of marine diversity Paleobiology. 2004;30:522542 DOI:10.1666/00948373(2004)030<0522:O EAMDO>2.0.CO;2

21. Salvati L, Marco Z. Natural resource depletion and economic performance of local districts: Suggestions from a within-country analysis. Journal of Sustainable Development and World Ecology. 2008;15(6):518–523.

22. Forgie V, Horsley P, Johnston J. Facilitating community-based conservation initiatives. Science for Conservation. Report No. 169, Department of Conservation, Wellington, New Zealand; 2001.

23. UNEP. Cultural diversity and biodiversity for sustainable development, World Summit on Sustainable Development, Johannesburg; 2002.

24. Abrams RW, Anwana ED, Ormsby A, Dovie DBK, Ajagbe A, Abrams A. Integrating top-down with bottom-up conservation policy in Africa. Conservation Biology. 2009;23(23):779–804.

25. Milton SJ. Community-based conservation: exploring positive feedback between economic development and conservation. SA. J. of Sc. 2000;96.

26. Bettinger Pete, Boston Kevin, Siry Jacek, Grebner Donald, eds. Forest management and planning (Second edition) Academic Press. 2017;362. ISBN 9780128094761

27. Brooks Jeremy S, Waylen Kerry A, Mulder Monique Borgerhoff. How national context, project design, and local community characteristics influence success in community-based conservation projects; 2012. DOI:10.1073/pnas.1207141110 ISSN 0027-8424. PMC 3535631 PMID

28. Ardoin NM, Bowers AW, Gaillard E. Environmental education outcomes for conservation: A systematic review. Biological Conservation. 2020;241: 108224.

Available:https://doi.org/10.1016/j.biocon.2 019.108224

29. Goldman M. Partitioned nature, privileged knowledge: Community-based conservation in Tanzania. Dev. Change. 2003;34(5):833-862.
30. Chase L, Decker D, Lauber B. Public participation in forestry management: What do stakeholders want?. Society and Natural resources. 2004;17(7):629-539.
31. FAO. The impact of disasters and crises on agriculture and food security. Italy; 2017.
32. Hammami MBA, Mohammed EQ, Hashem AM, Al-Khafaji MA, Alqahtani F, Alzaabi S, Dash N. Survey on awareness and attitudes of secondary school students regarding plastic pollution: Implications for environmental education and public health in Sharjah city, UAE. Environmental Science and Pollution Research. 2017;24(25):20626–20633. Available:https://doi.org/10.1007/s11356-017-9625-x
33. Karatas A, Karatas E. Environmental education as a solution tool for the prevention of water pollution. Journal of Survey in Fisheries Sciences. 2023;3 (1):61–70.
34. Hartter J, Southworth J. Dwindling resources and fragmentation of landscapes around parks: Wetlands and forest fragments around Kibale National Park, Uganda. Landscape Ecol. 2009;24(5):643-656.
35. Agrawal A, Gibson CC. Enchantment and disenchantment: the role of community in natural resource conservation. World Development. 1999;4(27):629–649.
36. Murphree MW, Hulme D. (eds.). African wildlife and livelihoods: The promise and performance of community conservation. London: James Currey; 2001.
37. Glasser S, Osborne M, Krause AE. Augmenting function with value.

An exploration of reasons to engage in and disengage from listening. 2021; 41-13. Available:https://doi.org/10.1177/20592043 211022535
38. Uganda National Bureau of Standards (UNBS). The Annual Report for the Financial Year, 2018-2019; 2019. Available:https://www.unbs.go.ug
39. Amin ME. Social science research: Conception methodology and analysis. Makerere University Printery, Kampala; 2005.
40. Gibson C. People and forests: Communities, institutions and the governance of forests. Cambridge, MIT Press; 2000.
41. Bretton Woods Project. Factors that have led to the collapse of the bretton woods system. American Journal of Industrial and Business Management. 2001;8(10): 23. DOI: 10.4236/ajibm.2018.810141
42. Farnsworth KL. River discharge to the Coastal Ocean: A global synthesis. Cambridge University Press, Cambridge. 2011;143-144. Available:https://doi.org/10.1017/cbo97805 11781247
43. Azwar S. Sikap manusia teoridan pengu kurannya. Pustaka Pelajar; 2013.
44. Gombya-Ssembajjwe W, Banana AY. Property rights and the sustainability of forests in Uganda. [in:] Presented at International Association for the Study of Common Property, Vancouver, British Columbia, Canada; 1998.
45. Lee Derek E, Bond Monica L. Quantifying the ecological success of a community-based wildlife conservation area in Tanzania. Journal of Mammalogy. 2018;99(2):459–464. DOI:10.1093/mammal/gyy014. PMC 5965405 PMID 29867255

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