Environmental Education and Sustainable Development: Assessing Its Impact on Environmental Management Practices

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Abstract: Purpose: This study examined how environmental education influences environmental management practices among households living adjacent Mbololo Forest in Taita-Taveta County, Kenya. It sought to determine whether environmental education improves awareness, encourages positive attitudes toward conservation, and promotes the adoption of sustainable forest management practices.

Approach: A quantitative cross-sectional survey was conducted among households residing adjacent Mbololo Forest. The target population consisted of 4,138 households, from whom a sample of 365 respondents were selected using Yamane's formula. Data were collected using structured questionnaires. A total of 353 completed questionnaires were returned and analyzed, resulting in a response rate of 96.7%. Descriptive statistics and regression analysis were used to examine the relationship between environmental education and environmental management practices.

Findings: The results showed that 69.4% of respondents had participated in environmental education programs, which helped increase environmental awareness and improve attitudes toward sustainability. Regression analysis indicated a positive and statistically significant relationship between environmental education and environmental management practices ($\beta = 0.52$, $p < 0.05$). Environmental education explained about 45% of the variation in sustainable practices. Households exposed to environmental education were more likely to practice proper waste management, participate in community conservation activities, and use forest resources more responsibly.

Originality/value: The study provides empirical evidence from a rural forest-adjacent community in Kenya, showing that environmental education can play an important role in promoting sustainable environmental management.

Keywords: environmental education; sustainable development; environmental management; forest-adjacent communities; pro-environmental behavior; Kenya.

JEL Classification: Q01; Q28; Q56; I25; O13.

Introduction

Environmental degradation, climate change, biodiversity loss, and the unsustainable use of natural resources have become serious global challenges that threaten ecosystems and human well-being. As populations grow, urbanization increase and economic activities expand, the demand for natural resources continues to increase. This makes effective environmental management essential for long-term sustainability. As a result, sustainable development has become a major global priority, especially after the adoption of the United Nations 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs). These global commitments stress the need to balance environmental protection, economic growth, and social well-being to ensure a sustainable future (Velempini 2025).

Education plays an important role in promoting sustainability by shaping people's awareness, attitudes, and behavior toward the environment. Environmental education (EE) is therefore widely recognized as an effective way to support sustainable development and encourage responsible environmental practices. It helps people gain the knowledge, skills, values, and motivation needed to understand environmental problems and adopt sustainable lifestyles. By improving environmental understanding, environmental education enables individuals and communities to make informed decisions that support environmental conservation and responsible resource use (Chavula *et al.* 2024).

Policymakers increasingly recognize the importance of environmental education in achieving sustainability across sectors such as tourism, natural resource management, and community development. Research suggests that environmental education can influence people's attitudes and behaviors toward the environment, encouraging more responsible decision-making and sustainable management practices (Mensah 2015). Awareness campaigns and sustainability training programs have also been shown to strengthen people's commitment to protecting the environment and encourage environmentally responsible practices in tourism areas and local communities (Nasution *et al.* 2025).

Environmental management practices refer to the strategies, policies, and actions taken by organizations, institutions, and communities to reduce environmental harm and promote the sustainable use of natural resources. These practices may include waste management, energy conservation, biodiversity protection, pollution control, and sustainable land use. Effective environmental management depends not only on policies and technology but also on individuals who are aware of environmental issues and willing to apply sustainable practices in their daily lives and work. In this context, environmental education plays an important role in strengthening environmental governance and supporting sustainable management efforts (Lestari and Wahyuni 2024).

Despite increasing recognition of environmental education as an important tool for sustainability, there is still limited empirical evidence showing how it directly influences environmental management practices. Many studies focus mainly on environmental awareness or attitudes, while fewer examine whether environmental education leads to actual environmental actions. This gap is especially important in developing countries and emerging tourism destinations where environmental pressures are increasing and effective management strategies are urgently needed.

This study examined the relationship between environmental education and sustainable development by assessing its influence on environmental management practices. Specifically, the study explored how environmental education encourages the adoption of sustainable environmental management strategies and supports broader sustainability goals. By providing empirical evidence on the role of environmental education in promoting sustainable environmental practices, this study contributes to the growing body of knowledge on sustainability education and environmental governance. The findings will offer useful insights for policymakers, educators, and environmental managers seeking to strengthen environmental education programs and promote sustainable development.

Null Hypothesis

H_0: Environmental education has no statistically significant effect on environmental management practices in the context of sustainable development.

1. Literature Review and Theoretical Orientation

1.1 Environmental Education and Environmental Literacy

Environmental education has increasingly become an important way of building environmental literacy and encouraging sustainable environmental practices. Environmental literacy refers to the knowledge, attitudes, skills, and willingness that enable people to understand environmental issues and take part in environmental decision-making. Environmental education helps develop this literacy by providing people with the knowledge and practical skills needed to engage in environmentally responsible activities (Ardoin *et al.* 2020). Some studies shows that environmental education programs can improve people's understanding of ecological systems and environmental challenges. Learning about sustainability, ecological awareness, and environmental responsibility helps individuals think critically about environmental problems and identify possible solutions. According to Ardoin *et al.* (2020), environmental education not only increases environmental knowledge but also helps people develop problem-solving skills and competencies related to sustainability.

Environmental education has also been integrated into school curricula and community development programs to increase sustainability awareness. Educational institutions, government agencies, and non-governmental organizations now run environmental education programs to strengthen environmental responsibility

among students and community members. These programs often include practical learning activities such as field visits, environmental campaigns, and sustainability projects that encourage people to actively engage with environmental issues. A study by Liu *et al.* (2024) suggests that participatory and experiential learning approaches are especially effective in increasing environmental awareness and changing behavior. These learning methods allow participants to interact directly with nature, which can strengthen their emotional connection to the environment. According to Stevenson *et al.* (2012), such experiences can increase people's commitment to environmental protection and encourage long-term conservation attitudes and behaviors.

Environmental education also helps people develop sustainability competencies such as systems thinking, critical thinking, teamwork, and problem-solving skills. These abilities are important for addressing complex environmental problems that require cooperation and knowledge from different disciplines. Studies show that these competencies can improve people's ability to take part in environmental management initiatives (Odell *et al.* 2020). Therefore, environmental education plays an important role in equipping individuals with the knowledge and skills needed to support sustainable environmental management practices.

The studies reviewed in this section assumed a linear relationship between knowledge acquisition and behavioural change, reflecting a knowledge-deficit model that overlooks social, economic, and cultural barriers influencing pro-environmental behaviour (Dong *et al.* 2026). Although environmental literacy is defined, the discussion does not engage with competing perspectives that emphasize values, action competence, and civic participation, limiting theoretical rigor. The cited studies are presented with little attention to their methodological limitations or contextual variability. For instance, participatory and experiential learning approaches are portrayed as universally effective, despite their dependence on resources and local contexts (Bartels 2023). The success of environmental education programs is generalised without addressing inequalities in access, particularly in resource-constrained settings. The practical challenges such as inadequate teacher training, curriculum constraints, and weak policy implementation have also not been addressed (Buabeng and Amo-Darko 2025).

1.2 Environmental Education and Pro-Environmental Behavior

The relationship between environmental education and pro-environmental behavior has attracted significant attention from researchers. Pro-environmental behavior refers to actions that people take to reduce environmental harm or support environmental sustainability. These actions may include recycling, saving energy, reducing waste, protecting biodiversity, and supporting environmental policies. Environmental education has been found to positively influence pro-environmental attitudes and behavior. Knowledge gained through environmental education increases awareness of environmental problems and encourages individuals to adopt environmentally responsible practices. Otto and Pensini (2017) note that environmental education can strengthen people's emotional connection to nature, which often encourages responsible environmental behavior.

However, Amoah and Addoah (2021) point out that environmental knowledge alone does not always lead to behavioral change. Other factors such as environmental attitudes, social expectations, and personal motivation also influence people's actions. Environmental education plays an important role in shaping these factors by encouraging environmental values and a sense of responsibility for environmental protection. Studies conducted in higher education institutions show that sustainability-focused programs can influence students' environmental attitudes and behavior. Students who take part in environmental education programs often show stronger commitment to environmental protection and are more likely to participate in sustainability activities in their communities (Cebrián *et al.* 2020).

Environmental education programs can also influence collective environmental behavior by encouraging community participation and environmental responsibility (Gupta *et al.* 2024). Community-based environmental education initiatives often involve activities such as tree planting, waste management, and ecosystem restoration. In the tourism sector, environmental education has also been shown to influence responsible behavior among tourists and tourism stakeholders (Yu *et al.* 2024). Tourism activities can put pressure on natural ecosystems, making environmental awareness essential for promoting sustainable tourism practices. Educational programs targeting tourists and tourism operators can therefore increase awareness about conservation and encourage responsible tourism behavior (Mensah 2015). Overall, research shows that environmental education helps people develop behaviors that support environmental protection and sustainable environmental management.

The authors note that the studies analyzed tends to generalize the effectiveness of environmental education programs without critically addressing methodological limitations, contextual variability, or long-term impacts. For example, the cited studies focus primarily on short-term behavioral outcomes, neglecting the sustainability of these behaviors over time (Wang et al. 2024). The studies also assume a largely positive influence of environmental education while insufficiently considering structural barriers such as socio-economic constraints, cultural

differences, and institutional support, which can limit the translation of knowledge into action (Harahap and Uthman 2024).

1.3 Environmental Management Practices

Environmental management practices refer to the actions taken by organizations, institutions, and communities to reduce environmental impacts and promote sustainable use of natural resources (Awewomom *et al.* 2024). These practices may include waste reduction, pollution control, energy conservation, biodiversity protection, and sustainable land management. Many organizations are now adopting environmental management systems to improve environmental performance and comply with environmental regulations. Such systems provide structured approaches for identifying environmental risks, implementing solutions, and monitoring environmental performance (Ronalter *et al.* 2023).

Environmental management practices are influenced by several factors including organizational culture, environmental policies, technological capacity, and environmental awareness (Khalid *et al.* 2024). Among these factors, environmental awareness and education play an important role in shaping environmental management behavior. Educational institutions, for example, have introduced green campus initiatives that incorporate environmental management practices into daily operations. These initiatives often involve sustainability policies, waste management programs, environmental monitoring systems, and energy conservation efforts. Research suggests that environmental education programs in educational institutions help support the implementation of these environmental management initiatives (Lozano *et al.* 2021).

Environmental management practices are also widely applied in tourism management to promote sustainable tourism development. Many tourism destinations depend on natural ecosystems, making environmental conservation essential for maintaining tourism sustainability. As a result, tourism organizations are adopting environmental management practices aimed at reducing environmental damage and protecting natural resources (Baloch *et al.* 2023). Studies show that environmental awareness and environmental education programs can improve the adoption of environmental management practices among tourism stakeholders. Tourism operators who understand environmental issues are more likely to implement sustainable practices such as waste reduction, energy efficiency, and ecosystem protection (Wang *et al.* 2024).

Community participation also plays a key role in the success of environmental management initiatives. Environmental education programs that involve communities in conservation activities can strengthen local environmental governance and encourage sustainable resource management. Overall, existing studies show that environmental education supports environmental management practices by increasing environmental awareness, encouraging positive environmental attitudes, and promoting responsible environmental behavior.

While environmental education is presented as a key driver of environmental management, the studies have not sufficiently addressed structural or institutional barriers such as limited resources, organizational inertia, or inconsistent policy enforcement that may hinder implementation as observed by Yuan (2026).

1.4 Theoretical Orientation

Understanding how environmental education influences environmental management practices requires a theoretical framework that explains how knowledge, values, and attitudes affect human behavior. This study is guided by three related theoretical perspectives namely the Theory of Planned Behavior, the Value–Belief–Norm Theory, and Sustainable Development Theory.

1.4.1 Theory of Planned Behavior

The Theory of Planned Behavior (TPB), developed by Icek Ajzen, is widely used to explain how people form intentions and behaviors. The theory states that behavior is influenced by three main factors. The factors are attitudes toward the behavior, subjective norms, and perceived behavioral control (Rapi and Kassim 2023). Attitudes refer to how individuals evaluate a behavior, while subjective norms refer to social pressure or expectations from others. Perceived behavioral control refers to a person's belief about whether they are capable of performing a certain behavior.

Environmental education can influence all three components of the theory (Fauzi *et al.* 2024). Education increases environmental knowledge, which can lead to positive attitudes toward environmental protection. It also helps create social expectations that encourage environmentally responsible behavior. In addition, environmental education provides practical skills that increase people's confidence in their ability to practice sustainable behaviors.Several studies have used the Theory of Planned Behavior to explain environmental behavior in sustainability contexts. Research shows that environmental attitudes, social expectations, and perceived behavioral

control significantly influence people's willingness to adopt environmentally responsible behaviors (Zulkepeli *et al.* 2024). This theory provides a useful framework for understanding how environmental education can influence environmental management practices.

1.4.2 Value–Belief–Norm Theory

The Value–Belief–Norm (VBN) Theory provides another useful perspective for understanding environmentally responsible behavior. According to this theory, people's environmental values influence their beliefs about environmental problems, which then shape their personal norms and behavior (Batool *et al.* 2024). Environmental education can strengthen environmental values and beliefs by increasing awareness about environmental challenges and promoting environmental responsibility. When people develop strong environmental values, they are more likely to feel morally responsible for protecting the environment. Studies using the VBN framework show that environmental awareness and personal responsibility strongly influence sustainable behavior, especially in areas such as environmental conservation and sustainable tourism (Negm 2024). The VBN theory therefore complements the Theory of Planned Behavior by focusing on the moral and ethical aspects of environmental behavior.

1.4.3 Sustainable Development Theory

Sustainable Development Theory provides a broader framework for understanding the role of environmental education in sustainability. The theory emphasizes the need to balance economic growth, social well-being, and environmental protection in order to achieve long-term sustainability (Islam and Wang 2023). Education is widely recognized as an important driver of sustainable development because it equips people with the knowledge and skills needed to address sustainability challenges. Environmental education specifically supports sustainable development by promoting environmental awareness, sustainability competencies, and responsible environmental behavior (Odell *et al.* 2020). Within this framework, environmental education can be seen as an important tool for strengthening environmental governance and supporting sustainable environmental management practices.

1.5 Synopsis of Literature

The literature reviewed shows that environmental education plays an important role in shaping environmental knowledge, attitudes, values, and behavior. It helps build environmental literacy, encourages pro-environmental behavior, and supports the adoption of sustainable environmental management practices. Theoretical perspectives such as the Theory of Planned Behavior, the Value–Belief–Norm Theory, and Sustainable Development Theory help explain how environmental education influences environmental behavior and sustainability outcomes. Although research on environmental education and sustainability has grown significantly, there is still a need for more empirical studies examining how environmental education influences environmental management practices in different social and institutional contexts. This study therefore contributes to existing knowledge by examining the relationship between environmental education and environmental management practices within the broader context of sustainable development.

1.6 Contribution in Relation to Existing Literature

The existing literature demonstrates that environmental education enhances environmental literacy, encourages pro-environmental behavior, and supports sustainable environmental manageHowever, this research assumed a linear knowledge-to-action pathways and tends to overlook structural, socio-economic, and contextual factors that mediate outcomes. Previous studies have largely focused on short-term behavioral changes, with limited attention to long-term sustainability, resource constraints, organizational inertia, and inequities in access to environmental education programs. While theoretical frameworks such as the Theory of Planned Behavior, Value–Belief–Norm Theory, and Sustainable Development Theory explain mechanisms linking education to behavior, empirical applications across diverse institutional and community contexts have not received adequate attention.

This study contributes to the literature by addressing these gaps through an empirical examination of how environmental education influences environmental management practices within multiple social and institutional settings. By integrating theoretical insights with real-world applications, it explores not only knowledge acquisition and attitude formation but also the structural, cultural, and resource-based factors that affect the adoption of sustainable management practices. The study helps explain how education influences people's intentions and actual environmental actions, and it provides practical, research-based suggestions for improving policies and programs.

2. Research Methodology

2.1 Research Design

This study adopted a quantitative research approach using a cross-sectional survey design to examine the relationship between environmental education and environmental management practices in the context of sustainable development. A cross-sectional design was considered appropriate because it allows the collection of data from respondents at a single point in time while examining relationships between variables within a defined population. Quantitative research methods are widely used in environmental management studies because they enable researchers to analyze patterns, relationships, and causal associations among variables using statistical techniques.

The study focused on assessing how environmental education influences environmental management practices among households living adjacent to forest ecosystems. Forest-adjacent communities often play a significant role in environmental conservation and sustainable resource management, making them an important population for investigating environmental education and sustainability outcomes.

2.2 Study Area

The study was conducted in Mbololo Forest, which is located in Taita Hills within Taita-Taveta County in Kenya. Mbololo Forest forms part of the Eastern Arc Mountains, a biodiversity hotspot known for its unique flora and fauna and high levels of endemism. The forest plays a crucial role in supporting ecological stability, water catchment functions, and biodiversity conservation in the region.

Communities residing around Mbololo Forest depend heavily on forest resources for their livelihoods, including fuelwood, medicinal plants, grazing, and small-scale agriculture. As a result, human activities around the forest have important implications for environmental sustainability and forest conservation. Environmental education initiatives implemented by government agencies, conservation organizations, and community groups in the region aim to promote sustainable resource use and encourage environmentally responsible behavior among local communities. The selection of Mbololo Forest as the study area was therefore appropriate because it provides an ideal context for examining the relationship between environmental education and environmental management practices among forest-adjacent households.

2.3 Target Population

The target population for this study consisted of households living adjacent to Mbololo Forest. According to local administrative records, the total population of households residing near the forest is approximately 4,138 households (County Government of Taita Taveta 2023).These households represent communities that interact frequently with forest resources and therefore play a critical role in forest conservation and environmental management. Household heads or adult representatives were selected as respondents because they are typically responsible for household decision-making related to resource use, environmental practices, and participation in environmental education programs.

2.4 Sample Size Determination

The sample size for this study was determined using the Yamane (1967) formula for sample size calculation. The Yamane formula is widely used in social science research to determine an appropriate sample size when the population size is known. The formula is expressed as follows:

$$n = N/\{1 + N(e\text{^}2)\}$$

Where:
n = sample size
N = population size
e = margin of error

In this study, the population size (N) was 4,138 households, and the margin of error (e) was set at 0.05, corresponding to a 95% confidence level. Using the formulae, the study determined a sample size of 365 respondents, which was considered adequate to represent the target population and allow reliable statistical analysis.

2.5 Sampling Procedure

A multistage sampling technique was used to select the respondents for this study. First, villages located adjacent Mbololo Forest were identified using administrative records. Secondly, households in these villages were selected using systematic random sampling so that each household had an equal chance of being included in the study. From each selected household, the household head or another adult member was invited to take part in the survey. This approach helped ensure that the respondents had adequate knowledge about household environmental practices and their participation in environmental education activities.

Data were collected over a three-month period, from June to August 2025. Respondents were recruited using a combination of face-to-face household visits and digital platforms. Specifically, in-person recruitment was conducted by trained research assistants within the selected villages. Supplementary recruitment and follow-up communication were facilitated through mobile phone calls and messaging platforms such as WhatsApp. This mixed approach enhanced response rates and ensured broader participation, particularly in cases where initial contact required scheduling flexibility.

2.6 Data Collection Methods

Primary data for the study were collected using a structured questionnaire that was administered to the selected respondents. The questionnaire contained both closed-ended questions and Likert-scale questions to gather information about environmental education and environmental management practices.The questionnaire was divided into several sections. The first section collected demographic information about respondents, such as age, gender, education level, and occupation. The second section focused on respondents' exposure to environmental education programs and their level of environmental knowledge and awareness. The third section examined environmental management practices adopted by households, including waste management, conservation practices, and sustainable use of natural resources. Using a structured questionnaire made it possible to collect consistent data that could easily be analyzed using statistical methods. Before the main data collection began, the questionnaire was pretested with a small group of respondents to ensure that the questions were clear and reliable.

2.7 Measurement of Variables

The main independent variable in this study was environmental education. It was measured using indicators such as environmental knowledge, participation in environmental education programs, and environmental awareness. Environmental knowledge was measured using the following items: "I understand the causes of environmental degradation," *and* "I am aware of the importance of conserving forest resources.*"* Environmental awareness included the following items: *"*Environmental problems in my area affect my daily life," and "Protecting the environment is a personal responsibility.*"* Participation in environmental education was measured using the following items: *"*I have attended environmental education training," and "I actively engage in community environmental awareness activities

The dependent variable was environmental management practices. This was measured using indicators such as waste management practices, participation in conservation activities, sustainable use of forest resources, and adoption of environmentally friendly behaviors. The items used were: "I practice proper waste disposal and recycling," "I participate in tree planting or conservation activities," "I use forest resources responsibly," and "I adopt practices that reduce environmental harm."

The Likert-scale measurement helped the researcher quantify respondents' perceptions and behaviors related to environmental education and environmental management. All items were measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), enabling quantification of attitudes and behaviors.

2.8 Data Analysis

The collected data were analyzed using statistical techniques suitable for quantitative research. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondents' demographic characteristics and the main study variables. Inferential statistical analysis was also conducted to examine the relationship between environmental education and environmental management practices. Regression analysis was used to determine whether environmental education significantly influences environmental management practices among households living near Mbololo Forest. The analysis was conducted using appropriate statistical software to ensure accuracy and reliability of the results. The significance level for hypothesis testing was set at 0.05, meaning that relationships between variables were considered statistically significant when the p-value was equal to or less than 0.05.

2.9 Ethical Considerations

Ethical considerations were observed throughout the research process. Participation in the study was voluntary, and respondents were informed about the purpose of the research before completing the questionnaire. The confidentiality and anonymity of respondents were protected by ensuring that no personal identifying information was included in the data analysis or reporting of results. Respondents were also informed that the information they provided would be used only for the purposes of the study. These measures helped ensure that the research followed accepted ethical standards in social science research.

3. Research Results

A total of 365 questionnaires were distributed to households living near Mbololo Forest in Taita-Taveta County, Kenya. Out of these, 353 questionnaires were properly completed and returned, giving a response rate of 96.7%. Twelve questionnaires were either not returned or were incomplete, so they were excluded from the analysis. The high response rate was considered adequate to provide reliable data for statistical analysis and proper representation of the target population.

3.1 Demographic Characteristics of Respondents

The demographic characteristics of the respondents were analyzed to better understand the households living near Mbololo Forest. The results showed that 56.4% (n = 199) of the respondents were male, while 43.6% (n = 154) were female. This indicates that male household heads were slightly more represented in the survey, which may reflect the role they often play in household decision-making related to environmental matters in the community. Regarding age distribution, 33.7% (n = 119) of respondents were between 31 and 40 years, 27.5% (n = 97) were between 41 and 50 years, 22.1% (n = 78) were between 21 and 30 years, and 16.7% (n = 59) were above 50 years. These findings show that most respondents were within the economically active age groups, which are commonly involved in natural resource use and environmental management activities. The level of education among respondents varied. The results indicated that 34.8% (n = 123) had completed secondary education, 30.6% (n = 108) had primary education, 21.8% (n = 77) had tertiary education, and 12.8% (n = 45) had no formal education. This suggests that most respondents had at least basic education, which may help them understand environmental education programs and adopt sustainable environmental practices.

3.2 Environmental Education Awareness

Respondents were asked whether they had participated in environmental education programs related to forest conservation and sustainable environmental practices. The results showed that 69.4% (n = 245) had participated in environmental education programs, while 30.6% (n = 108) had not participated. Further analysis indicated that environmental education had a positive influence on respondents' awareness and understanding of environmental conservation. About 74% of respondents agreed that environmental education programs improved their knowledge of forest conservation, while 70% said that these programs influenced their attitudes toward protecting the environment. These results suggest that environmental education initiatives in communities surrounding Mbololo Forest have helped increase environmental awareness and understanding of sustainable environmental practices.

3.3 Environmental Management Practices

The study also examined the environmental management practices adopted by households living near Mbololo Forest. Respondents were asked about their involvement in different environmental conservation and sustainability activities. The results showed that 66% of respondents practiced proper waste management, including safe disposal and separation of household waste. In addition, 60% reported participating in community conservation activities such as tree planting and forest protection programs. About 63% of respondents indicated that they used forest resources sustainably, for example by collecting firewood in a regulated manner and following community forest management guidelines. A total of 57% reported practicing environmentally friendly behaviors such as protecting water sources and reducing the use of forest products. These findings demonstrate that many households living near Mbololo Forest have adopted practices that support sustainable forest conservation.

3.4 Relationship Between Environmental Education and Environmental Management Practices

Regression analysis was conducted to examine the relationship between environmental education and environmental management practices. The results showed a positive and statistically significant relationship between the two variables ($\beta = 0.52$, $p < 0.05$). This means that respondents who had greater exposure to environmental education programs were more likely to adopt environmentally responsible practices such as proper

waste management, conservation activities, and sustainable use of natural resources. The regression model also showed that environmental education explained about 45% of the variation in environmental management practices ($R^2 = 0.45$) among households living near Mbololo Forest.

3.5 Hypothesis Testing

The study tested the null hypothesis that environmental education has no statistically significant effect on environmental management practices. The regression results showed that environmental education had a statistically significant positive effect on environmental management practices ($p < 0.05$). Based on this result, the null hypothesis was rejected and the alternative hypothesis was accepted. This means that environmental education significantly influences environmental management practices among households living near Mbololo Forest.

3.6 Synopsis of Findings

These findings show that environmental education plays an important role in promoting sustainable environmental management practices among communities living near Mbololo Forest. Environmental education programs helped increase environmental awareness, improve attitudes toward conservation, and encourage the adoption of environmentally responsible practices. These results highlight the importance of environmental education as a key strategy for strengthening community participation in environmental conservation and promoting sustainable development in communities located near forest areas.

4. Discussions

This study examined how environmental education influences environmental management practices among households living near Mbololo Forest in Taita-Taveta County, Kenya. The results showed that environmental education has a strong positive influence on environmental management practices such as proper waste management, participation in conservation activities, and the sustainable use of forest resources. This section explains these findings by relating them to previous studies, relevant theories, and their implications for practice, policy, and future research.

4.1 Environmental Education and Community Awareness

One important finding of this study was that most respondents (about 69.4%) had participated in environmental education programs. These respondents also showed higher levels of environmental awareness and more positive attitudes toward sustainability. This finding agrees with earlier studies which show that environmental education helps people understand environmental issues and develop environmental literacy. Environmental literacy includes knowledge about the environment, awareness of environmental problems, and the skills and values needed to support sustainable behavior (Ardoin *et al.*, 2020). When people understand the consequences of unsustainable practices, they are more likely to make better decisions about how natural resources are used. This finding is particularly important in areas like Mbololo Forest where local communities rely heavily on natural resources for their livelihoods. In Kenya, studies on environmental education in major forest ecosystems such as Cherangany, Mt. Kenya, Aberdares, and Kakamega show that environmental awareness and sustainable forest management are strengthened by education, community participation, and supportive government policies (Chisika & Yeom, 2024). These findings support the results of the present study, which show that environmental education can strongly influence environmental awareness and attitudes within communities.

Research in Kenya has also shown that environmental education programs in schools can influence students' attitudes and behaviors toward conservation (Saro *et al.*, 2025). These studies suggest that environmental values can be developed at an early stage and later influence people's actions toward the environment. In communities like those around Mbololo Forest, where adults have different levels of education, expanding environmental education initiatives could further strengthen long-term conservation outcomes.

4.2 Environmental Education and Pro-Environmental Behaviour

The positive relationship between environmental education and environmental management practices found in this study is consistent with earlier research showing that education encourages behavior change in different social and environmental settings. Studies have shown that environmental education helps develop pro-environmental attitudes and behaviors by increasing environmental awareness and helping people internalize ecological values (Simiyu *et al.*, 2022; Estrada *et al.*, 2023).

For example, Simiyu *et al.* (2022) found that environmental knowledge, together with social influences such as community norms and peer pressure, plays an important role in shaping pro-environmental behavior among university students in Kenya. The present study extend this understanding beyond students to households. This suggests that the influence of environmental education is not limited to schools or universities but can also affect behavior within communities where knowledge interacts with social norms and everyday experiences. Similarly, studies among young people in Kenya have found a positive relationship between environmental education programs and behaviors such as waste sorting, tree planting, and water conservation (Malwa, 2024). These findings are similar to those of the present study, where households that were more aware of environmental issues through education were more likely to adopt sustainable practices.

One explanation for this pattern is that environmental education strengthens both the knowledge and emotional aspects of behavior. Education increases environmental knowledge, encourages positive attitudes toward the environment, and builds people's confidence in their ability to take action. This idea is supported by the Theory of Planned Behavior, which suggests that behavior is influenced by attitudes, social expectations, and people's belief in their ability to perform certain actions (Ajzen, 1991). When environmental education strengthens these factors, individuals are more likely to adopt sustainable behaviors.

4.3 Environmental Education and Environmental Management Practices

Another important contribution of this study is the evidence that environmental education significantly predicts environmental management practices among households living near forests. The regression analysis showed that environmental education explained about 45% of the differences in environmental management practices ($R^2 \approx 0.45$). This means that environmental education plays an important role in encouraging sustainable environmental practices.

This finding agrees with earlier studies showing that environmental education supports responsible behaviors such as proper waste management, participation in conservation programs, and sustainable use of natural resources (Mensah, 2015; Wang *et al.*, 2024). For example, Mensah (2015) found that environmental education significantly influenced responsible tourist behavior in tourism areas. Although that study focused on tourism rather than rural communities, the basic idea is similar: when people become more aware of environmental issues, they are more likely to act responsibly.

In forest-adjacent communities, sustainable practices often depend on how relevant environmental issues are to people's daily lives and whether they feel responsible for protecting the environment. Studies on environmental literacy show that awareness of environmental problems, understanding the effects of human actions, and believing that individual actions matter can strongly influence sustainable behaviors (Ardoin *et al.*, 2023). In the case of Mbololo Forest, households that received environmental education may feel more responsible for protecting the forest and therefore participate in activities such as waste recycling, controlled harvesting of forest products, and conservation initiatives.

4.4 Community-Level and Cultural Dimensions

This study highlights the importance of community and cultural factors in environmental learning and action. In Kenya, research has shown that cultural practices and indigenous knowledge systems often play an important role in environmental conservation. For instance, among the Ogiek community living near the Mau Forest, cultural beliefs and sacred traditions contribute to the protection of forests, water sources, and sacred areas (Kiage, 2019). These traditional forms of environmental knowledge show that conservation can also be influenced by cultural education and local values. Although the present study mainly focused on formal environmental education programs, indigenous knowledge and cultural traditions may also influence environmental behavior within communities. Combining formal environmental education with local cultural practices could strengthen conservation efforts. This approach may be particularly useful in areas like Mbololo, where cultural beliefs and community traditions still influence how natural resources are used and managed.

4.5 Theoretical Implications

4.5.1 Theory of Planned Behavior

This study supports the Theory of Planned Behavior, which states that human behavior is influenced by attitudes, social expectations (subjective norms), and perceived behavioral control (Ajzen, 1991). Environmental education appears to strengthen these factors by improving attitudes toward environmental protection, encouraging supportive social norms, and increasing people's confidence in their ability to carry out sustainable practices.

For example, respondents who had participated in environmental education programs were more likely to believe that they could adopt sustainable environmental practices and that environmental protection was important within their community. These findings support the idea that behavioral change occurs when both psychological and social influences are strengthened. Other studies have also shown that environmental knowledge and attitudes are strong predictors of sustainable behavior (Simiyu *et al.*, 2022).

4.5.2 Value – Belief - Norm Theory

The results of this study are also consistent with the Value-Belief-Norm Theory. This theory explains that people's environmental values and beliefs influence their personal norms and behaviors. When individuals believe that environmental problems are serious and that their actions can help address them, they are more likely to act in environmentally responsible ways.

Environmental education may help develop these values by showing the importance of protecting natural systems and the possible consequences of environmental degradation. In communities around Mbololo Forest, households that receive environmental education may develop stronger conservation values, which then motivate them to participate in forest protection activities, proper waste management, and sustainable use of forest resources.

4.5.3 Sustainable Development Framework

The results of this study also support the sustainable development framework, which emphasizes balancing environmental protection, social wellbeing, and economic development for long-term sustainability. Environmental education plays an important role in this process because it encourages responsible environmental behavior and promotes community participation in natural resource management.

In Kenya, different studies have shown that sustainable forest management improves when environmental education is combined with community engagement and collaboration among stakeholders such as government institutions, local communities, and conservation organizations (Chisika & Yeom, 2024). This shows that environmental education can support broader environmental governance systems that encourage inclusive decision-making and responsible resource management.

4.6 Practical and Policy Implications

The findings of this study have several important implications for environmental policy and practice.

1.Scaling Environmental Education Programs**:** Since in this study the environmental education was strongly linked to sustainable practices, policymakers should expand environmental education programs in communities located near forests. Such programs should include formal education, community training, and practical learning activities.

2.Integrating Indigenous Knowledge: Environmental education programs should also incorporate indigenous ecological knowledge. Traditional cultural practices and local knowledge systems can complement formal education and strengthen conservation efforts resulting in sustainability.

3.Institutional Support and Partnerships: Successful environmental education programs require support from institutions. Collaboration between government agencies, schools, non-governmental organizations, and community leaders can strengthen the implementation of environmental education initiatives.

4.Behavior-Focused Educational Design: Environmental education should go beyond raising awareness and should focus on encouraging actual behavior change. This can be achieved through practical activities such as community conservation projects, demonstration sites, and participatory environmental programs.

4.7 Managerial Implications

The managerial implications of this study are;

1.Program Planning and Resource Allocation: Managers in educational institutions, NGOs, and environmental agencies should prioritize the expansion of environmental education programs by allocating adequate financial, human, and technical resources.

2.Program Design and Implementation: Managers should design environmental education programs that are action-oriented and context-specific, incorporating experiential learning and community engagement to enhance effectiveness.

3.Stakeholder Coordination: Effective management of environmental initiatives requires active coordination and partnership-building among key stakeholders, including government bodies, community groups, and development organizations.

4.Monitoring and Evaluation Systems: Managers should establish robust monitoring and evaluation frameworks to assess program outcomes, track behavioral changes, and inform continuous improvement of environmental education strategies.

4.8 Limitations and Directions for Future Research

Although this study provides useful insights, several limitations should be acknowledged. First, the cross-sectional design limits the ability to establish causal relationships, as data were collected at a single point in time. Future studies could adopt longitudinal approaches to better examine changes in environmental behavior over time. Secondly, the study relied on self-reported data to measure environmental management practices and participation in environmental education. Such data may be affected by social desirability bias and recall errors, where respondents may overstate environmentally responsible behaviors. Future research could incorporate objective measures such as direct observation or environmental audits to enhance validity. Thirdly, the sample was limited to households located near Mbololo Forest and mainly involved adult respondents, which may restrict the generalizability of the findings to other populations and contexts. Future studies should consider larger and more diverse samples across different regions and socio-economic groups. Finally, adopting mixed-methods approaches and conducting comparative studies across different ecosystems would provide deeper and more context-sensitive insights into the role of environmental education in shaping environmental management practices.

Conclusions and Further Research

This study examined how environmental education influences environmental management practices among households living near Mbololo Forest in Taita-Taveta County, Kenya. The results showed that environmental education plays an important role in promoting sustainable environmental management at the community level. Households that had participated in environmental education programs showed higher levels of environmental awareness, more positive attitudes toward conservation, and greater involvement in activities such as proper waste management, participation in community conservation programs, and sustainable use of forest resources.

The results of this study also confirmed a strong positive relationship between environmental education and environmental management practices. These results support both the Theory of Planned Behavior and the Value-Belief-Norm Theory. Environmental education helped strengthen people's attitudes toward environmental protection, increased social support for conservation actions, and improved individuals' confidence in their ability to practice sustainable behaviors. In addition, environmental education helped shape values and beliefs that encourage people to act in environmentally responsible ways. This shows that these behavioral theories are also useful for understanding environmental actions in rural communities located near forests.

From a practical point of view, the study shows that environmental education can be an effective and affordable way to improve sustainable forest management. Educational programs that increase knowledge, raise awareness, and encourage community participation can influence household behavior and promote better management of natural resources. The outcome suggest that policymakers, conservation organizations, and local communities should focus on expanding environmental education programs and linking them with community activities such as tree planting, forest monitoring, and community training workshops.

The study also highlights the importance of designing environmental education programs that consider local contexts and cultural practices. Including local knowledge, traditions, and cultural values in environmental education can make these programs more meaningful and acceptable to communities. In the case of Mbololo Forest, combining formal environmental education with traditional conservation practices could make conservation efforts more effective and encourage responsible use of forest resources.

The study further contributes to broader efforts toward sustainable development by showing that environmental education can help balance environmental protection, social well-being, and economic needs at the community level. When households gain knowledge, skills, and motivation through education, they are better able to support conservation efforts, maintain sustainable livelihoods, and protect natural ecosystems in the long term.

This study has demonstrated that environmental education does more than simply provide information. It can change attitudes, influence behavior, and improve how communities manage natural resources. Continued investment in environmental education, combined with strong community involvement and supportive policies, will be important for promoting sustainable forest management and environmental protection in communities living near forests in Kenya and similar regions around the world.

Declarations

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Credit Authorship Contribution Statement:

Humphrey M. Mwambeo: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft preparation, Visualization.
Lydiah N. Wambugu: Supervision, Methodology, Validation, Writing – review and editing.
Raphael O. Nyonje: Supervision, Methodology, Validation, Writing – review and editing.
James T. Kariuki: Conceptualization, Supervision, Project administration, Writing – review and editing.

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References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Amoah, A., & Addoah, T. (2021). Does environmental knowledge drive pro-environmental behaviour in developing countries? Evidence from households in Ghana. *Environment, Development and Sustainability, 23*, 2719–2738. https://doi.org/10.1007/s10668-020-00698-x

Ardoin, N. M., Bowers, A. W., & Gaillard, E. (2020). Environmental education outcomes for conservation: A systematic review. *Biological Conservation, 241*, 108224. https://doi.org/10.1016/j.biocon.2019.108224

Ardoin, N. M., Bowers, A. W., & Wheaton, M. (2023). Leveraging collective action and environmental literacy to address complex sustainability challenges. *Ambio, 52*, 30–44. https://doi.org/10.1007/s13280-022-01764-6

Awewomom, J., Dzeble, F., Takyi, Y. D., Ashie, W. B., Ettey, E. N. Y. O., Afua, P. E., Sackey, L. N. A., Opoku, F., & Akoto, O. (2024). Addressing global environmental pollution using environmental control techniques: A focus on environmental policy and preventive environmental management. *Discover Environment, 2*, 8. https://doi.org/10.1007/s44274-024-00033-5

Baloch, Q. B., et al. (2023). Impact of tourism development upon environmental sustainability: A suggested framework for sustainable ecotourism. *Environmental Science and Pollution Research, 30*, 5917–5930. https://doi.org/10.1007/s11356-022-22496-w

Bartels, K. P. R. (2023). Experiential learning: A relational approach to sustaining community-led social innovation. *Innovation: The European Journal of Social Science Research, 36*(3), 434–452. https://doi.org/10.1080/13511610.2022.2121268

Batool, N., Wani, M. D., Shah, S. A., & Dada, Z. A. (2024). Theory of planned behavior and value-belief norm theory as antecedents of pro-environmental behaviour: Evidence from the local community. *Journal of Human Behavior in the Social Environment, 34*(5), 693–709. https://doi.org/10.1080/10911359.2023.2205912

Buabeng, I., & Amo-Darko, B. (2025). Curriculum reforms without foundation: The effects of inadequate preparation in curriculum reforms on Ghanaian teachers and the education system. *Curriculum Perspectives, 45*, 133–147.

Cebrián, G., Junyent, M., & Mulà, I. (2020). Competencies in education for sustainable development: Emerging teaching and research developments. *Sustainability, 12*(2), 579. https://doi.org/10.3390/su12020579

Chavula, P., Umer, Y., Abdi, E., Uwimbabazi, A., Habowa, C., Mensah, G. B., Ntezimana, G. M., Amanzi, L., Lungu, G., & Kayusi, F. (2024). Bridging environmental education and sustainable development: An integrated approach for a greener future. *Asian Basic and Applied Research Journal, 6*(1), 161–171.

Chisika, S., & Yeom, C. (2024). Optimizing environmental education and awareness strategies for sustainable forest management in Kenya: Lessons from Cherangany, Mt. Kenya, Aberdares, and Kakamega forest ecosystems. *Visions for Sustainability*. https://doi.org/10.13135/2384-8677/8830

County Government of Taita Taveta. (2023). *Taita Taveta county annual development plan 2024/2025*. County Government of Taita Taveta.

Dong, Z., Zhang, Y., Mao, Y., Jiao, L., Huo, X., & Wu, L. (2026). Harnessing machine learning to explore influencing mechanism in the dual pro-environmental intention–behavior gap. *Scientific Reports*. https://doi.org/10.1038/s41598-026-42468-1

Estrada Araoz, E. G., Gallegos Ramos, N. A., & Valverde, Y. P. (2023). Examining the relationship between environmental education and pro-environmental behavior in regular basic education students: A cross-sectional study. *Social Sciences, 12*(5), 307. https://doi.org/10.3390/socsci12050307

Fauzi, M. A., Hanafiah, M. H., & Kunjuraman, V. (2024). Tourists' intention to visit green hotels: Building on the theory of planned behaviour and the value-belief-norm theory. *Journal of Tourism Futures, 10*(2), 255–276. https://doi.org/10.1108/JTF-01-2022-0008

Gupta, M. S., Samrutwar, A. M., Rahandale, A. M., & Edlabadkar, A. A. (2024). The influence of environmental education on college students' behavioural attitudes towards sustainability. *Journal of Learning and Educational Policy, 4*(6), 48–58. https://doi.org/10.55529/jlep.46.48.58

Harahap, D., & Uthman, Y. O. O.-O. (2024). Bridging the gap: Environmental education as a catalyst for human-environmental harmony. *Assyfa Learning Journal, 2*(1), 19–39. https://doi.org/10.61650/alj.v2i1.186

Islam, M. Z., & Wang, S. (2023). Environmental sustainability: A major component of sustainable development. *International Journal of Environmental, Sustainability, and Social Science, 4*(3).

Khalid, Z., Zhao, L., Elahi, E., & Chang, X. (2026). The impact of green management on green innovation in sustainable technology: Moderating roles of executive environmental awareness, regulations, and ownership. *Environment, Development and Sustainability, 28*(1). https://doi.org/10.1007/s10668-024-05393-9

Kiage, O. E. (2019). The Ogiek peoples' indigenous knowledge: A pathway towards sustainable natural resource management in the Mau Forest, Kenya. *African Journal of Hospitality, Tourism and Leisure, 8*(1).

Lestari, A., Wahyuni, I., & Fua, J. (2024). Green environmental management practices in schools in the implementation of the Deming cycle: A narrative inquiry approach. *Jurnal Ilmu Lingkungan, 22*(2), 347–354. https://doi.org/10.14710/jil.22.2.347-354

Liu, J., Yuan, L., Li, M., Li, S.-J., Sun, Y., & Yuan, J. (2024). Ecological experiential learning and tourists' pro-environmental behavior intentions: The mediating roles of awe and nature connection. *Heliyon, 10*(1), e23410. https://doi.org/10.1016/j.heliyon.2023.e23410

Malwa, D. (2024). Relationship between environmental education programs and pro-environmental behaviors among youth in Kenya. *American Journal of Environment Studies, 7*(1), 43–56.

Mensah, I. (2015). Environmental education and environmentally responsible behavior: The case of international tourists in Accra hotels. *International Journal of Tourism Sciences, 12*(3), 69–89. https://doi.org/10.1080/15980634.2012.11434664

Nasution, S., Sembiring, W., Dalimunthe, F., Sumarno, E., Saragih, M., & Moulita. (2025). Environmental education as a means of sustainable and responsible tourism development. *Sosioedukasi: Jurnal Ilmiah Ilmu Pendidikan dan Sosial, 14*, 1153–1164. https://doi.org/10.36526/sosioedukasi.v14i3.5723

Negm, E. (2024). Recognizing the impact of value-belief-norm theory on pro-environmental behaviors of higher education students: Considering aspects for social-marketing applications. *International Journal of Sustainability in Higher Education, 25*(2), 289–305. https://doi.org/10.1108/IJSHE-04-2023-0135

Odell, V., Molthan-Hill, P., Martin, S., & Sterling, S. (2020). Transformative education to address all sustainable development goals. In W. Leal Filho et al. (Eds.), *Quality education: Encyclopedia of the UN sustainable development goals*. Springer. https://doi.org/10.1007/978-3-319-95870-5_106

Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Global Environmental Change, 47*, 88–94. https://doi.org/10.1016/j.gloenvcha.2017.09.009

Rapi, M. Z. H., & Kassim, S. (2023). Perception and intention to participate in microtakaful scheme among Indonesians: An application of Ajzen's theory of planned behavior. *Journal of Islamic Monetary Economics and Finance, 9*(1), 133–166.

Ronalter, L. M., Bernardo, M., & Romaní, J. M. (2023). Quality and environmental management systems as business tools to enhance ESG performance: A cross-regional empirical study. *Environmental Development and Sustainability, 25*, 9067–9109. https://doi.org/10.1007/s10668-022-02425-0

Saro, J. M., Taray, J. D., Cinso, J. S., Ingaling, B. S., Enguio, M. J. A., & Hayon, C. P. B. (2025). Level of attitude, behavior, and awareness of senior high school students toward environmental conservation. *JPBI (Jurnal Pendidikan Biologi Indonesia), 11*(1), 111–124. https://doi.org/10.22219/jpbi.v11i1.37861

Simiyu, G., Kariuki, V., Ombaba, M., & Otuya, R. (2022). Does environmental knowledge matter? Social influence and pro-environmental behavior in university students: An indirect effect model. *SEISENSE Journal of Management, 5*(1), 1–16. https://doi.org/10.33215/sjom.v5i1.724

Stevenson, R. B., Brody, M., Dillon, J., & Wals, A. (2012). *International handbook of research on environmental education*. Routledge. https://doi.org/10.4324/9780203813331

Taita Taveta County Government. (2024). *Second-generation county integrated development plan (CIDP-II) 2018–2022*. https://www.taitataveta.go.ke/uploads/2024/05/CIDP-II.pdf

Velempini, K. (2025). Assessing the role of environmental education practices towards the attainment of the 2030 sustainable development goals. *Sustainability, 17*(5), 2043. https://doi.org/10.3390/su17052043

Wang, J., Dai, J., Gao, W., Yao, X., Dewancker, B. J., Gao, J., Wang, Y., & Zeng, J. (2024). Achieving sustainable tourism: Analysis of the impact of environmental education on tourists' responsible behavior. *Sustainability, 16*(2), 552. https://doi.org/10.3390/su16020552

Yu, Y., Chen, L., Qiu, H., Xiao, X., & Li, M. (2024). Can tourists be educated? The effect of tourist environmental education on environmentally responsible behavior. *Asia Pacific Journal of Tourism Research, 29*(1), 113–125. https://doi.org/10.1080/10941665.2024.2316602

Yuan, L. (2026). Environmental regulation at the crossroads: A review of catalysts and barriers in circular economy transitions. *Business Strategy and the Environment*, 1–16. https://doi.org/10.1002/bse.70588

Zulkepeli, L., Fauzi, M. A., Mohd Suki, N., Ahmad, M. H., Wider, W., & Rahamaddulla, S. R. (2024). Pro-environmental behavior and the theory of planned behavior: A state-of-the-art science mapping. *Management of Environmental Quality: An International Journal, 35*(6). https://doi.org/10.1108/MEQ-10-2023-0361