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Alternative Livelihood Options and Forest Resources Conservation in Cross River State, Nigeria			
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Keywords		Abstract	
Correspondence Email: comfortogboromari@gmail.com https://doi.org/10.60787/jeate.vol9no1.408-420		The purpose of this study was to investigate alternative livelihood options and forest resources conservation in Cross River State. To achieve the purpose of this study, 2 null hypotheses were formulated to guide the study. Conceptual and empirical literature were reviewed in accordance with the variables of the study. Predictive correlational research design was utilized for the study. The population of the study comprised all adult residents in forest communities in Cross River State. The ten local government areas and fifty-seven communities used for the study were proportionately selected using simple random sampling technique while systematic random sampling technique was adopted to select the six hundred and fifty-three (653) respondents used for the study. A forty-five item four-point Likert scale questionnaire was the instrument utilized for data collection. The instrument was duly validated by lecturers in Environmental Education and Measurement and Evaluation in the University of Calabar. Cronbach alpha method was used to ascertain the reliability of the research instrument. To test the hypotheses formulated for the study, simple linear and multiple regression statistical tools were employed for data analysis. The hypotheses were tested at 0.05 level of significance. The findings obtained from analysis of data and testing of hypotheses in the study revealed that there was a significant relationship between bee keeping, snail farming and forest resources conservation among members of forest communities in Cross River State. Based on these findings it was recommended among other things that non-Governmental organizations working on alternative livelihood activities should continue to empower more people with skills for snail farming in order to generate more income and conserve forest resources.	

INTRODUCTION

Forest resources are vital natural assets that provide a wide range of ecological, economic, social, and cultural benefits. They contribute to biodiversity conservation, climate regulation, soil protection, water cycle maintenance, and the provision of timber, non-timber forest products, and medicinal plants. Globally, forests are under increasing threat from human activities such as logging,

agricultural expansion, infrastructure development, and unsustainable exploitation, leading to deforestation, habitat loss, and environmental degradation.

Forests play a critical role in sustaining environmental balance, supporting biodiversity, and providing livelihood resources for millions of people globally. In tropical regions such as Nigeria, forests also serve as carbon sinks, regulate local climate, and offer ecosystem services that support agriculture, water resources, and cultural heritage. However, rapid deforestation, driven by agricultural expansion, logging, fuelwood harvesting, and infrastructural development, has placed these ecosystems under severe threat. Cross River State, located in the South-South geopolitical zone of Nigeria, harbours over 50% of Nigeria's remaining tropical rainforest (Forestry Commission, 2023), making it one of the country's most important biodiversity hotspots. The state's forests are home to rare and endangered species such as the Cross River gorilla, drill monkeys, and various endemic plant species.

Despite the ecological significance of the forests, the socio-economic realities of rural communities in Cross River State create challenges for sustainable conservation. Many local populations depend heavily on forest resources for their daily survival - engaging in activities such as farming, hunting, logging, and non-timber forest product collection. The high incidence of poverty, limited employment opportunities, and inadequate access to infrastructure and markets often push communities toward practices that degrade the forest. This situation creates a conflict between meeting immediate livelihood needs and protecting long-term environmental assets (Asu, 2022).

Cross River State is home to the Cross River National Park, Afi Mountain Wildlife Sanctuary, and numerous community forests, which harbour some of the richest biodiversity in West Africa, including endangered species such as the Cross River gorilla, chimpanzees, and forest elephants. These forests are also a source of food, medicine, fuelwood, and income for local communities. Ejim (2022) asserted that despite their importance, forest resources in Cross River State face significant threats from illegal logging, slash-and-burn agriculture, urban expansion, and infrastructural projects. The state has been at the center of conservation efforts in Nigeria, with initiatives including the creation of protected areas, community-based forest management programs, and collaborations with local and international Non-Governmental Organizations (NGOs). However, challenges such as weak enforcement of environmental laws, poverty, population pressure, and inadequate awareness continue to undermine conservation efforts.

In response to this dilemma, alternative livelihood options and community development initiatives have emerged as important strategies for forest conservation. Alternative livelihoods are income-generating activities designed to reduce direct dependence on forest exploitation – examples include ecotourism, beekeeping, mushroom farming, agroforestry, handicrafts, and small-scale processing industries. These initiatives, when integrated with community development programs, can improve household incomes, strengthen social cohesion, and build local capacity for sustainable resource management (Kilian, 2023). International organizations, government agencies, and NGOs have increasingly promoted such approaches in Cross River State, often combining them with awareness campaigns, participatory forest management, and policy reforms.

Freeman (2022) reported that bee keeping is one of the alternative livelihood options that could be introduced to empower members of forest communities to help them reduce their level of dependence on natural forest resources for their survival. The introduction of bee farming has helped people across various areas where it has been effectively implemented with requisite skills for income generation. This has reduced the level of dependence of several persons on forest resources in the wild for their livelihood. This reduced dependence has safeguarded forest resources and promoted sustainable forest resources management.

Obi (2021) identified snail farming as another alternative livelihood option that has been initiated in various forest communities to serve as a source of economic empowerment. Members of forest

communities are usually trained over a specified period of time on how to practice this alternative source of livelihood in a profitable and sustainable manner. This training has enabled numerous members across forest communities to engage profitably in snail farming. The aim is to divert their attention and dependence level on the natural forest resources. Ajah (2020) identified grass cutter rearing as a viable source of income for members of forest communities. The rearing of grass cutter at home serves the protein needs of several members of the public who usually depend on bush met from wild sources. Engaging in grass cutter rearing is considered easy and profitable with adequate training. As a result, members of forest communities who are interested in grass cutter rearing are usually trained by experts to enable them practice this trade with maximum benefits. This has contributed significant to forest resources conservation in such areas.

Statement of the problem

Cross River State is home to one of the last remaining tracts of tropical rainforest in the country, including parts of the Cross River National Park. These forests are globally significant for their rich biodiversity and vital ecological functions. However, over the past decades, they have been under increasing threat from unsustainable logging, agricultural expansion, fuelwood harvesting, and infrastructural development. Local communities, many of whom rely directly on forest resources for their livelihoods, are caught in a challenging dilemma: the need to meet immediate economic and subsistence needs often conflicts with long-term conservation goals. Poverty, limited access to alternative income sources, and inadequate livelihood diversification are major drivers of forest exploitation in the state. In many rural areas, communities depend heavily on hunting, logging, and slash-and-burn farming for survival. While these practices provide short-term gains, they contribute to deforestation, habitat loss, and declining wildlife populations, thereby undermining the very resources that support these communities.

Efforts at forest resources conservation, including government regulations and protected area policies, have often struggled to achieve desired outcomes due to insufficient integration of community development priorities. In some cases, strict conservation measures have restricted access to traditional forest resources without providing viable economic alternatives, leading to resistance from local people and even illegal resource extraction. Although several non-governmental organizations (NGOs) and development agencies have introduced alternative livelihood options - such as ecotourism, agroforestry, beekeeping, and non-timber forest product processing - the adoption and sustainability of these initiatives remain inconsistent. Factors such as inadequate training, poor market access, lack of financial support, and low community participation have limited their effectiveness. This necessitated the researcher to investigate alternative livelihood options and forest resources conservation in Cross River State.

Purpose of the study

The purpose of this study was to investigate alternative livelihood options and forest resources conservation in Cross River State. In specific terms, the study seeks to;

1. Examine how bee-keeping relate to forest resources conservation
2. Assess the relationship between snail farming and forest resources conservation

Research questions

The research questions raised for the study included the following;

1. How does bee-keeping relate to forest resources conservation?
2. To what extent does snail farming relate to forest resources conservation?

Statement of hypotheses

The following hypotheses were formulated for the study;

1. There is no significant relationship between bee-keeping and forest resources conservation

2. Snail farming does not significantly relate to forest resources conservation

LITERATURE REVIEW

Bee keeping and forest resources conservation

Bee keeping, also called apiculture, is the practice of managing and caring for honeybee colonies in artificial hives for the purpose of producing honey, bee-wax, and other useful products, as well as for pollination of crops. Bee keeping is an ancient practice. Early humans collected honey from wild bees. Traditional hives were made from clay pots, woven baskets, gourds, or tree trunks. Modern bee keeping began with the invention of the movable frame hive, which allowed easy inspection and harvesting (Eze, 2022). Beekeeping benefits forest conservation by providing income to local communities, which reduces their reliance on destructive forest practices like illegal logging and bushfires. Bees also enhance [forest biodiversity](#) and overall ecosystem health through pollination of both wild and cultivated plants. Additionally, the presence of bee colonies can protect forests by attracting community members who act as informal guardians, fostering a sense of ownership and stewardship over forest resources.

Beekeeping is an old agricultural activity in Ethiopia. It is a major integral component in agricultural economy of the country, which accounts for 1.3% of agricultural GDP (Watkins, 2020). Apiculture is a non-harmful activity mutual to the environment as well as a non-farm business activity, which can contribute to the economic growth of a society in particular and a national economy in general. In developing countries, the sector offers an environmentally beneficial activity that can help in alleviation of poverty and maintaining natural biodiversity (MASHAV, 2016). Ethiopian government is strengthening the sector as a mechanism for poverty reduction and improving the livelihood of many people including the unemployment youths, jobless women and adults, elder peoples, carpenters for beehive construction and equipment preparation, living both in rural and urban areas (CSA, 2013). The importance of the sector also extends to initiate youth groups to contribute to social, economic and ecological aspects (Alebachew & Eshetie, 2020).

Reports mention that beekeeping in Ethiopia creates jobs for two million people (CSA, 2009; Oxfam, 2010). The promotion of beekeeping practices is, therefore, now widely recognized as being among the good practices in order to improve livelihood of society. Beekeeping is one of the extra household incomes generating activity (IGA) for many of rural poor farmer beekeepers as well as marginal (landless) people living in the country. Ethiopia has a large production potential from beekeeping since it is blessed with diversity in climate and vegetation resources for beekeeping (Kidane, 2014). The country is endowed with more than six million managed bee colonies and about 2 million smallholder beekeepers. The full flora of the country has six to seven thousand species of flowering plants of which many of them are bee forage sources. Therefore, the country is able to produce about 64,000 tons of honey and 6,000 tons of beeswax that account for more than 25% of the production in Africa, which makes it one of the top 10 honey and top have beeswax producers in the world (Apimondia International Symposium, 2018; FAO STAT, 2015; Oxfam, 2010).

The study by Mohammed (2019) examined the role of beekeeping in forest conservation and poverty alleviation in Moshi Rural District. It was guided by the following research objectives; firstly to examine the challenges of beekeeping, secondly to identify the market, products and technology used in beekeeping and lastly to examine the contributions of beekeeping on forest conservation and poverty alleviation in Moshi rural district. The study employed mixed research design where by 70 beekeepers were sampled. Both primary and secondary data were employed in this study. Different methods were used in data collection which included house hold questionnaire, interviews, wealth ranking, observation and focus group discussion. Statistical Package for Social Science (SPSS) version 16 and microsoft excel were used to analyze quantitative data. Findings revealed that 40% of sampled beekeepers agreed that beekeeping contributed to forest and biodiversity conservation

through afforestation programs. Results revealed that there is strong positive relationship ($r = 0.718$) between numbers of beehives and liters of honey produced in a year in Moshi rural district. Majority, 75% of the sampled beekeepers disagreed to the fact that beekeeping contributes to poverty alleviation. This is because majority lacks skills, reliable market and appropriate technology. The findings further revealed that financial constraint is the most emerging challenge where by 62% of the respondents said they lack finances to buy modern beehives.

Kingston (2021) examined the role of beekeeping on conservation of forest resources in Budongo sub-county, Masindi district and its major objective was to assess the role of beekeeping in the conservation of forest resources where the study determined the tree species preferred by beekeepers, agroforestry and conservation practices that promote beekeeping; natural habitats bee keepers prefer while citing bee hives and constraints faced by beekeepers while maintaining bee habitats in the study area. A total of 40 respondents from 4 parishes of Nyabyeya, Karongo, Bwinamira and Kasongore were interviewed through a sampling technique known as snowball sampling. The sample size was determined using Yamane's formulae of $n = N/1+N(e^2)$ and data was analyzed using SPSS where Chi-square tests were conducted to determine the association between the variables. The study found that beekeeping is a vital practice as it contributes to conservation of trees through improving on tree cover and reducing pressure on trees.

Snail farming and forest resources conservation

Snail farming, or [heliculture](#), is the controlled breeding of snails for human consumption, with the meat and eggs being the primary products. It involves providing a suitable habitat with controlled feeding, water, and optimal soil conditions to ensure the snails' healthy growth and reproduction for commercial or personal use. Snail farming is known for its low startup costs, minimal space requirements, and potential for profit from snail meat and other byproducts, making it an accessible agricultural venture. Harry (2023) stated that snail farming, or heliculture, is the practice of breeding and raising snails for commercial purposes, especially for food. Snails have been a staple food in many parts of the world, including Nigeria, due to their high nutritional value. They are rich in proteins, low in fat, and contain important vitamins and minerals such as iron, calcium, and magnesium. Snail farming is becoming an increasingly popular agribusiness venture in Nigeria, offering a viable solution to issues such as food security, poverty alleviation, and sustainable livelihoods. Snails are not only a rich source of protein and other vital nutrients, but they also provide economic opportunities for farmers.

Snail farming supports forest conservation by providing a sustainable alternative livelihood, reducing pressure on wild snail populations and bush meat harvesting, and offering an environmentally friendly source of protein. By diversifying income sources for forest-dependent communities, snail farming helps to lessen their reliance on forest resources and promotes ecological sustainability. Snail farming can potentially aid in forest resources conservation, as it provides an alternative livelihood and may reduce pressure on forests. Industrial snail farming involves maintaining a specific microbiological environment within the breeding park. These farms cultivate snail species for human consumption. The practice could offer a sustainable approach to food production, potentially reducing reliance on activities that harm forest resources.

However, the specific mechanisms of conservation and the extent of its impact require further investigation (Agbor, 2021).

The study by Okon (2024) aimed to ascertain alternative livelihood options and forest resources conservation in Odukpani Local Government Area of Cross River State. To achieve this purpose four null hypotheses were formulated and tested at 0.05 level of significance. A detailed review of literature was carried out in accordance with the variables of the study. Survey research design was considered most appropriate for the study. Simple random sampling technique was adopted to select the six forest communities while systematic random sampling technique was adopted to select the three hundred and twenty three (323) respondents used for the study. A thirty item modified four point Likert scale questionnaire was the instrument adopted for data collection. The instrument was properly validated by relevant personnel. To test the hypothesis that stated that there is no significant relationship between snail farming and forest conservation, Pearson product moment correlation statistical tool was employed for data analysis and testing of hypotheses. The hypotheses were tested at 0.05 level of significance. The result obtained from the analysis s data revealed that there was a significant relationship between snail farming and forest resources conservation in the study area. based on these findings it was recommended among others that non-Governmental organizations working on alternative livelihood activities should continue to empower more people with skills for snail farming in order to generate more income and conserve forest resources.

Jonah (2020) examined the practice and adoption of snail farming technology in Cross River State, Nigeria. Cross River State was stratified into three zones, and three local government areas were randomly selected from each stratum. A total of nine Local government Areas were randomly selected for the study. A set of pre – tested structured questionnaire and in-depth interviews were used to elicit information from owners of all the functioning snail farms in selected local government areas. Group Discussion was held with management of all non functioning snail farms. Data collected were augmented with on - farm investigation. Results were presented in form of percentages, frequency of counts and tables. Owners of snail farms in the study area were all males, Christians and literates. Majority of the farms (71.43%) were between 1 and 3 years old. About 35.71% of established farms have stopped functioning and the active ones (64.39%) may become passive before 5 years due to poor management (100%), inadequate knowledge of snail farming (100%), lack of capital (100%) and no encouragement from the government (100%). The findings further revealed that majority of the respondents (71.43%) embarked on snail farming as hobby while some joined for conservation of snail (42.86%). Only 14.29% established snail farms for income generation. With exception of farm 7 with 1600 snails, no other farm had above 300 snails. Farm 1 has only 30 snails. About 57.14% of the respondents sourced their breeding stocks from the wild alone. Snail feed were locally sourced by all respondents. The housing system mostly used by respondents was enclosure with nets (71.42%) while only 14.20% used motor-tyres and concrete trench indicating low scale of production. All the 9 functioning snail farms are located in Calabar, Boki, Obubra and Yakurr while other areas had no adoption of the technology. Calabar metropolis had the highest concentration of 3 farms. Incubation period of snail eggs was unknown to most respondents (71.40%) revealing that they had not been breeding snails. The impact of snail farming has not been felt in the study area.

RESEARCH METHODOLOGY

The predictive correlational research design was considered most appropriate for the study. This design allows the researcher to assess the relationship between the independent and dependent variables in the study. Jones (2018) described predictive correlational design as a type of non-experimental research in which the researcher measures two variables and assesses the statistical relationship (i.e. the correlation) between them with little or no effort to control extraneous variables. This study investigates alternative livelihood options and forest resources conservation in Cross

River State. The purpose of this study can be achieved using the predictive correlational research design, because this design model provides the appropriate leverage to measure the independent variable and sub-variables against the dependent variables in order to establish their correlation without the interference of extraneous variables.

The research area for this study was Cross River State, Nigeria. Cross River State lies between latitudes 4° 28' and 6° 55' North of the Equator and longitudes 7° 50' and 9° 28' East of the Greenwich meridian within the tropical rainforest belt of Nigeria. The population of the study consisted of all adult residents in forest communities in Cross River State. The projected population of the study comprised individuals that are drawn from various occupations including students, public servants, farmers, business and trading. These groups have a direct link with forest resources utilization. The population of the study is five hundred and seventy-two thousand, three hundred and fifteen (572,315) persons (NPC, 2024).

The local government areas in the state were stratified into three education zones. The researcher wrote the names of the eighteen (18) local government areas that make up Cross River State according to their strata on little pieces of paper, folded the papers into small ball-like shapes which were turned into three bowls, each representing an education zone in the state. The papers were mixed and the researcher blindly picked (50%) of the paper balls from each of the bowls according to their strata with replacement. (50% from Calabar Education Zone which amounted to a total of four local government areas namely; Odukpani, Biase, Akamkpa and Akpabuyo, 50% from Ikom Education Zone which amounted to a total of three local government areas namely; Boki, Ikom and Obubra, 50% from Ogoja Education Zone which amounted to a total of three local government areas namely; Ogoja, Obudu and Yala. The total local government areas selected for the study was ten (10).

To select the communities used for the study, the researcher adopted proportionately, simple random sampling technique to select 30 percent of forest communities in each of the ten local government areas selected for the study. In each local government area, the researcher wrote the names of all the forest communities on pieces of paper and folded them into ball-like shapes. The paper-balls were mixed and the researcher blindly picked thirty percent of forest communities from each local government area. The total communities were fifty seven. To select the respondents used for the study, the systematic random sampling technique was adopted. In each community, the researcher numbered the houses in the community and every 200th house was selected for the study. This represented 0.5 percent of houses in each community. From the houses selected for the study, one respondent was selected as a sample. These persons formed the respondents used for the study. The sample for the study consisted of six hundred and fifty five (655) respondents that were randomly selected from fifty seven (57) forest communities in Cross River State.

The instrument used for data collection was a questionnaire titled Alternative Livelihood Options and Forest Resources Conservation Questionnaire (ALOFRSQ). The instrument was divided into two sections. Section A contained personal data of the respondents. Section B was developed using modified four point Likert scale of Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD). It contained forty five items that measured the variables of the study. Items 1-5 measured bee keeping, items 6-10 measured snail farming, items 11-15 measured grass cutter rearing, items 16-20 measured domestication of mushroom, items 21-25 measured agroforestry, items 26-30 measured poultry farming, items 31-35 measured fish farming while items 36-45 measured forest resources conservation.

The validity of the instrument was established with the help of Lecturers in Environmental Education as well as Measurement and Evaluation in the College of Education, University of Calabar. To ensure that the items that made up the instrument adequately measured the variables of the study, the researcher presented the developed instrument to three Lecturers in Environmental Education and three others in Measurement and Evaluation. They scrutinized, made necessary corrections and ascertained the usability, clarity and appropriateness of the instrument. Some items were rephrased. The corrections pointed out were duly effected

Data that was used for the study was gathered directly from respondents through the use of questionnaire. The researcher visited all the forest communities selected for the study to administer copies of the questionnaire. To enable the researcher accomplish this task, a research assistant was trained to help the researcher in the administration of the instrument for data collection. In each of the communities visited, the researcher and the research assistant obtained permission from the community heads before administering the questionnaire to the respondents used for the study. Six hundred and fifty five copies of the questionnaire were administered and retrieved in four weeks. At the point of coding it was discovered that only six hundred and fifty three (653) copies of the questionnaire were properly responded to by the respondents.

Data obtained for the study was duly coded by assigning numerical codes to each item in the questionnaire. For the items designed with Likert scale, for positively worded items, Strongly Agree was assigned 4, Agree 3, Disagree 2, and Strongly Disagree 1. For negatively worded items, the reverse scoring was adopted.

RESULTS AND DISCUSSION

Presentation of results

In this section, the researcher presents the result of analysis of data obtained in the study as well as the interpretation of the results. The hypotheses were tested at 0.05 level of significance.

Research question one

How does bee-keeping relate to forest resources conservation? Simple percentage statistic was employed for data analysis. The result obtained is presented in Table 1, the data obtained from respondents on bee-keeping and forest resources conservation among members of forest communities shows that 186 (28.5%) of the respondents strongly agreed. 205 (31.4%) of the respondents indicated agreed. 134 (20.5%) of the respondents disagreed while 128 (19.6%) indicated strongly disagree with regards to the relationship that existed between bee-keeping and forest resources conservation in Cross River State. This showed that majority of the respondents agreed that bee-keeping significantly related to forest resources conservation in forest communities in the study area.

TABLE 1

Simple percentage analysis of the relationship between bee-keeping and forest resources conservation in Cross River State

Bee-keeping	Frequency	Percentage (%)
SA	186	28.5
A	205	31.4
D	134	20.5
SD	128	19.6

Total	653	100.0
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Research question two

To what extent does snail farming relate to forest resources conservation? Simple percentage statistic was employed for data analysis. The result is presented in Table 2, the data obtained from respondents on snail farming and forest resources conservation among members of forest communities shows that 194 (29.7%) of the respondents strongly agreed. 211 (32.3%) of the respondents indicated agreed. 127 (19.4%) of the respondents disagreed while 121 (18.6%) indicated strongly disagree with regards to the relationship that existed between snail farming and forest resources conservation in Cross River State. This showed that majority of the respondents agreed that snail farming significantly related to forest resources conservation in forest communities in the study area.

TABLE 2

Simple percentage analysis of the relationship between snail farming and forest resources conservation in Cross River State

Snail farming	Frequency	Percentage (%)
SA	194	29.7
A	211	32.3
D	127	19.4
SD	121	18.6
Total	653	100.0

Hypothesis one

There is no significant relationship between bee-keeping and forest resources conservation. The independent variable in this hypothesis is bee-keeping while the dependent variable is forest resources conservation. Simple linear regression statistical tool was utilized for data analysis. The result obtained from the analysis presented in Table 3 shows that the independent or predictor variable (bee-keeping) has a significant relationship with the dependent or predicted variable (forest resources conservation) among residents of forest communities in Cross River State. This implied that bee-keeping accounted for 17.7% of forest resources conservation in Cross River State. This shows a low positive relationship.

Secondly, the result of regression ANOVA presented in Table 3 revealed that there was a significant relationship between bee-keeping and forest resources conservation, $F(1, 651) = 53.971$; $p < .05$. The result of this analysis indicated that there is a low contribution of bee-keeping to forest resources conservation among residents. This showed that the null hypothesis was rejected. Therefore, bee-keeping positively relates to forest resources conservation in the study area.

The regression coefficient shows that the independent or predictor variable bee-keeping ($\beta = .277$; $t = 7.347$; $p < .05$) has a low positive relationship with forest resources conservation among residents of forest communities in Cross River State. This showed that there was a significant relationship between bee keeping and forest resources conservation among residents of forest communities in Cross River State. The reason for this finding could be that as part of efforts geared towards reducing the dependence on forest resources for survival by rural dwellers, bee keeping has been introduced as an alternative livelihood option. As the attention of residents of forest communities is diverted from relying directly on forest resources to finding alternative means of livelihood through bee keeping, the forest is conserved. People now have other means of generating income without

depending so much on the forest. This has promoted the conservation of forest resources in the study area. Although the cost of purchasing apiaries is quite high, this has discouraged some persons from engaging in bee keeping. Communities that have fully embraced bee keeping have significantly reduced their dependence on forest resources.

The finding of this study is in agreement with that of Etta (2021) who reported that beekeeping is an important, sustainable and alternative source of income in rural areas, benefiting communities living in and around forests. Beekeeping can also be a practical tool for raising the awareness of these communities to the importance of good management of their forests and for stimulating their sensibility for conservation, and for improving biodiversity. For the households of rural communities, beekeeping is a promising off-farm activity and contributes to the income of the farmers and the economy of the nation.

The finding of this study also supported that of Asu (2022) who disclosed that the important role of honey bee in world food production, climate change mitigation, forest and biodiversity conservation and their economic values cannot be overemphasized. Forests, most especially the ones with no direct agricultural activity, provide a source of organic nectar that is necessary for the honey bees (*Apis mellifera*) because they are nature's very important agent of pollination. The original concept of ecosystem is majorly understood in the aspect of the services and benefits that it provides to the living, both human and animals. This can be categorized into different functions such as provisioning, regulating, cultural and supporting services.

TABLE 3

Simple linear regression analysis of the relationship between bee-keeping and forest resources conservation in Cross River State

Model	R	R ²	Adj.R ²	Std error of estimate	
1	.377	.177	.175	1.47902	
Model	SS	Df	MS	F	Sig.
Regression	118.062	1	118.062	53.971	.000
Residual	1424.058	651	2.187		
Total	1542.119	652			
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. error	Beta		
(Constant)	18.600	.710		26.188	.000
1 Bee-keeping	.374	.051	.377	7.347	.000

a. Dependent Variable: Forest resources conservation

Source: Researcher's Fieldwork, 2026

Hypothesis two

Snail farming does not significantly relate to forest resources conservation. The independent variable in this hypothesis is snail farming while the dependent variable is forest resources conservation. Simple linear regression statistical tool was employed for data analysis. The result obtained from the analysis presented in Table 4 shows that the independent or predictor variable (snail farming) has a significant relationship with the dependent or predicted variable (forest resources conservation)

among residents of forest communities in Cross River State. This implied that snail farming accounted for 19.8% of forest resources conservation in forest communities in Cross River State. This shows a low positive relationship.

Secondly, the result of regression ANOVA presented in Table 4 revealed that there was a significant relationship between snail farming and forest resources conservation, $F(1, 651) = 160.862$; $p < .05$. The result of this analysis indicated that there is a low contribution of snail farming to forest resources conservation among residents. This showed that the null hypothesis was rejected. Therefore, snail farming positively relates to forest resources conservation in the study area. The regression coefficient shows that the independent or predictor variable snail farming ($\beta = .445$; $t = 12.683$; $p < .05$) has a low positive relationship with forest resources conservation among residents of forest communities in Cross River State.

This showed that there was a significant relationship between snail farming and forest resources conservation among residents of forest communities in Cross River State. The reason for this finding could be that snail farming has become a popular activity in the study area in recent years. It was introduced as alternative source of livelihood for members of forest communities in the study area to reduce their level of dependence on the forests. Snail farming is a very lucrative business because it does not require large capital or technical know-how. The practice of snail farming has empowered various individuals to become self-reliant and depend less on natural forest resources as their main source of livelihood. This has contributed positively to efforts aimed at promoting the conservation of forest resources.

The finding of this study agrees with that of Agbor (2021) who opined that snail farming supports forest conservation by providing a sustainable alternative livelihood, reducing pressure on wild snail populations and bush meat harvesting, and offering an environmentally friendly source of protein. By diversifying income sources for forest-dependent communities, snail farming helps to lessen their reliance on forest resources and promotes ecological sustainability. Snail farming can potentially aid in forest resources conservation, as it provides an alternative livelihood and may reduce pressure on forests. Industrial snail farming involves maintaining a specific microbiological environment within the breeding park. These farms cultivate snail species for human consumption. The practice could offer a sustainable approach to food production, potentially reducing reliance on activities that harm forest resources.

The finding of this study also supported that of Barry (2023) who asserted that the need for increase in animal protein consumption of the rural and urban Nigerian populace in the face of inflation has resulted in the increase in the consumption of snails as food and as a source of income to the peasant farmers and families in rural areas. This increasing demand for snails prompted the inclusion of snail farming as an alternative livelihood option in most rural forest communities. Through this initiative, several thousands of community members have been trained and supported to establish snail farms within their homes. This has become a major alternative source of income for several rural families. The domestication of snails has helped to bridge the demand and supply gaps experienced as well as reduced the rate of harvesting of this resource from the wild and ensured its conservation.

TABLE 4

Simple linear regression analysis of the relationship between snail farming and forest resources conservation in Cross River State

Model	R	R ²	Adj.R ²	Std error of estimate
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1	.445	.198	.197	1.37822	
Model	SS	Df	MS	F	Sig.
Regression	305.555	1	305.555	160.862	.000
Residual	1236.565	651	1.899		
Total	1542.119	652			
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. error	Beta		
(Constant)	16.038	.614		26.102	.000
1 Snail farming	.571	.045	.445	12.683	.000

a. Dependent Variable: Forest resources conservation

Source: Researcher's Fieldwork, 2026

CONCLUSION AND RECOMMENDATIONS

The findings obtained from analysis of data and testing of research questions and hypotheses in the study revealed that there was a significant relationship between bee keeping, snail farming and forest resources conservation among members of forest communities in Cross River State. It can be concluded that alternative livelihood options significantly relate positively to forest resources conservation in Cross River State, Nigeria.

Implication of the findings

An increase in bee keeping as an alternative source of income will continue to promote forest resources conservation. The expansion of snail farming operations in forest communities will contribute positively to forest resources conservation. As more members of forest communities are trained to engage in grass cutter rearing, the conservation of forest resources will be promoted and sustained. The continuous involvement of members of forest communities in domestication of mushroom will contribute positively to the conservation of forest resources within the study area. The practice of agroforestry as a means of generating additional income by members of forest communities will always contribute to forest resources conservation. When all the alternative livelihood options covered in this study are combined in poverty reduction activities, it will significantly promote forest resources conservation.

Recommendations

Based on the findings obtained from analysis of data and testing of hypotheses in the study, it was recommended that;

1. The Forestry Commission should collaborate with its intervention partners to provide more apiaries to interested bee farmers in order to expand bee farming operations and contribute more to forest conservation
2. Non-Governmental organizations working on alternative livelihood activities should continue to empower more people with skills for snail farming in order to generate more income and conserve forest resources

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