Examine the Socio-Economic Impacts of Ptreicarpuserinaceus Exploitation in Taraba State, Nigeria

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https://doi.org/10.56201/ijgem.vol.12.no11.2026.pg171.183

Abstract
This study examined the socio-economic impacts of Pterocarpus erinaceus (rosewood) exploitation in Taraba State, Nigeria. The study focused on how rosewood exploitation affects local livelihoods, employment opportunities, household income, access to education, community security and social relationships. A mixed-methods research design was adopted, combining quantitative and qualitative approaches. Primary data were collected through structured questionnaires, interviews and field observations, while secondary data were obtained from relevant published materials and documentary sources. Questionnaire responses from 400 respondents were analysed using descriptive statistics, regression analysis and analysis of variance (ANOVA). The findings revealed that damage to local infrastructure was the most highly rated impact, with a mean score of 4.52 and a standard deviation of 0.85. Other major impacts included reduced access to education (mean = 4.10), community insecurity (mean = 4.09) and the creation of employment opportunities (mean = 4.07). The findings also indicated increased migration and weakened community relationships. However, respondents reported relatively low economic benefits to local businesses (mean = 2.93) and limited increases in household income (mean = 2.77). The regression model reported an R-value of 0.506, while the analysis of variance produced an F-value of 4.026 with a reported significance level of 0.000. The study concluded that although rosewood exploitation provides employment for some community members, its overall socio-economic consequences are largely negative. It recommends stronger enforcement of forestry regulations, the promotion of alternative livelihood opportunities, rehabilitation of damaged infrastructure and measures to protect children's access to education. These measures would help improve community welfare while promoting sustainable forest resource management.

Keywords: *Pterocarpus erinaceus, rosewood exploitation, socio-economic impacts, livelihoods,*

1. Introduction

Globally, forest ecosystems play a critical role in regulating climate, preserving biodiversity, supporting water cycles, and sustaining the livelihoods of millions of people (Ellwanger et al., 2023). However, deforestation continues to pose a major environmental threat, contributing significantly to biodiversity loss (Sodhi et al., 2004), soil degradation (Veldcamp et al., 2020), and global climate change (Lawrence et al., 2022). The rapid rate at which forest cover is declining globally is alarming. According to the Food and Agriculture Organization's Global Forest Resources Assessment (FAO,

2020), the total global forest area decreased from 4.16 billion hectares in 2000 to 4.10 billion hectares by 2020. This downward trend underscores a pressing need for environmental conservation and sustainable forest management to mitigate further degradation and ensure the continued provision of ecosystem services. Efforts to address this crisis are made increasingly difficult by the realities of the Anthropocene an era marked by intense human interference in natural systems (Scorpio &Piégay, 2021). The impacts of human activity, especially in the form of illegal logging and unsustainable resource extraction, have severely compromised the regenerative capacity of many forest ecosystems (Kemppinen et al., 2020). Among the myriad drivers of deforestation, commercial logging of economically valuable timber species remains one of the most pervasive. One such species under considerable pressure is *Pterocarpuserinaceus*, commonly referred to as Rosewood or "Madrid wood" in Nigeria. *Pterocarpuserinaceus* is a deciduous legume tree indigenous to the savannah and dry forests of West and Central Africa. It is renowned for its durable hardwood, aesthetic appeal, and multiple ecosystem services, including its utility as high-protein animal fodder, shade, and traditional medicine (Babalola, 2012; Balarabe, 2011). It thrives in semi-arid regions with annual rainfall between 600 mm and 1200 mm, and it exhibits exceptional drought tolerance, making it well adapted to the ecological conditions of the Sudanian zone (Barnekow et al., 2000). Found across a vast range from Senegal to the Central African Republic, the tree contributes significantly to both environmental stability and the livelihoods of local communities (Beamon & Cargill, 2007; Burgess et al., 2011).

Over the last decade, however, *Pterocarpuserinaceus* has come under intense exploitation, particularly due to growing international demand, with China emerging as a major importer. While the species did not previously feature in significant global trade (Loupe, Oteng-Amoako& Brink, 2008), by 2014, it had become one of the most heavily traded hardwoods. That year alone, China imported over 830 million cubic meters of Rosewood logs from West Africa, with *P. erinaceus* accounting for a significant share (Treanor, 2015; Senegal CITES Authority, 2017). As a result, the tree is now facing the threat of depletion across many West African countries, including Nigeria.

The situation in Taraba State exemplifies the consequences of such unchecked exploitation. Located in Nigeria's north-central zone, Taraba is richly endowed with natural forests that once supported diverse flora and fauna. However, due to the high market value of Rosewood, its indiscriminate harvesting has escalated dramatically in recent years (Aiyetan, 2016). Timber merchants, driven by profit and international demand, have expanded operations across the state, often circumventing existing forestry regulations and engaging in illicit logging practices. According to Bosu (2013), the complexity of the Rosewood trade, marked by weak forest governance, corruption, and a lack of enforcement, has facilitated a coordinated extraction network that undermines sustainable forest management efforts in Nigeria. Locally, the impacts of this exploitation are multifaceted. Forest-dependent communities in Taraba State rely heavily on *Pterocarpuserinaceus* not only for income through selective logging but also for fuelwood, livestock feed, and traditional medicine (Mustapha et al., 2020). The unregulated felling of the species has led to visible degradation of forest landscapes, reducing shade, raising surface temperatures, and altering local microclimates. The loss of Rosewood also affects pastoralist communities, particularly during the dry season when its foliage provides critical fodder. Its depletion thus threatens both ecological resilience and human well-being.

Moreover, the selective and unsustainable logging of *Pterocarpuserinaceus* has significant implications for biodiversity conservation. Forests where Rosewood trees once thrived are now increasingly vulnerable to erosion, reduced soil fertility, and fire outbreaks due to the removal of canopy cover (European Commission, 2008). This, in turn, affects other species and ecological functions supported by these habitats. Several studies have shown that extensive deforestation can

lead to increased temperatures and decreased precipitation, with long-term repercussions on regional climate systems (Aber, 2001; Bosu, 2013).

The socio-economic dimension of Rosewood exploitation is equally critical. While local loggers may benefit temporarily from the trade, the long-term costs in terms of environmental degradation, loss of non-timber forest products, and community conflicts particularly between farmers and herders can be substantial (Bosu, 2013). In many instances, the monetary gains from logging are not equitably distributed among community members, leading to increased poverty, marginalization, and social tensions. Furthermore, the disorganized nature of the trade allows foreign actors, especially Chinese buyers, to dominate the market, often at the expense of local economies and environmental sustainability (Aiyetan, 2016). The growing exploitation of *Pterocarpuserinaceus* (commonly known as rosewood) in Taraba State, Nigeria, reflects a broader trend across West Africa, where the surge in demand, particularly from Asian markets such as China, has led to unsustainable and largely illegal harvesting practices. Despite the species being classified as protected under existing forestry regulations in Taraba State, reports consistently indicate a dramatic escalation in logging activities, with limited regard for legal prohibitions or sustainable harvesting principles. Evidence from previous studies (Leicht et al., 2018;

2. Material and Methods

2.1 Study Area

Taraba State, located in northeastern Nigeria, serves as the case study area for investigating the impacts of the indiscriminate harvest of Pterocarpuserinaceus (Rosewood or Madrid wood) on its microclimate and on the livelihood of dependent communities. Taraba State offers a suitable context for this study due to the significant presence of Pterocarpuserinaceus and the observed impacts of indiscriminate logging activities in the region.Taraba State is located between Latitudes 6 0’30” and 9 0’ 36” N and longitudes 9 10’ 50”and 12 0’ 0” E (Figure 1) Taraba State is situated in the northeastern part of Nigeria, bordered by Benue State to the west, Plateau and Nasarawa States to the northwest, Adamawa State to the northeast, Gombe and Bauchi States to the east, and Cameroon to the south.

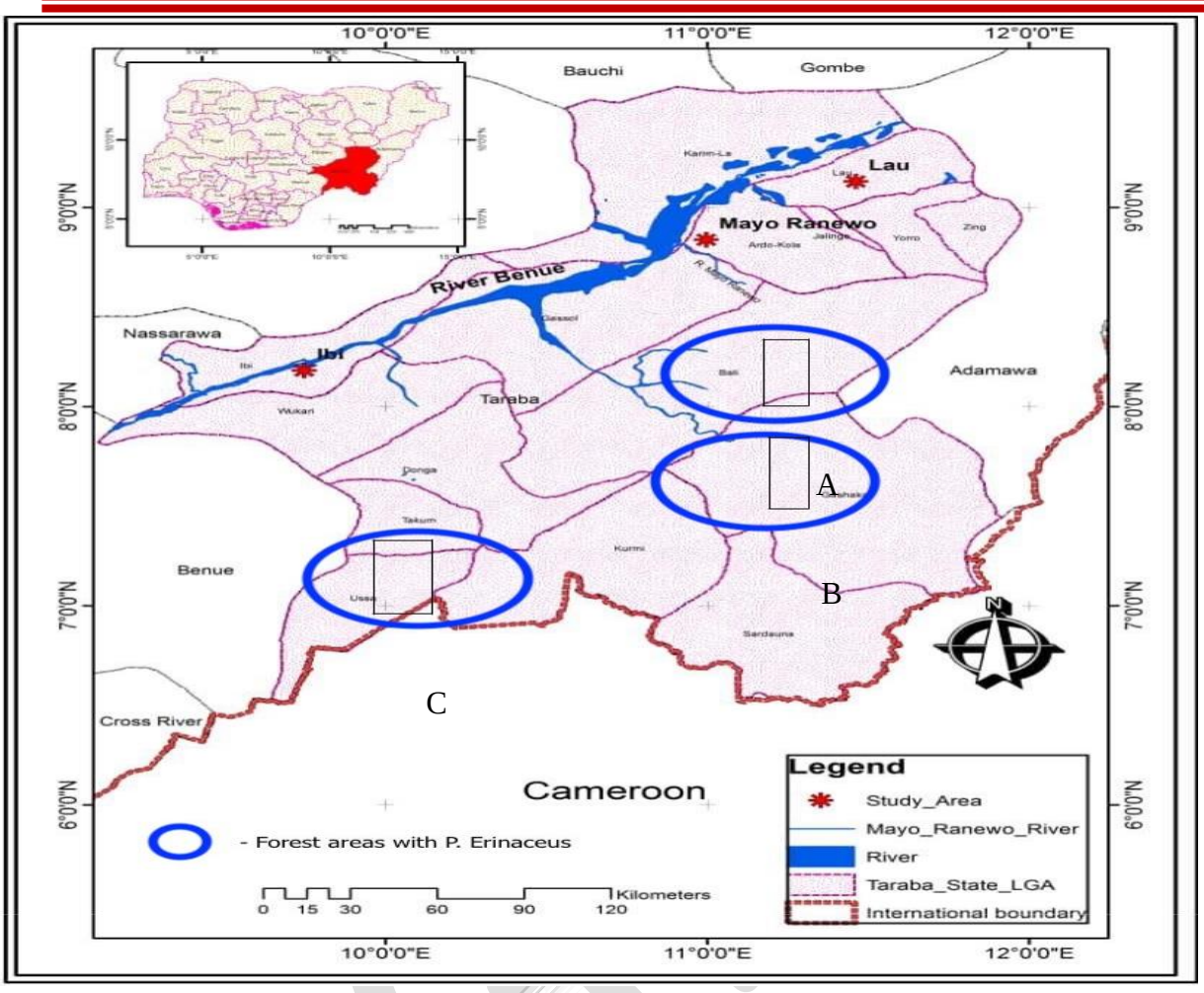

Figure .1: Taraba State showing Local Governments with P. Erinaceus species.
Source: *Ministry of Lands and Survey, Jalingo, Taraba State, 2024*

2.2 Methodology

Research Design

The study adopted a mixed-methods research design to examine the socio-economic impacts of *Pterocarpus erinaceus* exploitation in Taraba State, Nigeria. The design combined quantitative and qualitative approaches to obtain a broader understanding of the effects of rosewood exploitation on the affected communities. The quantitative approach was used to assess respondents' views on household income, employment opportunities, access to education, community security, local infrastructure, migration, health and social cohesion. The qualitative approach provided additional information on the experiences of community members and the social and economic changes associated with the exploitation.

Primary data were collected through structured questionnaires, interviews and field observations, while secondary data were obtained from relevant published materials and documentary sources. The structured questionnaires provided information that could be analysed statistically, while interviews helped to obtain further explanations of the issues raised by respondents. Field observations provided an opportunity to examine conditions within the affected communities,

particularly those relating to infrastructure and other visible socio-economic effects. Secondary data complemented the primary information by providing relevant background to the study.

The study analysed questionnaire responses from 400 respondents using descriptive statistics, including mean scores and standard deviations, to examine the major socio-economic impacts of rosewood exploitation. Regression analysis and analysis of variance (ANOVA) were also employed to examine the relationships between the selected socio-economic variables and the reported impacts. Information obtained through interviews, field observations and secondary sources was used to provide additional context for interpreting the quantitative findings. The combination of these methods provided a broader basis for understanding the socio-economic consequences of *Pterocarpus erinaceus* exploitation in the study area.

3. Results

Socio-Economic Impacts of Exploitation of Pterocarpus Erinaceus

The Socio-Economic Impacts of Pterocarpus Erinaceus Exploitation

Socio-economic impacts of *Pterocarpuserinaceus* exploitation, as presented in Table 1, reveals a complex and multidimensional set of outcomes within the affected communities. The statement with the highest mean score (M = 4.52, SD = 0.85) indicates that respondents strongly agreed that the exploitation has significantly damaged local infrastructure, suggesting visible physical degradation such as deteriorated roads, bridges, and public utilities due to unsustainable logging practices. This is followed by high mean scores for the negative impact on access to education (M = 4.10, SD = 0.99), community insecurity (M = 4.09, SD = 1.06), and the creation of employment opportunities (M = 4.07, SD = 0.91). These results point to a dual reality where economic benefits such as job creation exist alongside serious disruptions to social services and security. The exploitation is also reported to have weakened community bonds and social cohesion (M = 3.80, SD = 1.06), indicating a deterioration in trust, cooperation, and traditional community structures. Furthermore, the mean score of 3.67 (SD = 1.40) for increased migration suggests that the influx of people seeking opportunities may be placing additional strain on local resources and altering social dynamics. Meanwhile, moderate mean scores were recorded for increased cost of living (M = 3.15, SD = 0.91) and adverse health impacts (M = 3.11, SD = 1.13), suggesting that although these issues are evident, they are perceived with varying intensity across the population.

On the other hand, respondents expressed relatively low agreement with the idea that local businesses have benefited economically (M = 2.93, SD = 0.84) and that household income has significantly increased as a result of the exploitation (M = 2.77, SD = 1.32). This implies that while some individuals may gain employment, the broader community may not be experiencing substantial economic upliftment. In summary, the data indicate that the socio-economic consequences of *Pterocarpus erinaceus* exploitation are largely negative, with only limited and uneven economic benefits failing to outweigh the broader harms to infrastructure, education, security, and social cohesion.

Table 1 Descriptive Analysis of Socio-Economic Impacts of Pterocarpus Erinaceus Exploitation

	N	Min	Max	Sum	Mean	Std. Deviation
The Local Infrastructure has been damaged by the Exploitation	400	1.00	5.00	1807.00	4.5175	.85236
The Exploitation has negatively impacted access to education	400	1.00	5.00	1640.00	4.1000	.99371
The Exploitation has led to Insecurity in the Community	400	1.00	5.00	1634.00	4.0850	1.06094
Pterocarpus Erinacius Exploitation has provided more Employment Opportunities	400	1.00	5.00	1628.00	4.0700	.90949
The Exploitation has Weakened Community Bonds and Social Cohesion	400	1.00	5.00	1521.00	3.8025	1.06364
Pterocarpus Erinaceus Exploitation has led to increased migration into the community	400	1.00	5.00	1468.00	3.6700	1.40215
Pterocarpus Erinaceus Exploitation has increased the cost of living in the community	400	1.00	4.00	1258.00	3.1450	.90611
The Health of Community Members has been adversely affected by the Exploitation	400	1.00	5.00	1242.00	3.1050	1.13455
Local Businesses have benefited economically from the Exploitation	400	1.00	5.00	1172.00	2.9300	.83777
Pterocarpus Erinaceus Exploitation has Significantly increased household Income	400	1.00	5.00	1107.00	2.7675	1.31635
Valid N (listwise)	400					

Source: *Author's Field Survey, 2024*

Regression Analysis of the Socio-Economic Impacts of Pterocarpus Erinaceus Exploitation

The regression analysis summarized in Table 2 explores the relationship between the exploitation of *Pterocarpus erinaceus* (rosewood) and its socio-economic impacts on local communities in Taraba State. The model yields a correlation coefficient (R) of 0.506, indicating a moderate to strong positive relationship between the dependent variable (socio-economic impacts) and the set of independent variables. This suggests that changes in the level of exploitation are associated with observable shifts in the socio-economic conditions of the affected communities. More notably, the coefficient of determination (R^2) is 0.94, which implies that 94% of the variation in socio-economic outcomes can be explained by the combination of ten predictor variables included in the model. These variables encompass critical dimensions such as community insecurity, significant changes in household income, increased cost of living, adverse health effects, damage to local

infrastructure, migration trends, limited access to education, employment dynamics, weakened community cohesion, and economic gains to local businesses.

Furthermore, the adjusted R^2 value of 0.71, which accounts for the number of predictors and sample size, confirms that the model remains statistically robust even when controlling for potential overfitting. This means that the model retains substantial explanatory power, with 71% of the variability in socio-economic conditions reliably attributable to the predictors. The relatively low standard error of the estimate (1.278) indicates that the predicted values closely align with observed data, thereby affirming the model's accuracy and the strength of the relationship between rosewood exploitation and community-level socio-economic effects.

The significance of these findings lies in the multifaceted nature of the socio-economic impacts. On one hand, the exploitation of *Pterocarpus erinaceus* has created new income streams and short-term economic opportunities for some community members, particularly those involved in the trade and processing of the timber. On the other hand, it has concurrently exacerbated several negative externalities such as increased insecurity, strain on social services, environmental degradation, health challenges due to exposure to logging dust and machinery, and a widening gap between beneficiaries and marginalized groups. These outcomes reflect the dual-edged nature of resource-based livelihoods, where economic gains often come at the cost of long-term social and environmental sustainability (Cerutti et al., 2021; FAO, 2020).

Overall, the results of the regression analysis underscore the urgent need for a balanced approach to natural resource governance in Taraba State. The high explanatory power of the model reveals that *Pterocarpus erinaceus* exploitation is a major driver of socio-economic transformation both positively and negatively. Consequently, any policy intervention aimed at sustainable forest management must go beyond ecological conservation to also address the social, economic, and institutional dimensions of forest exploitation. This includes promoting inclusive livelihood alternatives, strengthening community resilience, and establishing equitable benefit-sharing mechanisms to ensure that forest-dependent communities are not left vulnerable in the face of resource depletion and market pressures.

Table 2 Model Summary of the Socio-Economic Impacts

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.506[a]	.94	.71	1.27800

Source: *Author's Field Survey, 2024*

ANOVA Analysis of the Socio-Economic Impacts of *Pterocarpus erinaceus* Exploitation

Table 3 showed that the socio-economic effects of *Pterocarpus erinaceus* exploitation in Taraba State are not just noticeable they're statistically significant. With an F-value of 4.026 and a p-value of 0.000, the model confirms that the selected factors, insecurity, cost of living, damage to infrastructure, migration, and changes in education and employment collectively have a real and measurable impact on the lives of people in the affected communities. This supports what researchers like Cerutti et al. (2021) and the FAO (2022) have found in other parts of West Africa: that timber exploitation, if unmanaged, can cause deep-rooted social and economic shifts.

During interviews and field visits to communities like Kurmi, Takum, and Sabongida, many residents shared firsthand experiences of how rosewood logging has affected their lives. One farmer from Kashimbilla said, *"We were earning more money for a while, but now everything is*

more expensive the cost of food, even renting land." This reflects broader issues seen in similar forest communities across Nigeria and Ghana, where studies by Obiri et al. (2020) found that logging can temporarily increase income but often brings inflation, road destruction, and economic imbalance. In fact, many respondents pointed out that timber trucks had damaged roads previously used for farming and school runs.

Another common concern raised in the communities was the rise in insecurity and tension. Respondents spoke of increased migration of outsiders into logging zones, competition over land, and even the involvement of armed guards by timber merchants. In Ussa, a youth leader remarked, *"Our people no longer agree on anything; everyone is chasing money from the forest."* This speaks to a breakdown in community trust and social cohesion, which aligns with recent work by Foli et al. (2018) showing that forest exploitation can weaken traditional leadership and fuel conflict in rural areas.

Overall, the ANOVA analysis and community voices together tell a clear story: the exploitation of *Pterocarpus erinaceus* is having a strong and widespread impact on people's daily lives. While some economic benefits exist, they are often short-lived and unevenly distributed. As supported by studies like Wunder et al. (2019), real solutions will require more than regulation they will require community-based forest management, alternative livelihoods, and investments that prioritize both environmental sustainability and human well-being.

Table 3 ANOVA Table for the Regression of the Socio-Economic Impacts

Model		**Sum of Squares**	df	Mean Square	F	Sig.
1	Regression	65.763	10	6.576	4.026	.000[b]
	Residual	635.347	389	1.633		
	Total	701.110	399			

a. Dependent Variable: ImpactofPtericapusErinaceusExploitation

b. Predictors: (Constant), Insecurity in the Community, Significant increase IN household Income, increased cost of living in the community, The Health of Community Members has been adversely affected, Damage of Local Infrastructure, Increased migration into the community, negative impact on access to education, More Employment Opportunities, Weakness of Community Bonds and Social Cohesion, Local Businesses have benefited economically.

Source: *Author's Field Survey, 2024*

Regression Analysis of the Socio-Economic Impacts of *Pterocarpus erinaceus* Exploitation

Table 4 provided strong evidence of the diverse socio-economic impacts resulting from *Pterocarpus erinaceus* exploitation in local communities across Taraba State. The constant value (B = 3.063, p = .000) indicates that, irrespective of the predictors, exploitation has a significant inherent effect on community well-being. Among the most significant variables was increased migration (B = 0.111, p = .000). Respondents in communities like Kurmi and Takum reported that the influx of people seeking employment in the timber trade has increased pressure on local resources and created tension over land and housing. One respondent in Lissam stated, *"Many strangers have come here because of rosewood. It is now harder for us to find land for farming or build houses."* This supports findings by Cerutti et al. (2021), who note similar migration-driven pressures in high-value timber zones in West Africa.

Another major impact revealed in the analysis is the negative effect on access to education (B = 0.178, p = .000). In several communities, including Wukari and Donga, respondents highlighted that many youths and even school-aged children have abandoned their studies to engage in logging-related activities. A head teacher in Kashimbilla lamented, *"Some of our students now follow timber trucks or help loaders instead of coming to school. We are losing them."* This aligns with literature from Wunder et al. (2018), which shows how resource exploitation often draws labor away from long-term investments like education. Similarly, infrastructure damage (B = 0.041, p = .000) was frequently mentioned. In areas such as Suntai, roads and bridges originally constructed for community use have deteriorated due to the heavy trucks used in timber transportation. Respondents noted increased travel difficulty and risks during the rainy season.

The issue of community insecurity (B = 0.092, p = .000) was also statistically significant. Residents of Serti and Gembu expressed fear about rising crime and conflict fueled by competition over timber routes and illegal revenue collection. A community elder in Gembu commented, *"People are now fighting over who controls the rosewood routes. Even small boys are carrying weapons."* This observation reinforces earlier findings by Foli et al. (2018), who highlighted the correlation between extractive industries and localized insecurity in poorly regulated zones. Interestingly, variables like increase in household income (B = 0.013, p = .872) and economic benefits to local businesses (B = 0.197, p = .251) were not statistically significant. This suggests that, while the timber trade brings money into some hands, the broader economic uplift is limited. Many respondents agreed, with one female trader in Takum saying, *"Only a few people benefit. Most of us are left with the dust and bad roads."*

Other socio-economic indicators revealed mixed or marginal significance. For example, adverse health effects (B = -0.255, p = .063) were noted by several respondents in Ussa and Takum, who reported respiratory problems and water pollution linked to tree felling and transport dust. A youth leader in Lacheke added, *"The environment is not the same. People cough more, and our streams are not clean like before."* On the other hand, the exploitation's impact on community social cohesion (B = -0.042, p = .743) was statistically insignificant, though some interviewees did note rising mistrust, especially where benefit-sharing is opaque. The cost of living also showed a near-significant negative trend (B = -0.234, p = .061), with respondents citing increased prices of food and accommodation, particularly in areas experiencing migration surges. These cumulative findings affirm that *Pterocarpus erinaceus* exploitation creates complex and uneven socio-economic effects some visible and measurable, others hidden within the fabric of daily life in these forest communities.

Table 4 Coefficients of the Regression of Socio-Economic Impacts

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.063	.773		3.962	.000
	Pterocarpus Erinaceus Exloitation has significantly increased household Income	.013	.081	.013	.162	.872
	Pterocarpus Erinaceus Exploitation has increased the cost of living in the community	-.234	.125	-.148	-1.881	.061
	Ptericarpus Erinaceus Exploitation has provided more employment opportunities	.201	.143	.138	1.405	.161
	Local Businesses have benefited economically from the exploitation	.197	.171	.135	1.150	.251
	The exploitation has led to increased migration into the community	.111	.070	.117	1.577	.000
	The Exploitation has negatively impacted access to education	.178	.122	.133	1.451	.000
	The health of community members has been adversely affected by the exploitation	-.255	.137	-.218	-1.865	.063
	The exploitation has weakened community bondsand social cohesion	-.042	.128	-.034	-.328	.743
	The local infrastructure has been damaged by the exploitation	.041	.113	.026	.359	.000
	The exploitation has led to insecurity in the community	.092	.108	.074	.853	.000

a. Dependent Variable: Impact of Ptericapus Erinaceus Exploitation

Source: *Author's Field Survey, 2024*

4 Conclusion

The study examined the socio-economic impacts of *Pterocarpus erinaceus* exploitation in Taraba State, Nigeria. The findings revealed that the exploitation has both positive and negative consequences for the affected communities. Although it provides employment opportunities for some residents, the overall socio-economic effects are largely negative. The major concerns identified include damage to local infrastructure, reduced access to education, increased insecurity, migration and weakened community relationships.

The findings further showed that the economic benefits of rosewood exploitation are not evenly distributed among community members. Despite the employment opportunities associated with the activity, respondents reported relatively low benefits to local businesses and limited increases in household income. This indicates that the financial gains from rosewood exploitation have not translated into substantial economic improvements for the wider community.

The study concludes that uncontrolled exploitation of *Pterocarpus erinaceus* poses challenges to community welfare and sustainable natural resource management. Addressing these challenges requires effective regulation of timber exploitation, improved protection of forest resources and greater attention to the needs of affected communities. Sustainable management practices that balance economic opportunities with environmental protection and social well-being are essential to ensuring that the benefits of forest resources do not come at the expense of long-term community development.

5. Recommendations

Based on the findings of the study, the following recommendations are made:

i. The relevant government agencies in Taraba State should strengthen the monitoring of rosewood exploitation and enforce existing forestry regulations. This will help reduce uncontrolled tree felling and encourage the sustainable use of forest resources.

ii. **:** Government agencies, non-governmental organisations and community leaders should promote alternative sources of income, including sustainable agriculture, agroforestry and small-scale enterprises. This will reduce excessive dependence on rosewood exploitation and help protect household livelihoods.

iii. The government should prioritise the maintenance and rehabilitation of roads, bridges and other public infrastructure affected by timber transportation. Better infrastructure will improve access to schools, markets and other essential services.

iv. Community leaders, parents and education authorities should discourage school-age children from abandoning their education to participate in logging activities. Awareness programmes and support for vulnerable households should be encouraged to help children remain in school.

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