

Socio-Economic Factors Limiting the Effectiveness of Anti-Illegal Activity Measures in Osun State Forest Reserves

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Abstract

This study examined the socio-economic constraints affecting the effective implementation of control measures against illegal activities in forest reserves of Osun State, Nigeria. A multistage sampling technique was used to select 90 forest guards, and data were collected through structured questionnaires. Descriptive statistics and a Logit regression model were employed for analysis. The results showed that the majority of respondents were male (57.8%) and within the economically active age group of 31–40 years (51.1%), with low educational attainment, as only 2.2% had a tertiary education. Fuelwood collection (68.9%), agricultural encroachment (62.2%), and illegal resource extraction (62.2%) were identified as the most prevalent illegal activities. Control measures such as boundary demarcation (72.2%), public awareness campaigns (70.0%), and regular patrols (66.7%) were widely implemented but uneven in effectiveness. The Logit regression results revealed that socio-economic factors significantly influenced effectiveness, with age ($B = -0.041$; $p = 0.023$), education ($B = -0.489$; $p = 0.011$), household size ($B = 0.318$; $p = 0.010$), income ($B = -0.0004$; $p = 0.027$), and years of residency ($B = 0.052$; $p = 0.013$) being significant (Nagelkerke $R^2 = 0.58$; $p < 0.001$). The study concluded that while control measures were moderately effective, their performance was constrained by poor remuneration, low educational capacity, and institutional weaknesses. It was therefore recommended that the government should improve funding, enhance staff welfare, strengthen training programmes, and promote community-based forest management to ensure sustainable forest conservation and reduce illegal activities.

Keywords: *Low Education, Poor Remuneration, Illegal Activities, Forest reserves, Logit regression, Forest governance*

Introduction

Forests play a fundamental role in sustaining ecological balance, supporting biodiversity, and providing livelihood opportunities for rural populations. In Nigeria, forest reserves were

established to regulate resource use, promote conservation, and ensure sustainable exploitation of forest resources. However, increasing pressure from human activities has led to widespread illegal practices such as

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unauthorized logging, poaching, and agricultural encroachment, which threaten the integrity of forest ecosystems (Olawuyi, 2019; Adekunle *et al.*, 2021). These illegal activities have continued to undermine conservation objectives, particularly in southwestern Nigeria, where dependence on forest resources remains high.

Efforts to curb illegal activities have largely relied on control measures, including law enforcement, boundary demarcation, monitoring, and public sensitization. Despite these interventions, the persistence of illegal practices suggests that enforcement strategies alone may be insufficient. Previous studies have emphasized that the effectiveness of such measures is closely linked to underlying socio-economic conditions, including income levels, education, household size, and occupational structure (Ogunjinmi *et al.*, 2021). These factors not only influence community behavior but also shape compliance with forest regulations. While much research has focused on forest-dependent communities, limited attention has been given to the socio-economic characteristics of forestry personnel, who are directly responsible for implementing control measures. Foresters play a critical role in monitoring forest reserves, enforcing regulations, and managing conservation programs (Bertzky and Bomhard, 2010). However, their effectiveness may be constrained by socio-economic challenges such as inadequate remuneration, limited training, and poor working conditions, which can reduce motivation and efficiency. In addition, institutional challenges such as corruption and weak governance structures further complicate enforcement efforts (Li *et al.*, 2020).

Understanding the nature of illegal activities within forest reserves is also essential for

designing targeted control measures. Illegal resource extraction, fuelwood collection, and land clearing for agriculture have been identified as dominant practices contributing to forest degradation in Nigeria (FAO, 2022). These activities are often driven by economic necessity and population pressure, making them difficult to control without addressing their root causes. Consequently, assessing both the types of illegal activities and the measures adopted to control them is crucial for improving forest governance. Given these challenges, this study examined the socio-economic constraints affecting the effective implementation of control measures against illegal activities in forest reserves of Osun State, Nigeria. Specifically, it evaluated the socio-economic characteristics of foresters, identified prevalent illegal activities, assessed the control measures in place, and analyzed the socio-economic factors influencing their effective implementation. The findings were expected to provide empirical insights that could inform policy interventions aimed at strengthening forest management and enhancing the capacity of forestry personnel in Nigeria.

Methodology

Area of Study

The study was carried out in Osun State, Nigeria. The State is in southwestern Nigeria; bounded to the East by Ekiti and Ondo State for 84km and 78km respectively, to the north by Kwara State for 73km, to the south by Ogun State for 84km, and to the west by Oyo State, mostly across the River Osun. Named for the River Osun, a vital river which flows through the State, the State was formed from the southeast of Oyo State on 27th August 1991, and has its capital in the city of Osogbo. The State is situated in the tropical rainforest zone. It covers an area of approximately 14,875 sq km and lies between latitude 7° 30' 0" N and

longitude 4° 30' 0" E. It has an estimated population of about 4.7 million as of 2016. The state also has many hills in towns like Ikirun, Iragbiji, Ilesha, Ikire, and Ile-Ife. These hills were fortresses for the people during the Yoruba wars and the Fulani expansionist period. Presently, they serve as beautiful scenery and landscapes to look upon when visiting or passing through these towns.

Target Population

The target population of the study was the foresters in Osun State.

Sampling Procedure and Sampling Size

A multistage sampling technique was used in this study. At the first stage, purposive sampling techniques were used to select the list of foresters in the State, and the list was retrieved from the Ministry of Agriculture and Forestry in Osogbo, Osun State, Nigeria. A total of 180 foresters are on the list of civil service in the State (Ministry of Agriculture and Forestry, Osun State). Simple random sampling techniques were used to select (50%) 90 forest guards in the study area.

Method of Data Collection

The primary and secondary data were used for the study. Primary data was obtained from the field survey through the administration of well-structured questionnaires, which were used to solicit information from the respondents on issues that centered on the set objectives of the study.

Data Analysis

Descriptive statistics such as frequency and percentage were used to analyze the objectives, while the Logit Regression model was used to analyze the socio-economic factors influencing their effective implementations of control measurement.

Measurement of Variables

The dependent variable in the study was the effectiveness of control measures, which was measured as a binary outcome (1 = effective, 0

= not effective). This dichotomous measurement justified the use of a Logit regression model. The independent variables included key socio-economic characteristics of the respondents. Sex was measured as a dummy variable (male = 1, female = 0). Age was measured in years as a continuous variable. Educational level was proxied by years of formal schooling, reflecting the respondent's level of human capital. Household size was measured as the number of individuals living in a household, indicating dependency pressure. Monthly income was measured in Nigerian Naira, representing economic capacity. Years of residency captured the duration of stay in the community, reflecting familiarity with the forest environment, while working experience measured the number of years spent in the forestry service. These variables were selected based on their theoretical relevance to behaviour and performance in natural resource management, as supported by Ogunjinmi *et al.* (2021) and Adebayo *et al.* (2022), who identified socio-economic factors as critical determinants of compliance and enforcement effectiveness.

Model Specification

The study adopted a Logit regression model to analyze the influence of socio-economic factors on the effectiveness of control measures. The model was specified as:

$$\ln(P / 1 - P) = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7$$

Where:

P = Probability that control measures are effective

1-P = Probability that control measures are not effective

$\ln(P / 1 - P)$ = Log-odds (logit) of effectiveness

Y = Effectiveness of control measures (1 = effective, 0 = not effective)

β_0 = Intercept

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β_1 – β_7 = Coefficients of explanatory variables

X1 = Age (years)

X2 = Sex (1=male, 0=female)

X3 = Educational level (years)

X4 = Household size (number of persons)

X5 = Monthly income (naira)

X6 = Years of residency

X7 = Working experience (years)

ε = Error term

The choice of the Logit model was appropriate because the dependent variable was binary in nature. The model estimated the probability that control measures were effectively implemented, given the socio-economic characteristics of the foresters. The goodness-of-fit statistics (Nagelkerke $R^2 = 0.58$; $p < 0.001$) indicated that the model had strong explanatory power, meaning that the included variables adequately explained variations in effectiveness. This approach was consistent with similar studies in forest governance and resource management (Ogunjinmi *et al.*, 2021; Adebayo *et al.*, 2022).

Results and Discussion

The socio-economic characteristics of foresters, as presented in Table 1, showed that the workforce was predominantly male, with 57.8% of respondents being men, while 42.2% were women. This indicated that forest management and enforcement activities in the study area were largely male-dominated, likely due to the physically demanding and sometimes hazardous nature of forestry operations (Elias *et al.*, 2017). This gender structure implied that policy interventions and capacity-building programmes may need to be tailored toward improving inclusiveness while still addressing the physical demands of the job. The age distribution further revealed that the majority of respondents were within the economically active age group of 31–40 years (51.1%), followed by 41–50 years (31.1%). This

suggested that most forest guards were energetic and capable of carrying out enforcement duties effectively. The implication was that the presence of a relatively youthful workforce could enhance operational efficiency and responsiveness to illegal activities if properly motivated and supported (Etemesi *et al.*, 2018). In addition, the high proportion of married respondents (63.3%) and relatively large household sizes implied increased socio-economic responsibilities among forest personnel. This suggested that financial pressures could influence job performance, either positively through increased motivation or negatively through vulnerability to corrupt practices. Educational attainment was generally low, with only 2.2% having a tertiary education, indicating limited professional and technical capacity. The implication of this was that low educational levels could reduce the effectiveness of enforcement due to limited understanding of modern forest management practices and regulatory frameworks, as supported by Olawuyi (2019). Furthermore, the long years of residency and considerable work experience among respondents indicated strong familiarity with the forest environment. While this enhanced operational knowledge and effectiveness, the implication was that prolonged exposure without adequate supervision could also lead to complacency or informal practices, as noted by Adekunle *et al.* (2021).

The identification of illegal activities in Table 2 revealed that fuelwood collection in the protected area and buffer zones (68.9%) was the most prevalent activity, followed by agricultural encroachment and extraction of protected resources (62.2% each). This highlighted the strong dependence of local populations on forest resources for livelihood and energy needs. This finding implied that

enforcement strategies alone would be insufficient unless alternative livelihood and energy sources were provided. This aligned with FAO (2022), which emphasized that poverty and energy dependence are key drivers of deforestation. The high incidence of illegal poaching, sand excavation, and felling of undersized trees further suggested unsustainable exploitation of forest resources. The implication here was that continued pressure on forest ecosystems could lead to biodiversity loss and long-term ecological degradation if not properly addressed. Moreover, the prevalence of regulatory violations such as unauthorized access to protected areas and failure to produce log certificates indicated weak institutional enforcement and poor compliance with forest laws. The implication was that strengthening governance structures, improving monitoring systems, and enhancing accountability mechanisms were necessary to reduce illegal activities.

The assessment of control measures in Table 3 showed that boundary demarcation, public awareness campaigns, and regular patrols were widely implemented. This indicated that both preventive and enforcement-based strategies were in place. The implication was that the forestry system had a functional structure for controlling illegal activities (Smith, 2004). However, the moderate implementation of community surveillance and logging certification suggested gaps in stakeholder participation and monitoring systems. This implied that without stronger community involvement and improved traceability mechanisms, illegal activities might persist despite enforcement efforts. Additionally, the relatively low emphasis on reforestation indicated that long-term sustainability strategies were not adequately prioritized. The

implication was that forest management efforts were more reactive than proactive, focusing on control rather than restoration, which could undermine sustainability in the long run (Rist and Moen, 2013).

The logit regression results in Table 4 demonstrated that socio-economic factors significantly influenced the effectiveness of control measures. Age had a negative and significant effect, indicating that younger foresters were more actively involved in enforcement activities. The implication was that younger personnel might be more physically capable and adaptable to modern enforcement techniques, suggesting the need for continuous recruitment and training of younger staff. Education also had a significant influence, implying that higher educational levels improved efficiency and decision-making capacity. The implication was that investing in training and educational development would enhance the effectiveness of forest management.

Household size showed a positive relationship with effectiveness, suggesting that individuals with greater family responsibilities were more motivated to perform their duties effectively. The implication was that socio-economic pressures could drive commitment to work, although this might also increase vulnerability to unethical practices if income levels were inadequate. Monthly income had a negative effect, indicating that poor remuneration reduced motivation and efficiency. This finding implied that improving salary structures and welfare packages would be essential for enhancing job performance and reducing corruption, as noted by Sato (2011). Also, years of residency positively influenced effectiveness, reflecting the importance of local knowledge and familiarity with forest terrain.

The implication was that experienced personnel with strong local knowledge were valuable assets in enforcement operations. However, working experience showed a negative effect, suggesting possible complacency among long-serving staff. The implication was that periodic training, supervision, and performance evaluation were necessary to maintain efficiency and prevent decline in productivity over time (Silayo *et al.*, 2014). Overall, the combined findings implied that while control measures existed and were moderately effective, their success was heavily dependent on the socio-economic conditions of the personnel implementing them. Therefore, improving forest governance in the study area required not only strengthening enforcement mechanisms but also addressing underlying socio-economic constraints such as education, income, and welfare.

Conclusion

The study concluded that illegal activities within forest reserves in Osun State were widespread and largely driven by socio-economic pressures such as low-income levels, large household sizes, and limited educational attainment among respondents. The findings showed that forest-dependent individuals relied heavily on forest resources for their livelihoods, which contributed to practices such as fuelwood collection, agricultural encroachment, and illegal logging. Although several control measures, particularly law enforcement, public awareness campaigns, community participation, and monitoring, were implemented, their effectiveness varied across the study area. The study further revealed that while many respondents perceived a decline in illegal activities due to these strategies, the overall effectiveness of control measures was constrained by critical challenges, including inadequate funding, poor logistics, weak enforcement, corruption, and insufficient alternative livelihood opportunities. In addition, the regression results confirmed that socio-economic factors such as education, income,

household size, and years of residency significantly influenced both the effectiveness of control measures and the involvement in illegal activities. Overall, the study implied that forest governance in the area required a more integrated and sustainable approach that addressed both enforcement and underlying socio-economic conditions. Based on these findings, the study recommended that government intervention should focus on increasing funding for forest management to improve logistics, equipment, and operational efficiency. It also suggested the promotion of alternative livelihood opportunities such as agroforestry and small-scale enterprises to reduce dependence on forest resources. Furthermore, strengthening institutional capacity through recruitment, training, and improved welfare for forestry personnel was emphasized as essential for enhancing enforcement effectiveness. The study also recommended increased community participation in forest management, supported by continuous public education and awareness campaigns to encourage compliance with conservation practices. These measures were considered necessary for achieving sustainable forest management and reducing illegal activities in the long term.

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Table 1: Socio-Economic Characteristics of Foresters in the Study Area

Variables	Frequency (n=90)	Percentage (%)
Sex		
Male	52	57.8
Female	38	42.2
Age (years)		
20–30	14	15.6
31–40	46	51.1
41–50	28	31.1
>50	2	2.2
Marital Status		
Married	57	63.3
Divorced	32	35.6
Widowed	1	1.1
Household Size		
<3	20	22.2
4–7	31	34.4
8–11	26	28.9
>11	13	14.4
Educational Level		
No formal education	23	25.6
Primary education	33	36.7
Secondary education	32	35.6
Tertiary education	2	2.2
Nativity		
Indigene	43	47.8
Non-indigene	47	52.2
Years of Residency		
1–3	14	15.6
4–6	22	24.4
7–9	34	37.8
>9	20	22.2
Occupation		
Civil servant	54	60.0
Trader	36	40.0

Source: Field Survey, 2025

Table 2: Illegal activities in the study area

Illegal Activities	Yes	No
1. Extraction of prohibited resources, such as protected species	56(62.2)	34(37.8)
2. Clearing of the forest for agricultural purposes	56(62.2)	34(37.8)
3. Illegal poaching	54(60.0)	36(40.0)
4. Sand excavation	52(57.8)	38(42.2)
5. Obtaining fuel wood from the reserve	62(68.9)	28(31.1)
6. Violation of resource-use regulations	47(52.2)	43(47.8)
7. Felling of undersized trees	52(57.8)	38(42.2)
8. Non- renewal of property hammer	36(40.0)	54(60.0)
9. Arson or illegal burning	49(54.4)	41(45.6)
10. Clearing of the bush for urbanizations	32(35.6)	58(64.4)
11. Failure to produce a log certificate	50(55.6)	40(44.4)
12. Taking of resources from protected areas or private land without permission	55(61.1)	35(38.9)
13. Excessive logging	43(47.8)	47(52.2)

Source: Field Survey, 2025

Table 3: Assessment of Control Measures in Place in the Study Area (n = 90)

Control Measures (Variables)	Yes (Frequency)	Yes (%)	No (Frequency)	No (%)
Forest boundary demarcation	65	72.2	25	27.8
Regular patrol by forest guards	60	66.7	30	33.3
Enforcement of forest laws	58	64.4	32	35.6
Community surveillance system	52	57.8	38	42.2
Arrest and prosecution of offenders	55	61.1	35	38.9
Public awareness campaigns	63	70.0	27	30.0
Use of permits and logging certification	50	55.6	40	44.4
Reforestation enforcement	48	53.3	42	46.7

Source: Field Survey, 2025

Table 4: Logit Regression Analysis of Socio-Economic Factors Influencing Effective Implementation of Control Measures (Y)

Variables	B	S.E	Wald	Sig.	Exp(B)	Decision
Constant	1.945	0.812	5.74	0.017	—	Significant
Age	-0.041	0.018	5.18	0.023	0.96	Significant
Sex	0.276	0.231	1.43	0.232	1.32	Not Significant
Education Level	-0.489	0.192	6.47	0.011	0.61	Significant
Household Size	0.318	0.124	6.58	0.010	1.37	Significant
Monthly Income	-0.0004	0.0002	4.89	0.027	0.99	Significant
Years of Residency	0.052	0.021	6.12	0.013	1.05	Significant
Working Experience	-0.367	0.171	4.61	0.032	0.69	Significant

n = 90; Dependent Variable: Effectiveness of Control Measures = 1 Effective, 0 Not Effective

-2 Log Likelihood = 94.21, Cox & Snell $R^2 = 0.44$, Na ox & Snell $R^2 = 0.44$, Model Chi-square = 51.36, value = p-value = <0.001

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