

Assessing Community Perceptions of the Environmental Consequences of Deforestation and Identifying Mitigation and Adaptation Strategies in Katcha Local Government, Niger State, Nigeria

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Abstract: Deforestation is a pressing environmental issue with far-reaching consequences for biodiversity, climate, and community livelihoods, making it essential to understand community perceptions and identify effective mitigation and adaptation strategies for sustainable forest management. This study, conducted through a field survey of 300 respondents, aimed to evaluate community awareness of deforestation, its environmental impacts, and preferred solutions to inform policy and interventions. Findings revealed that 66.3% of respondents are highly aware of deforestation, with 43.3% identifying biodiversity loss as the primary consequence, alongside significant impacts such as soil erosion (18%), water scarcity (12%), reduced agricultural productivity (16.3%), wildlife decline (50%), soil fertility degradation (42%), and climate disruptions (46%). Respondents highlighted afforestation and reforestation (31.3%), community awareness programs (22.3%), and strict law enforcement (16.3%) as key strategies, while also emphasizing solar energy (42%) as an alternative to fuelwood and the role of traditional leaders (44%) in promoting conservation. To address these challenges, the study recommends strengthening community awareness, promoting reforestation, enforcing policies, adopting alternative livelihoods, and fostering stakeholder collaboration to ensure sustainable forest management and mitigate deforestation's adverse effects.

Keywords: *Deforestation, Community Perceptions, Environmental Impacts, Mitigation Strategies, and Sustainable Forest Management.*

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I. INTRODUCTION

Deforestation is one of the key sources of heightened greenhouse impact. Trees and other plants take carbon in the form of carbon dioxide from the atmosphere during the process of photosynthesis. Carbon dioxide is detrimental to creatures, including man, and as deforestation takes place, the few trees left cannot make use of the carbon dioxide, consequently, the surplus carbon dioxide flows into the atmosphere, creating global warming. Deforestation is projected to contribute up to one-third of all carbon dioxide. The water cycle is similarly affected by deforestation as trees collect groundwater through their roots and release it into the atmosphere. When deforestation takes place, the land may not contain as much water which might lead to a significantly drier climate. (Wikipedia, 2008).

Available figures in the department of forestry reveal that Nigeria has a forest land area of 10,752,702 hectares and this represents around 10% of the overall land area. This excludes from the Games Reserves and National Parks. However, most of these reserves simply exist on paper and the federal Department of forestry argues that deforestation in Nigeria is presently progressing at the rate of 3.5% per annum. Forest and forest plantation are very significant natural resources relied upon by man for food, furniture, fuel wood, timbers, animal and flora to mention a few. In both developed and developing countries, exploitation of these forest resources take place consistently for various purposes which varies from commercial to non-commercial, need for space in road construction shifting agriculture, firewood harvesting, construction of residential building, sand excavation etc. (Akingbogun et al, 2012)

Most of these approaches however have had a negative influence on the forest plantation. (Balogun, 2004). The depletion of the natural environment is a worrisome development in the study area as the entire forest land is been destroyed for the purpose of farming, fuel wood production, timber production, hunting of games etc. with these activities the forest land and the biodiversity is endangered and even been in extinction. Usually, woods function as windbreaks and shadows for land to limit its exposure to erosion. They frequently experience luxuriant growth, close canopy and the subsequent consequence is that such trees intercept direct rain drops and prevent it from having direct influence on the soil surface, a circumstance which apart from preventing erosion and stream flood, lowering evaporation. Akingbogun et al, (20212)

In addition, trees stagnate carbon dioxide and therefore, limit the rate of global warming and slowing down climate change. The search for fire wood is thought to be one of the leading causes for deforestation in developing nations whereas fingered fuel wood for domestic and economic purposes is the major cause of the vast loss of the indigenous trees in Katcha Local Government Area of Niger State. Yusuf and Muhammad (2014). This demands the need to look at how these processes of forest exploitation have severely affected the communities of Katcha Local Government Area of Niger State and how to alleviate the impact.

II. MATERIALS AND METHOD

➤ *The Study Area*

Katcha Local Government Area (LGA) in Niger State, Nigeria, serves as the study area for this research. Located at coordinates 8° 0' 37" N, 6° 4' E to 9° 29' N, 6° 28' E, Katcha LGA covers an area of 1,681 km² and has a population of over 122,176 (Federal Republic of Nigeria, 2006). The region is characterized by a tropical savannah climate, with distinct wet and dry seasons. The wet season spans from April to October, with peak rainfall occurring in July and August, while the dry season lasts from November to March, marked by the Harmattan winds that bring dry and dusty conditions from the Sahara Desert. Annual rainfall ranges between 1,100 mm and 1,300 mm, supporting the growth of Guinea Savannah vegetation, which includes a mix of open forests, tall grasses, and undergrowth, as well as indigenous trees such as mango, orange, and cashew.

The climate of Katcha LGA significantly influences agricultural activities, water resource management, and the livelihoods of its inhabitants. However, the region faces environmental challenges such as deforestation, which threatens its biodiversity, soil fertility, and water availability. Deforestation in Katcha LGA has led to biodiversity loss, soil erosion, reduced agricultural productivity, and climate disruptions, all of which have profound implications for the community's well-being and environmental sustainability. The region's proximity to forest resources and its reliance on agriculture make it particularly vulnerable to the adverse effects of deforestation and climate change.

The region's tropical savannah environment, reliance on natural resources, and vulnerability to deforestation and climate change make it an ideal location for this study. The research aims to evaluate community awareness of deforestation and its environmental impacts, such as biodiversity loss, soil erosion, water scarcity, and reduced agricultural productivity, which are critical issues in Katcha LGA. Additionally, the study seeks to identify community-preferred mitigation and adaptation strategies, such as afforestation, reforestation, community awareness programs, and the adoption of alternative energy sources like solar energy. These strategies are particularly relevant in Katcha LGA, where traditional leaders play a significant role in promoting conservation and sustainable resource management.

By focusing on Katcha LGA, the research provides a localized understanding of deforestation's consequences and offers context-specific recommendations for mitigating its impacts. The study area's unique climatic and environmental conditions, combined with its socio-economic reliance on natural resources, make it a microcosm for understanding the broader challenges of deforestation and climate change in tropical savannah regions. The findings from this research will contribute to the development of sustainable forest management practices and climate adaptation strategies that are tailored to the needs and realities of communities in Katcha LGA and similar regions.

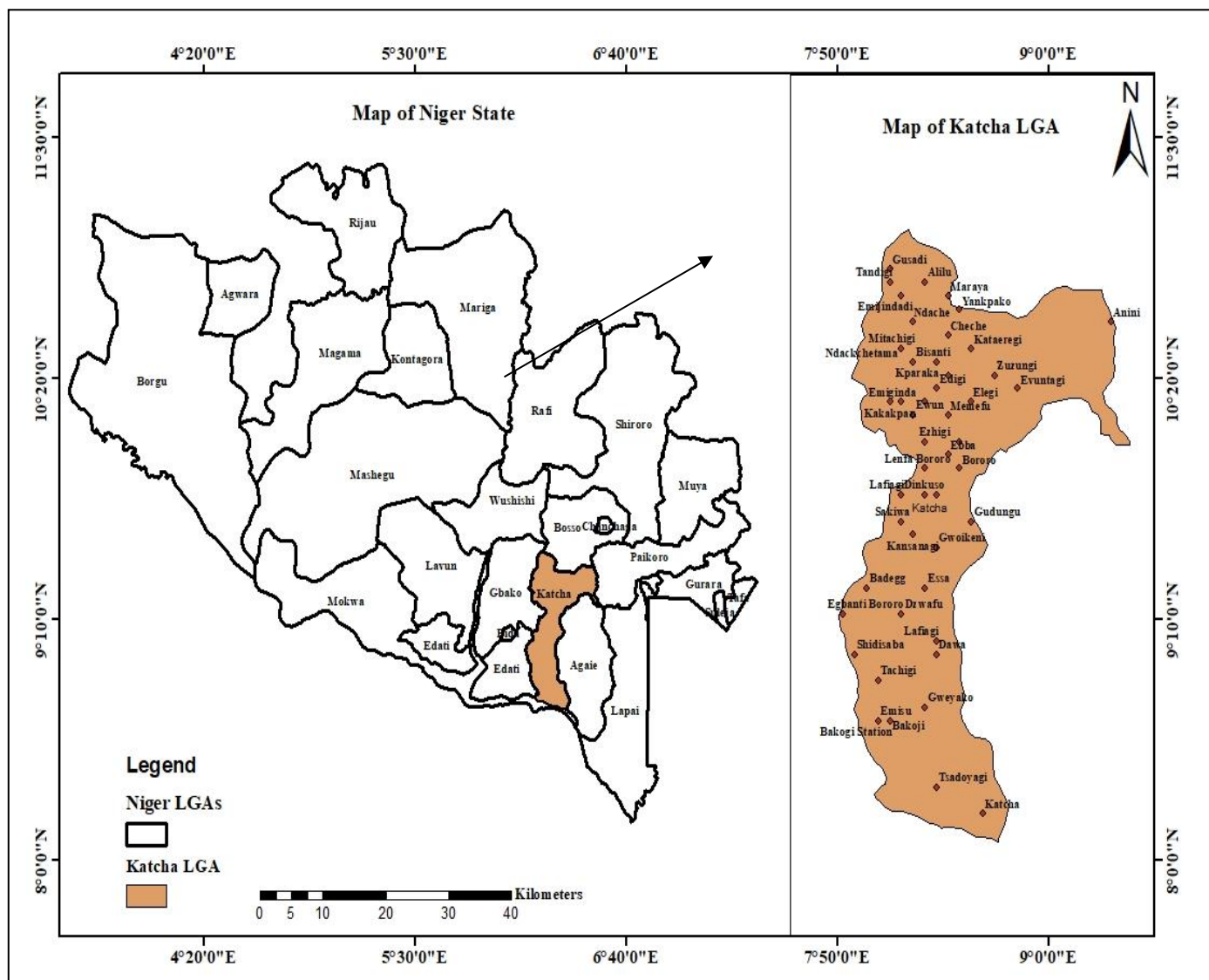


Fig 1 Map of Niger State showing Katcha Local Government Area

➤ *Sample Size and Sampling Techniques*

According to the National Population Commission (2006) census, the population of the Katcha Local Government Area of Niger state is 122,176. This population was projected to 2023 (321,546). Views of the people on the driving forces behind deforestation and land use land cover changes was captured using Key Informant Interview (KII) and semi-structured questionnaire. The projection of the population is based on Niger state population growth rate of 3% (NPC, 2009) using the formula:

$$P(t+n) = P_t e^{rn} \dots \dots \dots \text{EQ 1}$$

Where:

$P_t + n$ = future population (2023)

P_t = base year population (2006); r = growth rate (3%); n = interval between future population and base year population (2023 – 2006) = 17 years and e = exponential

Based on the projected population of the study area 2023 (184486) Yamane's (1967) formula for sample size determination was used to get the number of respondents for questionnaire administration:

$$n = \frac{N}{1 + Ne^2} \dots \dots \dots \text{EQ 2}$$

Where n = Number of samples

N = number of populations under study
 e = error tolerance (level) or margin error at the proportion of population given as 0.05%

A total of 462.21 which was rounded up to 463 respondents but 300 were selected for the administration of the questionnaire using Open Data Kit (ODK). The questionnaire was randomly administered to the selected households in the study area.

➤ *Data Analysis*

This objective was achieved using the designed and distributed structured questionnaires to a representative

sample of the community to gather data on their perceptions and awareness of deforestation's impacts. Data collected were coded and entered into statistical software for analysis. Frequency analysis and cross-tabulation to assess the level of awareness and the perceived consequences of deforestation among different demographic groups within the community were performed in SPSS version 27. identification of mitigation and adoption strategies to deforestation. This was achieved by Integrating findings from the previous analyses (extent of deforestation, land use activities, and community perceptions) to identify key drivers and consequences of deforestation. Engagement with environmental experts, local authorities, and stakeholders to gather insights and suggestions on effective mitigation and adaptation strategies for reducing deforestation. Qualitative analysis was used to compile and prioritize feasible strategies based on their potential effectiveness, community acceptance, and sustainability.

III. RESULTS AND DISCUSSION

The questionnaire was designed based on the background knowledge of the study area, previous research work, and discussion with key informants. To collect relevant information from the respondents, a scheduled interview was prepared considering the objectives in view. Personal interview was conducted with the respondents using an interview schedule. Information about historical changes in the environment was obtained through interviews with elderly people (heads of the village) in the respective study areas. This interview covers a vast range of topics regarding land use, deforestation, livestock, and human perception of the drivers of change. These interviews are very important as it provide information about the perception of local people on the impacts of environmental change on deforestation and land use dynamics dated back from 1993 to 2023.

➤ *Awareness of Deforestation Activities*

Table 1 Awareness of Deforestation Activities

	Frequency	Valid Percent
Very aware	199	66.3
Somewhat aware	84	28.0
Not very aware	11	3.7
Unaware	6	2.0
Total	300	100.0

Source: Field Survey, 2024

The majority of respondents (66.3%) are very aware of deforestation activities in their communities, with another 28.0% being somewhat aware. This indicates a high level of

community awareness, which is critical for fostering active participation in conservation efforts.

➤ *Main Consequence of Deforestation in Your Area*

Table 2 Main Consequence of Deforestation in Your Area

	Frequency	Valid Percent
Loss of Biodiversity	130	43.3
Soil Erosion	54	18.0
Water scarcity	36	12.0
All of the above	80	26.7
Total	300	100.0

Source: Field Survey, 2024

The table indicates that 43.3% of respondents see the loss of biodiversity as the most significant consequence of deforestation, followed by 18.0% who view soil erosion as the main impact, and 12.0% who cite water scarcity. Furthermore, 26.7% of respondents recognize all these

consequences together, indicating an understanding that deforestation has broad and interconnected environmental effects.

➤ *Effect of Deforestation on Wildlife in the Study Area*

Table 3 Effect of Deforestation on Wildlife in the Study Area

	Frequency	Valid Percent
Significant reduction in wildlife	150	50.0
Moderate reduction in wildlife	85	28.3
Minimal impact on wildlife	37	12.3
No impact	28	9.3
Total	300	100.0

Source: Field Survey, 2024

The table shows that most respondents perceive deforestation as having a substantial negative effect on local wildlife, with nearly 78.3% reporting either significant or

moderate reductions in wildlife. Only a minority (21.6%) feel that deforestation has had little to no impact on wildlife, which highlights a general concern regarding the ecological

consequences of deforestation. This emphasizes the importance of addressing deforestation and its environmental effects on biodiversity.

➤ *Impact of Deforestation on the Availability of Water Resources*

Table 4 Impact of Deforestation on the Availability of Water Resources

	Frequency	Valid Percent
Drastically reduced water availability	73	24.3
Moderately reduced water availability	85	28.3
Minimal reduction in water availability	65	21.7
No impact	77	25.7
Total	300	100.0

Source: Field Survey, 2024

The table reveals that 28.3% of respondents feel that deforestation has moderately reduced water availability, with 24.3% seeing a drastic reduction. A smaller proportion, 21.7%, believe there has been a minimal reduction in water resources, while 25.7% state that deforestation has had no impact. This suggests that the perceived effects of

deforestation on water availability are mixed, with many acknowledging a moderate to drastic impact, but others seeing little to no change.

➤ *Effect of Deforestation on Soil Fertility*

Table 5 Effect of Deforestation on Soil Fertility

	Frequency	Valid Percent
Severe degradation	126	42.0
Moderate degradation	96	32.0
Minimal degradation	42	14.0
No impact	36	12.0
Total	300	100.0

Source: Field Survey, 2024

The table shows that 42.0% of respondents believe deforestation has caused severe degradation of soil fertility, while 32.0% report moderate degradation. A smaller proportion, 14.0%, observes minimal degradation, and 12.0% claim that deforestation has had no impact on soil fertility. These results indicate a widespread concern over

deforestation's negative effects on soil quality, with most respondents acknowledging some degree of degradation, though the severity varies

➤ *Impact of Deforestation on Local Climate Conditions*

Table 6 Impact of Deforestation on Local Climate Conditions

	Frequency	Valid Percent
Increased temperatures and reduced rainfall	138	46.0
Stable climate with no change	18	6.0
Occasional changes in weather patterns	107	35.7
Decreased temperatures and increased rainfall	37	12.3
Total	300	100.0

Source: Field Survey, 2024

The table shows that 46.0% of respondents believe deforestation leads to increased temperatures and reduced rainfall, while 35.7% observe occasional changes in weather patterns. A smaller proportion, 12.3%, perceives decreased temperatures and increased rainfall, and 6.0% note no change in the climate. This data indicates that deforestation is largely

seen as having a disruptive effect on local climate, with varying degrees of impact.

➤ *Perceive the Relationship Between Deforestation and Flooding*

Table 7 Perceive the Relationship Between Deforestation and Flooding

	Frequency	Valid Percent
Strongly related	108	36.0
Somewhat related	143	47.7
Weakly related	49	16.3
Total	300	100.0

Source: Field Survey 2024

The data reveals that 36.0% of respondents perceive a strong relationship between deforestation and flooding, while 47.7% see a somewhat related link, acknowledging deforestation’s contribution but also considering other factors. 16.3% view the relationship as weak, suggesting less

impact. Overall, the majority of respondents see some level of connection between deforestation and flooding, with varying degrees of perceived severity.

➤ *How Deforestation Impacted on Agricultural Productivity*

Table 8 How Deforestation Impacted on Agricultural Productivity

	Frequency	Valid Percent
Significantly reduced crop yields	49	16.3
Moderately reduced crop yields	56	18.7
Minimal impact on crop yields	135	45.0
No impact	60	20.0
Total	300	100.0

Source: Field Survey, 2024

The majority of respondents believe that deforestation has minimal (44.9%) or moderate (18.6%) impacts on agricultural productivity, with 16.3% perceiving a significant reduction in crop yields. A smaller group (19.9%) does not see any effect from deforestation on agricultural outputs. This

indicates that while deforestation is recognized as a factor in some areas, its influence on agriculture is not universally seen as major.

➤ *Effect of Deforestation on Community Livelihoods*

Table 9 Effect of Deforestation on Community Livelihoods

	Frequency	Valid Percent
Severe negative impact	118	39.3
Moderate negative impact	59	19.7
Minimal impact	69	23.0
Positive impact	54	18.0
Total	300	100.0

Source: Field Survey 2024

The majority of respondents perceive deforestation as having a negative effect on community livelihoods, with 39.3% seeing a severe negative impact and 19.7% reporting a moderate negative impact. However, 23% report minimal impact, and 18% believe that deforestation has a positive impact, possibly due to the creation of more land for

agricultural activities or other benefits. This reflects a varied perspective on the consequences of deforestation in the area, with a significant portion recognizing its detrimental effects.

➤ *Overview of Concern for Environmental Consequences*

Table 10 Overview of Concern for Environmental Consequences

	Frequency	Valid Percent
Very concerned	127	42.3
Somewhat concerned	67	22.3
Not very concerned	59	19.7
Not concerned at all	47	15.7
Total	300	100.0

Source: Field Survey 2024

The survey reveals that a significant majority (42.3%) are very concerned about the long-term environmental impacts of deforestation, with 22.3% somewhat concerned. Together, they represent nearly two-thirds of respondents (64.7%). This demonstrates a heightened awareness and

concern about deforestation among participants, though a notable proportion (15.7%) is not concerned at all.

➤ *Most Effective Strategies to Reduce Deforestation*

Table 11 Most Effective Strategies to Reduce Deforestation

	Frequency	Valid Percent
Afforestation and reforestation	94	31.3
Law enforcement against illegal logging	49	16.3
Community awareness programs	67	22.3
Adoption of alternative energy sources	44	14.7
Il of the above	46	15.3
Total	300	100.0

Source: Field Survey 2024

Afforestation and reforestation are seen as the most effective strategies (31.3%), followed closely by community awareness programs (22.3%) and all-inclusive approaches (15.3%). These findings highlight the preference for

proactive forest recovery efforts and the importance of raising awareness.

➤ *Alternative Livelihood that can Best Reduce Dependence on Forest Resources*

Table 12 Alternative Livelihood that can Best Reduce Dependence on Forest Resources

	Frequency	Valid Percent
Improved farming practices	112	37.3
Small-scale industries	73	24.3
Renewable energy technologies	78	26.0
Fishing and aquaculture	37	12.3
Total	300	100.0

Source: Field Survey 2024

The most favored alternative livelihood to reduce dependence on forest resources is improved farming practices, with 37.2% of respondents supporting this option. Other significant alternatives include renewable energy technologies at 25.9% and small-scale industries at 24.3%, indicating a preference for diversifying income sources

through sustainable agricultural practices, green energy solutions, and local industrial development. Fishing and aquaculture received 12.3%, signaling that while important, it is considered a less central option compared to others.

➤ *Role of Government in Mitigating Deforestation*

Table 13 Role of Government in Mitigating Deforestation

	Frequency	Valid Percent
Implementing strict forest conservation policies	94	31.3
Providing financial support for afforestation	56	18.7
Promoting public education on forest conservation	35	11.7
All of the above	115	38.3
Total	300	100.0

Source: Field Survey, 2024

The majority of respondents advocate for a comprehensive approach to mitigating deforestation. 38.2% support a combination of strict forest conservation policies, financial support for afforestation, and public education on forest conservation. Among these options, 31.3% believe that implementing strict conservation policies is the most important, while 18.7% prioritize financial support for

afforestation, and 11.7% emphasize education. This suggests that while there is recognition of the need for various measures, the overarching view is that a combination of efforts will be the most effective in combating deforestation.

➤ *Improving Community Participation in Forest Management*

Table 14 Improving Community Participation in Forest Management

	Frequency	Valid Percent
Incentives for community involvement	63	21.0
Establishing community forest programs	80	26.7
Training programs on sustainable practices	66	22.0
All of the above	91	30.3
Total	300	100.0

Source: Field Survey, 2024

The majority of respondents (30.3%) believe that improving community participation in forest management requires a combination of incentives, community forest programs, and training on sustainable practices. Among individual measures, 26.7% advocate for establishing community forest programs, while 22% emphasize the

importance of training, and 21% support offering incentives. This reflects a consensus that a well-rounded, inclusive approach is needed to effectively engage local communities in forest conservation and management.

➤ *Energy Sources to Reduce Dependence on Fuelwood*

Table 15 Energy Sources to Reduce Dependence on Fuelwood

	Frequency	Valid Percent
Solar energy	126	42.0
Gas stoves	26	8.7
Efficient cookstoves	60	20.0
All of the above	88	29.3
Total	300	100.0

Source: Field Survey, 2024

The most popular alternative energy source to reduce dependence on fuelwood is solar energy, with 42% of respondents choosing it, followed by efficient cookstoves at 20%. Gas stoves were selected by 8.7% of respondents, while 29.3% preferred a combination of all these options. This suggests that a multifaceted approach, including

solar energy, more efficient cooking technologies, and cleaner alternatives like gas stoves, is seen as the most effective strategy to reduce fuelwood reliance.

➤ *Existing Reforestation Programs*

Table 16 Existing Reforestation Programs

	Frequency	Valid Percent
Highly effective	3	1.0
Moderately effective	60	20.0
Poorly effective	123	41.0
No programs exist	114	38.0
Total	300	100.0

Source: Field Survey, 2024

The table suggests that the effectiveness of reforestation programs in the community is seen as limited. A large proportion (41%) of respondents feel that existing programs are poorly effective, and 38% report that no reforestation programs exist at all. 20% view the programs as moderately effective, while only 1% consider them highly effective.

These results point to a need for significant improvement in both the implementation and scope of reforestation programs in the community.

➤ *Challenge in Adopting Sustainable Forest Management Practices*

Table 17 Challenge in adopting sustainable forest management practices

	Frequency	Valid Percent
Lack of funding	91	30.3
Poor enforcement of policies	23	7.7
Community resistance	42	14.0
Limited technical expertise	33	11.0
All of the above	111	37.0
Total	300	100.0

Source: Field Survey, 2024

The biggest challenge in adopting sustainable forest management practices, according to the table, is lack of funding, with 30.3% of respondents citing it as the main issue. Additionally, 37.0% of respondents believe that multiple factors, including poor policy enforcement, community resistance, and limited technical expertise, collectively hinder

progress. This highlights the multifaceted nature of the challenge, requiring a comprehensive approach to overcome financial, technical, and societal barriers.

➤ *Role of Traditional Leaders in Mitigating Deforestation*

Table 18 Role of Traditional Leaders in Mitigating Deforestation

	Frequency	Valid Percent
Actively enforcing forest protection laws	78	26.0
Promoting sustainable land use practices	52	17.3
Educating the community on conservation	38	12.7
All of the above	132	44.0
Total	300	100.0

Source: Field Survey, 2024

The majority of respondents (44%) believe that traditional leaders can play a comprehensive role in

mitigating deforestation by actively enforcing forest protection laws, promoting sustainable land use practices, and

educating the community on conservation. 26% emphasized the importance of enforcing laws, 17.3% focused on promoting sustainable land use practices, and 12.7% highlighted the educational role of traditional leaders in conservation efforts. This suggests that traditional leaders are

seen as key figures in facilitating a community-wide approach to forest conservation.

➤ *Encouraging Youth Involvement in Forest Conservation*

Table 19 Encouraging Youth Involvement in Forest Conservation

	Frequency	Valid Percent
Environmental education in schools	81	27.0
Incentives for youth-led conservation projects	53	17.7
Employment in reforestation program	49	16.3
All of the above	117	39.0
Total	300	100.0

Source: Field Survey, 2024

To encourage youth involvement in forest conservation, 39% of respondents believe that a combination of environmental education in schools, incentives for youth-led projects, and employment in reforestation programs would be most effective. Of these, 27% see environmental education as the most important, while 17.7% and 16.3% emphasize the value of providing incentives for youth-led initiatives and

creating employment opportunities in reforestation programs. This highlights the need for a multifaceted approach to engage the youth in conservation efforts.

➤ *The Most Important Factor in Ensuring Sustainable Forest Management*

Table 20 The Most Important Factor in Ensuring Sustainable Forest Management

s	Frequency	Valid Percent
Strong government policies	29	9.7
Active community involvement	54	18.0
Adequate funding and resources	39	13.0
Integration of modern technology	52	17.3
All of the above	126	42.0
Total	300	100.0

Source: Field Survey, 2024

The majority of respondents, 42%, believe that a combination of strong government policies, active community involvement, adequate funding, and integration of modern technology is the most effective strategy for ensuring sustainable forest management. Among these, active community involvement (18%) and integration of modern technology (17.3%) stand out as particularly important. However, strong government policies (9.7%) and adequate funding (13.0%) are also recognized as essential components.

IV. CONCLUSION

This study reveals the importance of integrating community perceptions and indigenous knowledge into forest management strategies. By strengthening community awareness, promoting reforestation, enforcing policies, and fostering stakeholder collaboration, policymakers and practitioners can develop more effective and sustainable solutions to mitigate deforestation and its adverse effects. The findings provide a strong foundation for designing targeted interventions that align with local needs and priorities, ensuring the resilience of both ecosystems and communities in the face of environmental change.

➤ *Recommendations*

- *Community Awareness and Education:*
Launch educational efforts to raise awareness about the harmful implications of deforestation, including its connection to climate change, soil erosion, and loss of biodiversity. Use local media, schools, and community centers to promote this information.
- *Development of Alternative Livelihoods:*
Promote the use of alternative energy sources such as solar cookers and better cookstoves to lessen the dependence on firewood and charcoal. Explore prospects for eco-tourism and the gathering of non-timber forest products (e.g., fruits, mushrooms, medicinal plants) as alternative sources of revenue.
- *Livestock Farming and Beekeeping:*
Support communities in adopting livestock farming or beekeeping as alternative revenue sources to minimise their dependence on forest resources.
- *Policy Support and Governance:*
Advocate for the creation and implementation of national and local policies aiming at sustainable forest management and land use practices. The government should

assist the implementation of environmental laws and create policies that favour sustainable growth.

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