



SHAPING FOREST SAFETY NET WITH FOREST MANAGEMENT AND CONSERVATION IN GAMBARI FOREST RESERVE OYO STATE NIGERIA

²Azeez F.A., ¹Onajobi A.A., ¹Tewogbade S.O., ²Odeyale O.C. and ²Falana A.R.

¹Forestry Research Institute of Nigeria PMB 5054, Jericho Hill, Ibadan

²Federal College of Forestry, PMB 5087, Jericho Ibadan

*Correspondent author: fazeez2013@gmail.com; +2348054360432,

ABSTRACT

There had been massive conversion of Forest Reserves into agricultural land without any meaningful effort by the authorities to halt the trend. The study evaluated the safety net roles of forests in relation to forest management and conservation in Oyo State Nigeria. The study was specifically conducted at Gambari Forest Reserve area of Oyo State. Purposive sampling method was employed in choosing the study area due to the high forest regeneration potential in Oyo state. Two hundred copies of a structured questionnaire were administered and retrieved. Both qualitative and quantitative (statistics) methods (such as Foster-Greer-Thorbecke (FGT), Gross Margin and Somer's D models) were used for the analysis. The results showed that forests had the capacity of improving the livelihood of the poor particularly those that ventured into forest income-generating activities. For instance, the poverty gap indices were conventionally measured to be 73% but reduced to about 66% with a drop of about 7% when forest income was included in the econometric analysis. Similarly, the inclusion of forest income reduced poverty severity measure from 69% (without forest resources income) to about 51%, a drop of 18%. Also, the study revealed that forest protection rate (49.4% timber, 21.3% non-timber) was appreciable among other factors while clearing of environment improved the management of non-timber (48%) than timber (24.5). Further, management of NTFPs had the capacity of improving peoples' welfare unlike timber forest products. Forest management mechanisms related to timber products favoured forest conservation at the expense of surrounding communities' welfare (poverty and income). Therefore, given the high dependence level of rural communities on forests and its attendant effects on the resources, balancing forest preservation and management mechanisms were recommended for creating a sustainable forest conservation model for rural communities.

Keywords: Safety net; poverty; rural household, forest management; conservation strategies; forest related enterprise

INTRODUCTION

The traditional safety net functions of forest holdings are likely to give way as rural livelihood shifts to a cash-based economy accelerated by changing roles of tropical forest in South-western Nigeria. The danger of this shift, however, is the potential disorder and exacerbation of vulnerability of the poor majority owing to the systematic disappearance of what constituted their safety net. As global food supplies change partially due to local climate change (Gregory *et al.*, 2005) and global energy crisis

(Cassman, 2007), the gap-filling role of forests among the poor of the world will only increase.

Some of the safety net potential of forests include (i) It is the home for wild animals like antelopes, monkeys, elephants snakes etc. (ii) The wood of the trees provide planks for making furniture, pulp for making paper and match sticks (iii) Forest trees help to prevent soil erosion, and also serves as wind breaks which prevent wind erosion and desert encroachment (iv) Forests provide mechanical herbs

for traditional medicine (v) Forests beautify the environment and also serve as centres for tourist attraction (vi) Forests helps in the purification of the air by removing carbon-dioxide (during photosynthesis) and adding oxygen (during respiration) (vii) Forests provide employment for people including the forest guards, saw millers and the forestry lawyers (Imasuen *et al.*, 2013).

Natural forests in Nigeria are being destroyed by various forms of land use, such as agriculture, grazing and construction activities as a result of rapid urbanization leading to desertification and degradation of the environment (FAO, 2007). Evidence of land conversion to agriculture in some forest reserves abounds without any meaningful effort by the authorities to halt the trend (USAID/Nigeria, 2008). Products of logging, which have dominated forest commercial activities, are predominantly in the hold of governments in the region, but there are also non-timber forest products (NTFPs) that are important resources for subsistence and commercial use. NTFPs refer to plant and animal products (with the exclusion of timber) harvested from forests, such as edible plants, animal products, mushrooms, snails and other living animals, edible nuts, gums, medicinal plants, firewood, forage, among others (Nkem *et al.*, 2010). While the forests have many important uses, only proper management such as forest regulation, selective exploitation regeneration, afforestation and taungya system will ensure the continuous supply of forest products and

ensure environmental sustainability (Imasuen *et al.*, 2013).

However, there should be a point of symmetry between using forests as a source of livelihood and at the same time conserving the forest and its biodiversity (Usman and Adefalu, 2010). In other words, forestry policies have to be tailored in a way that the primary focus of maintaining ecosystem integrity, the benefits and services derived from the forests will be linked with the livelihoods of all the stakeholders, especially the downtrodden populace living in the vicinity of forests, since their livelihoods are mostly dependent on forest resources. Consequently, from the foregoing, this study evaluated the role of forest products that so far, serve as safety net sustaining the livelihoods of forest communities and assessed the level of management conformity of the residents around the forest communities. The study further examined the connection between safety net of forest resources and management strategies in ensuring sustainability of forest resources in the study area.

MATERIALS AND METHODS

The study was conducted at Gambari Forest Reserve in Oyo State¹. Gambari Forest Reserve is located in Oluyole Local Government Area of Oyo State. It lies between Latitude 7° 22' and 9° 17' North; and Longitude 10° 2' and 20° 44' East (Faleyimu and Agbeja, 2004). It is one of the early forest reserves in the state

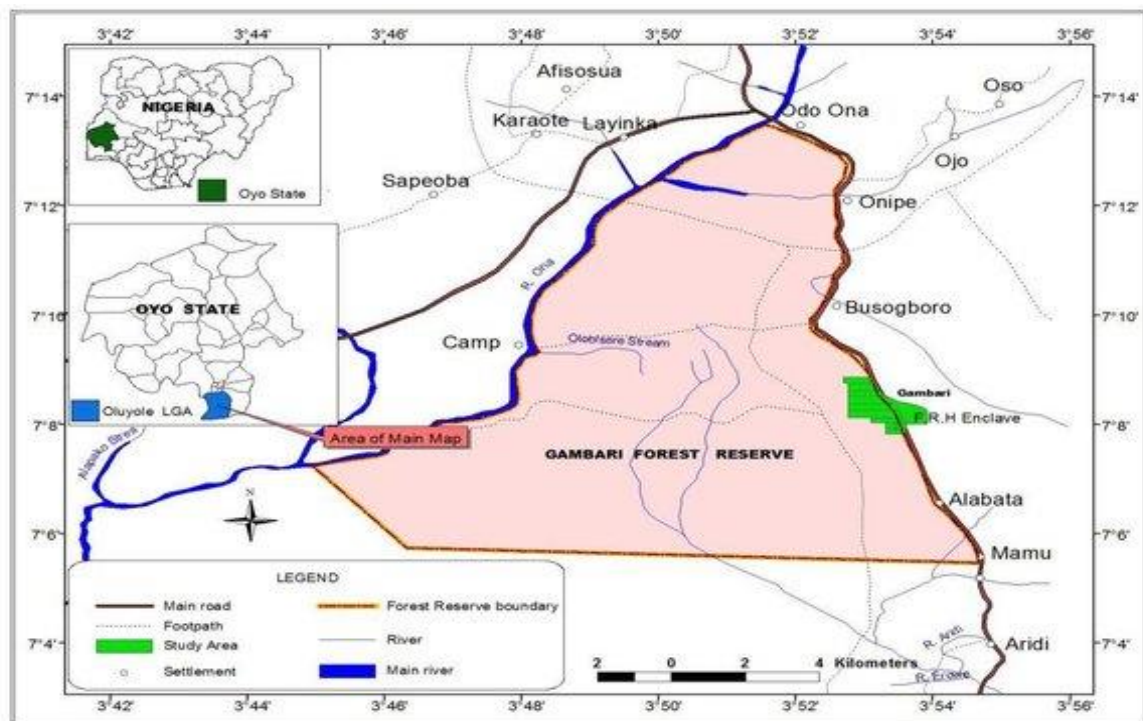


Fig. 1: Map of Gambari Forest Reserve Area, Oyo State

Gambari Forest Reserve is one of the largest forest reserves in Oyo state. It covers a total land area of 13932.18 hectares. This forest reserve has both the natural and plantation forests occurring side-by-side in the area. It has a large part of the original natural rainforest consisting of indigenous species such as *Terminalia spp*, *Triplochiton scleroxylon*, *Irvingia garbonensis*, and *Treculia africana*. Some of these tree species were cleared and replanted with exotic tree species of *Gmelina arborea* and *Tectona grandis* which make the forest to be more precious and valuable to the people especially the loggers (Aborisade and Aweto, 1990). Besides, most people in and around the state take advantage of these forests to source for fuel wood as an energy source for cooking while poles are used for supporting electricity cables, and sawn wood are utilized for production of furniture, pulp, paper and building of houses (Faleyimu et al., 2013).

The sample frame involved a field survey with the use of structured questionnaires to collect data from relevant stakeholders such as saw-millers, timber contractors, loggers, farmers who practise agro-forestry system, various forest products entrepreneurs (such as fuel wood, charcoal vegetables and fruits, honey, poles, bush meat, rattan sellers etc), wood craftsmen, basket weavers and rural dwellers within and around the forest reserves

including government and community workers in the forest reserve areas.

A purposive sampling method was employed in choosing the study location due to the high forest regeneration potential in Oyo state. Afterward, the study used a two-stage sampling technique. In the first stage, eight forested villages were selected for primary data collection. In the second stage, 25 households were randomly selected in each village using community group records obtained from each community leader and some of the forest reserve officers. This gave a total of 200 forest entrepreneurs in the eight selected villages of the study location (115 males and 85 females). Each respondent was interviewed separately and each interview lasted for about 1 hour. The exercise was carried out between December and April 2017. Some of the information collected included socio-economic characteristics of the forest users, contributions of forest income with respect to their livelihood, forest activities being engaged in, forest control management and strategies among others (Nkem et al., 2010).

Simple descriptive statistics such as frequency and percentages were used to describe the distribution of forest control and management compliance. Foster-Greer-Thorbecke (FGT) model was used to determine the safety net impacts of forest on the welfare status of the households that involved in

forest income generating activities while budgetary analysis was used to determine the investment worth of the forest-related enterprises. Likewise, Somer's D directional test was also used to analyse the relationship between forest extraction, poverty and forest conservation and management strategies.

Besides, households were considered poor if their per capita monthly expenditure was less than the pre-determined poverty line of eighteen thousand, three hundred and thirty-one naira (₦18331). This amount (₦18331) set as welfare threshold for the study area (Oyo State Nigeria) was calculated by dividing total households' monthly per capita expenditure by total households' size. Then, the two third of the answer was calculated. It coincidentally matched the present Nigerian workers' minimum wage of ₦18000.00 per month (Federal Republic of Nigeria, 2011).

Model Specification

Foster-Greer-Thorbecke (FGT, 1984)

FGT poverty index was used to estimate the required variables accordingly as used by Anyanwu (1997) and Fonta *et al.* (2013). FGT (1984) describes the poverty status of the rural households as well as the socio-economic benefits of forest on households' level of poverty. The analysis of poverty incidence using FGT measure usually starts with ranking of expenditures in ascending order $Y_1 \leq Y_2 \leq \dots \leq Y_n$: The FGT index is given by:

$$P_\alpha = \frac{1}{N} \sum_{i=1}^N \left[\frac{G_i}{z} \right]^\alpha, \quad (\alpha \geq 0)$$

Where α is a measure of the sensitivity of the index to poverty and the poverty line is z , the value of expenditure per capita for the i th person's household is x_i , and the poverty gap for individual i is $G_i = z - x_i$ (with $G_i = 0$ when $x_i > z$).

To determine the poverty line, the two-thirds of the mean per capita household expenditure of the sample was taken as the poverty line.

Gross Margin

$$GM \% = \frac{TR - TC}{TR} \times 100$$

Where GM= Gross Margin as a percentage

TR=Total Revenue

TC = Total Cost

Somers' D

Somers' D is an ordinal measure of association introduced by Somers (1962). Somers' D test is used to determine if there is a significant relationship between two bivariate random variables and to indicate the direction of the relationship. Given a sequence of bivariate random variables $(X, Y) = \{(X_i, Y_i)\}$, sampled using a sampling scheme for sampling pairs of bivariate pairs from a population of pairs of bivariate pairs. Somers' D of Y with respect to X is defined as $D(Y|X) = \tau(X, Y) / \tau(X, X)$ (2) or, equivalently, as the difference between the two conditional probabilities of concordance and discordance, assuming that the 2X-values are unequal. Somers' D is asymmetric in X and Y where: X = Forest extraction activities and Y = Poverty status of the households' heads

RESULTS

Safety Net Roles of Forests

In order to understand the potential contributions of forests as safety net particularly for the rural poor, it is important to take into consideration the degree of peoples' dependency on forests and the impacts of these resources on their livelihood (Table 1). The study gives credence to the observed relationship between rural households' poverty incidence status and dependence on forest resources income. On the average, the results showed that 66.03% of the rural households in the state were living below the poverty line.

Table 1: Impact of forest income on households' welfare in Gambari Forest Reserve

Poverty index	with FREs	without FREs
Poverty incidence	0.6369	0.6837
Poverty gap	0.6559	0.7320
Poverty severity	0.5051	0.6879

Source: Calculated from field survey, 2017

Specifically, in terms of poverty headcount measure, almost 68% of the households were regarded as poor in conservative income measure (i.e. with exclusion of forest income), whereas the inclusion of forest income reduced the headcount poverty to 64%, a relative drop of 4%. The poverty gap indices were conventionally measured to be 73% but reduced to about 66% with a drop of about 7% when forest income was included. Similarly, the inclusion of forest income reduced poverty severity measure

from 69% (without FREs) to about 51%, a drop of 18%.

Exploring the Investment Worth of Forest Income Generating Activities

The results in Table 2 indicate that Gross margin for some forest enterprises that were captured during the survey was 48.5 meaning that FREs have the potential of returning 48.5% profit of the total investment worth to the households on monthly basis

Table 2: Investment worth of forest income generating activities in Gambari Forest Reserve

Total Revenue (Total sales and other variations)	TR	₦710351
Total Variable Cost	TVC	₦274244
Total Fixed Cost	TFC	₦91500
Total Cost (Cost of revenue and other variations)	TC = TVC + TFC	₦365744
Gross Income (GI)	GI = TR - TC	₦344607
Gross Margin GM %	GI ÷ TR × 100	344607 ÷ 710351 × 100 = 48.5
Profitability Index		0.485

Source: Computed by the authors, 2017

Note: Total revenue is the addition of all marketable forest products and other variations (credit, promotions etc)

Then, the profitability index of 0.485 implies that for every ₦1 spent by the forest related entrepreneurs in the study area on their respective businesses, 48.5 kobo was realized as profit on the aggregate.

Management of Forests

Good forest management provided opportunity for sustainable livelihood as reflected in Table 3. The study assessed forest conservation and management

strategies in Gambari Forest Reserve areas of Oyo State. In terms of forests management, the study revealed that forest protection rate (49.4% timber, 21.3% non-timber) was appreciable among other factors while clearing of environment improved the management of non-timber (48%) than timber (24.5).

Table 3: Forest management measures in Gambari Forest Reserve

Forest management	Timber	Non-Timber
Forest protection	49.4	21.3
Reforestation	17.0	4.1
Clearing of environment	24.5	48.5
Watering of plant species	3.8	10.5
Nursery management	5.3	15.6

Source: Calculated from field survey, 2017

Essentially, results agreed with the fact that there is massive illegal extraction of forest resources within the forest reserve and its vicinity based on the oral interview conducted during the survey, unfortunately, there is no commensurate forests regeneration practices to ensure continuous and sustainable forest utilization. The rate at which

forests were being regenerated was very inconsequential (17% timber, 4.1% non-timber).

3.4. Forest Users' Activities and Conservation Strategies

With respect to curbing the act of illegal forest extractions, about (45%) of the respondents suggested the need for increased awareness and

enlightenment campaign towards the menace while 28.5% suggested a strict monitoring of the forest reserves (Table 4). More than 20% suggested reduction in extraction levy to accommodate the

livelihood of the poor and only 6% suggested a complete ban of the encroachment. All these were suggested towards ensuring protection and management of the ecosystem.

Table 4: Distribution of forest users' activities and conservation strategies in Gambari Forest Reserve

Solution to illegal extraction	%	Conservation strategies	%
Awareness	45	Set aside certain portion	18.5
Extraction levy	20.5	Selective exploration	26.5
Ban	6	Regeneration	30
Strict guard	28.5	Tungya system	25

Source: Calculated from field survey, 2017

In addition, striking balance between the poverty status of the rural poor (most especially the residents around the forest areas) and the forest conservation strategies, about (18.5%) of the respondents suggested that Government should set aside some portions of the forests for them to extract in order to mitigate their poverty conditions. Likewise, about 26.5% supported selective exploitation of forests. Similarly, 30% of respondents chose regeneration while 25% opined that there should be room for practising tungya system in form of agroforestry within the forest reserve so that the objectives of both the protected areas as well as the livelihood of the poor would be achieved.

Relationship between Forest Extraction, Poverty, Forest Conservation and Management Strategies

This section presents the relationship between poverty and forest products extraction in relation to forest conservation and management strategies using Somer's D directional test to confirm the strength of the association and the direction of the relationship between the set of two variables (Table 5). The study revealed first, whether there was relationship between forest extraction control and poverty status of the respondents. Secondly, the direction of such relationship if any. That is, either the variables increased in value together, or as one variable value increased, the other variable value decreased (monotonic relationship).

Table 5: Relationship between forest extraction, poverty and forest conservation and management strategies in Gambari Forest Reserve

Association between variables	Somer's D	P - value	Decision
Timber products and poverty	0.079	0.005	S
NTFPs products and poverty	-0.008	0.038	S
Timber products and FRI	-0.077	0.032	S
NTFPs products and FRI	0.145	0.062	NS

Source: Calculated from field survey, 2017

Note: S = significant; NS = Non-significant. If the P - values of Somer's D statistics are less than 5% level of significance, it means that there is an association [significant relationship (S)] between the variables. But if the values are greater than 5% level of significance, it means that there is no association [no significant relationship (NS)] between the variables.

From Table 5, considering the results of Somer's D directional test, there was a positive relationship between timber product management and poverty. This information means that increase in management of timber product led to an increase in poverty status of the forest dependent people. It may be possibly due to the fact that government usually dominates the control of timber products and might therefore be

very difficult for forest users most especially the forest - dwelling indigenous people to have direct access to the protected areas for timber extraction and consequently impact negatively on their welfare. Finally, the study revealed negative and significant relationship between timber products management and forest resources income meaning that increase in timber products management leads to decrease in

forest resources income of the rural household. This is possible particularly if the administration of such management measures is solely in full control of government security apparatus whilst forest conservation and protection regulations are not compromised. For example, Table 3 reveals that about 49.4% of management measures focused on timber protection while the rest 50.6% representing others (i.e. reforestation, clearing of environment, watering of plant species and nursery management) were also meant to ensure the sustainability of timber products in the study site.

DISCUSSION

The findings revealed that on the average, 66.03% of the rural households in the state were living below the poverty line. The poverty incidence, poverty gap and poverty severity were reduced by 4%, 7% and 18% respectively when forest resources income was included in measuring the poverty index of the forest indigenous users (Table 1). This result means that forests have the capacity of improving the livelihood of the poor particularly those that venture into forest income generating activities in the study site. This is not surprising, since most rural households found trust in forest income than in non-forest related enterprises. This result runs in conformity with the findings of Tangem (2012) who stated that small and medium scale forest enterprises have the potential to diversify rural livelihoods and alleviate poverty because they require only small initial investment to set up which can make them accessible and attractive to the poor and in turn diversify their economic opportunities and improve their livelihood security (UNFF, 2013).

Likewise, forest resources enterprises were profitable in the study site (that is, profitability index of 0.485) which implied that for every ₦1 spent by the forest related entrepreneurs in the study area on their respective businesses, 48.5 kobo was realized as profit on the aggregate (Table 2). This finding gave a strong support for the earlier works by Azeez *et al.* (2011, 2015) where a similar approach was used and 10% and 75% of the total investment worth were realized respectively as profits for any ₦1 spent on the investments. Moreover, the results also conform to the findings of Awe *et al.* (2012) on *Irvingia* kernels marketing in Akure, Ondo State which stated that, for every one naira spent by the sellers, there was a return of 65 kobo. Therefore,

FREs (most especially the most prominent ones) were veritable and prosperous businesses worthy of venturing into by the rural households since they returned almost half of the business capital as profit. In addition, in terms of forests management, the study revealed that there was massive illegal extraction of forest resources within the forest reserve and its vicinity. Unfortunately, there were no commensurate forests regeneration practices to ensure continuous and sustainable forest utilization. The rate at which forests were being regenerated was very inconsequential (17% timber, 4.1% non-timber). This situation explains part of the reasons why most of the protected areas were being depleted as noted by Usman and Adefalu (2010). This situation thus poses a serious danger to the sustainability of the ecosystem.

With respect to curbing the act of illegal forest extractions, various suggestions were made towards ensuring protection and management of the ecosystem. These include: increased awareness and enlightenment campaign (45%), reduction in extraction levy (about 20%), strict monitoring of the forest reserves (28.5%) and complete ban of the forest encroachment (6%) (Table 4). Further, striking a balance between the poverty status of the rural poor (most especially the residents around the forest areas) and the forest conservation strategies, about (18.5%) of the respondents suggested that Government should set aside some portions of the forests for them to extract in order to mitigate their poverty conditions.

Likewise, about 26.5% supported selective exploitation of forests. Similarly, 30% of respondents chose regeneration while 25% opined that there should be room for practising *tungya* system in form of agroforestry within the forest reserve so that the objectives of both the protected areas as well as the livelihood of the poor would be achieved. This outcome means that if all these measures are adequately put in place and at the same time well monitored, the degree of vulnerability of forest sector will be chequered and consequently, there will be stability in the ecosystem while the livelihood of the poor will not be threatened. This finding supported the stand of Faleyimu *et al.* (2013) who posited that unless there is regeneration and sustained yield to equate forest harvest, the depletion rates of the forest are bound to continue with adverse consequences on the environment.

Further, the study revealed that there was a positive relationship between timber product management and poverty. This information means that increase in management of timber product led to an increase in poverty status of the forest dependent people. More often than not, products of logging, which has dominated forest commercial activities were predominantly in government hands (Nkem *et al.*, 2010), unlike NTFPs which are surrounded by individual and community practices that in most cases provide direct economic, social, cultural, and environmental benefits (Stoian, 2005).

One other possible reason that may be responsible for this inequity is that, being a forest reserve community, most rural households within the community might have developed some phobia and apathy for timber management because of its attached strict security regulations and legal implications. This finding thus deviates from the reports of UNFF (2013) on potentials of timber which gives credence to timber management in mitigating poverty. It therefore suggests that the impact of timber management on poverty within protected areas may be different from non-protected areas.

On the other hand, NTFPs management is significant but negatively associated with poverty status of the rural households. This means that management of NTFPs has propensity of improving peoples' welfare unlike timber forest products, which are predominantly in government hands and monitored under stringent rules (Nkem *et al.*, 2010). One possible reason for this negative association might be due to a variety of management measures espoused by various stakeholders in the study site as revealed in Table 3. For instance, appropriate clearing of the forest environment (48.5%), protection of forest resources (21.3%), adequate nursery management (15.6%), watering of some plant species (10.5%) and reforestation (4.1%) would increase the chances of NTFPs availability and abundance needed for the livelihoods of the forest dependent people.

Also, since NTFPs management is somehow flexible compare to timber products because it is observed that most rural households usually found one means or the other to hunt for NTFPs irrespective of the stringent nature of the forest reserve. For instance, NTFPs such as fuel wood, charcoal, fruits and vegetables, chew sticks, snails among others are at the common reach of the rural dwellers living within

the forest reserve vicinities. Therefore, the mode of collection and management of NTFPs provide opportunities to improve the welfare of the poor who depend on it as explained by Sunderlin *et al.* (2008). Finally, the study revealed negative and significant relationship between timber products management and forest resources income meaning that increase in timber products management leads to decrease in forest resources income of the rural household. This is possible particularly if the administration of such management measures is solely in full control of government security apparatus whilst forest conservation and protection regulations are not compromised. As a result, rural households may not have capacity to encroach the forest at will and may negatively impact their involvement in timber management processes which in turn can reduce their means of income generation because such measures would have created a bottleneck for their timber extraction activities. This claim is in conformity with the findings of Kaimowitz (2003) who argued that greater enforcement of forestry and conservation laws have the potential to negatively affect rural income because such legislation often prohibits forestry activities such as small-scale fuel wood collection, charcoal production and hunting that millions of poor rural households depend on.

In summary, forest management mechanisms related to timber products favoured forest conservation at the expense of the surrounding communities' welfare (poverty and income) – this therefore needs further adjustment if welfare of the surrounding communities is to be considered.

However, forest management mechanisms related to NTFPs (such as forest protection, clearing of environment, watering of plant species, nursery management and reforestation) provide a win-win situation thus promote forest conservation and household welfare (poverty reduction). Specifically, forest protection method is the most effective forest management mechanism while watering of plant species is the least across all the sampled villages in the study site.

The study concluded that the inclusion of forest income in econometric analysis reduces poverty status of the forest indigenous people to 64%, 73% and a relative drop of 4% the headcount. The poverty gap indices were conventionally measured to be 73% but reduced to about 66% with a drop of about 7% when forest income was included.

Similarly, the inclusion of forest income reduced poverty severity measure from 69% (without FRES) to about 51%, (a drop of 18%). This means that forests have the capacity of improving the livelihood of the poor particularly those that venture into forest income generating activities in the study site.

Similarly, the study concluded that forest-related enterprises are veritable and prosperous businesses worthy of venturing into by the rural households since they returned almost half of the business capital as profit because for every ₦1 spent by the forest related entrepreneurs in the study area on their respective businesses, 48.5 kobo was realized as profit on the aggregate.

Furthermore, with respect to forest management and preservation, forest regeneration, increased awareness and enlightenment campaign, practise of tungya system, setting aside certain portions of forest, strict guard of forest domain, forest protection, reforestation and clearing of environment were key in protecting forest resources from going into extinction and sustaining the ecosystem in the study area.

Lastly, the results of Somer's D directional test suggest that management of NTFPs had the propensity of improving peoples' welfare unlike timber forest products while forest management mechanisms related to timber products favoured forest conservation at the expense of surrounding communities' welfare (poverty and income).

RECOMMENDATIONS

In line with the above findings, this finding recommends the following:

1. A forest-based poverty alleviation strategy (such as removing tenure and regulatory restrictions;

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improving marketing arrangements for marginal people; creating partnerships between the poor and forest enterprises; and integrating forest-based poverty efforts into rural development and poverty reduction strategies) should be adopted in the study area and well implemented.

2. Aggressive awareness and enlightenment campaigns on forest products management strategies should be enhanced.
3. Government should endeavour to set aside some portions of forests for the surrounding communities use so as to increase the resource control opportunity of the forest indigenous people.
4. Forest community people should be encouraged to practise agroforestry in form of tungya system in order to balance forest conservation strategies and forest dependency.
5. There is need to prioritise management of NTFPs especially by community people among other measures while levies charged on timber products extractions should also be adjusted to accommodate involvement of the rural poor in timber control and management mechanisms.
6. Lastly, given the high dependence level of rural communities on forests and its attendant effects on the resources, balancing forest preservation and management mechanisms will go a long way towards creating a sustainable forest conservation model for rural communities.

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