

*Original Research Article***Forestland-dependent households: a primary agent of deforestation in Nigeria?**Ayoade Matthew **Adetoye***Environmental and Economic Resource Centre, EERC Building, Opposite Federal University of Agriculture Abeokuta, Alabata Road, Abeokuta, Ogun State***Correspondence to:**

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Abstract

Despite global concerns on environment particularly, issues on deforestation, there is a lack of quantitative information on deforestation drivers. The study investigates the role of farm households in deforestation process in Nigeria. Household survey data were obtained from 300 farm households with the aid of personally administered questionnaire through a multistage sampling technique. The data were used to answer a question on how farmers contribute to deforestation process in Nigeria. The data were analysed using descriptive statistics and Probit regression model. The results show that 64% of the farmers gain access to cultivate already opened forestland through uncoordinated harvesting of forest trees while others still maintain sustainable forest land use practice – agroforestry. Sex ($P < 0.05$; $\beta = 2.34$), land security ($P < 0.01$; $\beta = 2.94$), personal preference for tree on farm land ($P < 0.05$; $\beta = -2.45$), and non-farm income ($P < 0.05$; $\beta = 2.50$) are factors influencing land use pattern among farm households. The study revealed that most farmers cultivate open forestland, but their continuous cultivation further enhanced forestland use change. The study concludes that rural farm households though one of the agents of forestland use change were found as opportunist and not mostly the primary agent initiating forestland use change in Nigeria. The study negates the conception of several past studies.

Keywords: rural farming; forest losses; deforestation; land use change.

INTRODUCTION

Over the years, and in the recent time, agriculture has always been considered as the main agent of deforestation in most developing countries with Nigeria inclusive. Often times, when issues of human interventions on environment are being discussed, particularly deforestation, farming activities are usually the first thing that comes to mind. From previous studies, it is very clear that forest losses can be attributed to both human and natural causes (Rademaekers et al. 2010; Lambin and Meyfroidt, 2011; Hosonuma et al., 2012; Malhi, 2013; UNFCCC, 2015; MacFarland et al., 2015). But the former is far more widespread than the latter, with deforestation occurring when people clear forests and use the land for other purposes, such as agriculture, infrastructure, human settlements and mining (FAO, 2016). People began converting forests to other land uses – using fire, primitive tools and grazing – thousands of years ago to facilitate hunting and agriculture. Nowadays, humankind has greater technological capacity than ever before to bring about rapid land-use change on a very

large scale. According to some estimates, agricultural expansion is the proximate driver of about 80% of deforestation worldwide (Kissinger et al., 2012), albeit with differences in geographical distribution (FAO, 2016). In Nigeria for instance, agriculture, particularly among rural farm households is seen as the major driver of forest degradation (NPF, 2006; Oyekale, 2007; Adekunle et al., 2011; Greengrass, 2012). These claims are strongly tied to dependency of rural farm households on forest land (Greengrass, 2006; Borokini, 2012; Mfon et al., 2014; Adetoye et al., 2017). Although there are three main perspectives at which the cause of deforestation has been established. The first is the issue associated with poverty. That is, the major cause of deforestation is the increase in the number of poor people, particularly in the rural areas, and mostly, farm households. In other words, farmers are the principal agents of deforestation. The second is the neoclassical view which believes that deforestation is caused by open access property rights. The third is the political ecology perspective which believes that deforestation is caused by capitalist entrepreneur (Mfon et al., 2014;

Ogundele et al., 2016). However, most scholars believed that the latter is the primary agent of deforestation while others are post emergence causes.

Generally, it has been established that the agents of deforestation are those slash and burn farmers (particularly, those living within and around forest areas), ranchers, loggers, firewood collectors, infra-structure developers and others who are cutting down the forests (NPF, 2006; Ajake, 2008; FAO, 2016). Causes of deforestation are the forces that motivate the agents to clear the forests (Chakravarty et al., 2012). It should be noted, however, that one of all the identified agents is usually the primary cause of deforestation while others are post emergence causes. Distinguishing clearly between the agents of deforestation and its causes is very crucial to understanding the major determinants of deforestation (Chakravarty et al., 2012). This is because deforestation is the result of processes driven by multiple causes occurring at various scales and differing significantly between locations. Despite global concerns, there is a lack of quantitative information on deforestation drivers (FAO, 2016).

Rudel (2013) observed that forest conversion to other land uses also differed across countries. Nigeria, for example, lost more than 90 percent of its primary forest due to practices initiated in the colonial era, such as the mechanized logging of forest reserves, the establishment of state-owned agricultural plantations (such as cocoa and oil palm), and mining (Enuoh and Bisong, 2015): forest loss here is not in any way connected to farming activity among rural farm households. It thus shows that the causes of deforestation may be proximate (direct), or underlying (indirect) (Kaimowitz and Angelsen, 1998; Kissinger et al., 2012). However, post emergence activities on such forestland area like continuous farming could result in a permanent land use change. Understanding the initial action in the process of deforestation and forestland use change is crucial to implementing effective sustainable land use policies, particularly in a country like Nigeria (Adetoye et al., 2018).

Underlying causes of deforestation relate to macro-level interactions of demographic, economic, technological, social, cultural and political factors that may operate at some distance from the forests they affect (Geist and Lambin, 2001; Millennium Ecosystem Assessment, 2005; Kissinger et al., 2012). The need to understand the context within which country specific land-use change is taking place is demonstrated by the important distinction between large-scale commercial agriculture (driven primarily by profit goals), and local subsistence agriculture (driven by livelihood needs). In Nigeria for instance, over 80% of the farming households are smallholder farmers while about 5% are commercial farmers (Akinsuyi 2011; Mgbenka and Mbah, 2016). In addition, most

the smallholder farmers live within the rural areas: where access to certain required technologies for commercialization appears impossible. Understanding the initial action in the process of deforestation and forest land use change is crucial to implementing effective sustainable land use policies, particularly in a country like Nigeria (Adetoye et al., 2018).

Further this fact, there is the need to investigate the contribution of smallholder farmers to deforestation, especially those living within the forest reserves, whose primary source of livelihood is largely tied to forest. Thus, the study seeks to: understand the socioeconomic status of farm households living within the forest reserves; investigate whether rural farm households are the primary cause of deforestation; and to provide information on the role of farmers in the deforestation process.

MATERIALS AND METHODS

Study Area

The study was conducted in South-west Nigeria with specific focus on selected forest areas; Omo, Oluwa, Shasha forest reserves in Ogun, Ondo and Osun States respectively. The area lies between longitude 2° 31' and 6° 00' East and Latitude 6° 21' and 8° 37' N with a total land area of 77,818 km². The reserves contain some of the last remaining forest in south-west Nigeria, that is, 40% of the natural forest in the reserves still remains (NCF, 2017). The climate of South-west Nigeria is tropical in nature and it is characterized by wet, harmattan, and dry seasons. The temperature ranges between 21 °C and 34 °C while the annual rainfall ranges between 1,500 mm and 3,000 mm. The wet season is associated with the Southwest monsoon wind from the Atlantic Ocean while the dry season is associated with the Northeast trade wind from the Sahara Desert. The vegetation in Southwest Nigeria is made up of fresh water swamp and mangrove forest at the belt, the low land in forest stretches inland to Ogun and part of Ondo state while secondary forest is towards the northern boundary where derived and southern Savannah exist (NPC, 2006). Farmers living within the forest reserves are those with legal right to live and cultivate the land (FAD, 1952). According to Amusa et al. (2014) the families are still in possession of their allotted forestlands while some have even extended beyond their right.

Data Collection

Prior to the data collection exercise, consultations were made (through a pilot survey) with government officials in charge of the forest reserves, to extract information on the number of enclaves, population, required sample size for the study, access to forest land, among others. Further this step, primary data were elicited from

Table 1. Summary of the Sampling Procedure for the Study (N = 300)

| Forest Reserve | Identified Enclaves | Selected Enclaves | Sample Size | Total |
|----------------|---------------------|-------------------|-------------|------------|
| Omo | 10 | Eleyele | 26 | 143 |
| | | Olooji | 70 | |
| | | Mokoore | 25 | |
| | | J4 | 14 | |
| | | Aberu | 08 | |
| Oluwa | 8 | Imo orun | 30 | 111 |
| | | Makinde | 30 | |
| | | Masole | 28 | |
| | | Ilu titun | 23 | |
| Shasha | 4 | Shasha/Mokoore | 24 | 46 |
| | | Owode/Ajegbemi | 22 | |
| Total | | | | 300 |

Note: The exact population of the study area was indeterminate despite consultations with government officials. The 30% final selection was based on law of minimum sample/law of central tendency.

rural farm households through a multistage sampling technique with the aid of personally administered questionnaire. The approach stimulates willingness to participate among respondents and thereby leading to no response issue. The first stage involved purposive selection of three (3) prominent (largest) forest reserves in South-west, Nigeria (Omo, Oluwas, and Shasha). The second stage involves a proportionate (50%) selection of the identified enclaves (settlement) in each of the sub-selected forest reserves and the final stage involves a proportionate (30%) random selection of 300 rural farm households from each of the selected enclaves. In addition, most of the respondents have lived and cultivate the acquired forest land for a long period of time and thus are good representatives to provide true information on the study. The sample distribution across the forest reserves is presented in Table 1.

Data elicited include socioeconomic data like age, farm size, income, years of farming (this is well correlated with their years of occupancy), and so on. In addition, community and land use data were also elicited. These data were collected to provide us understanding of the class of farmers in question (either subsistent, smallholder, or commercial farmers), forest land use practice/decisions, and factors influencing such choice of decisions. Farmers living within the forest reserves are not permitted to engage in the use of commercial technologies like tractor, for farming and hence information on their production technology was not included. All make use of cutlass and other farm tools.

Data Analysis

Farm households living within the forest reserves are issued a certificate of occupancy, and land use system among rural farm households within the forest reserves is strictly conditioned on sustainable practice

(agroforestry). Usually, farm households are permitted to cultivate open forest land and not untapped forestland. Individual farm household who engaged in cultivation of untapped forestland primarily contributes to forest degradation. Farmers were asked to state how they gain access to more land and this was limited mainly to two options: (i) cultivation on open forestland and (ii) cultivation of untapped forestland i.e. intact forest areas. Open forestland here means forestland whose trees have been harvested by timber workers) with no significant plan of reforestation. Farmers were well informed of the purpose of the study and thus were encouraged to provide true information on their land use decisions. Forestland degradation and the influencing factors were captured using probit model. The model is specified as follows:

$$y_i^* = Z_i Y + u_i \tag{1}$$

where y_i^* is the latent variable that defines the rule as to whether a household cultivates open forestland or otherwise. Z_i is a vector of exogenous variables; Y represents the coefficient associated with the repressors (X) including the the constant term. u_i is the error term assumed to be normally distributed with zero mean and a unit variance. The observation participation is linked with the latent participation y^* as follows:

$$y = \begin{cases} 1 & \text{if } y^* > 0 \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

Explanatory variables in the model and their respective description are presented in Table 2.

RESULTS AND DISCUSSION

Mean age of the farm households within the selected enclaves in forest reserves was calculated at approximately 46 years implying that farm households

Table 2. Description of Variables in the Probit Model

| Variables | Description | Measurement |
|-----------------------------------|---|---------------------------------------|
| Age | Age of the household head | Years |
| Education (dummy) | Educational level of the household head | 0 = no formal education, 1= otherwise |
| Sex (dummy) | Gender of the household head | 0 = male, 1 = female |
| Marital status (dummy) | Either married, single or otherwise | Single=1 otherwise = 0 |
| Household size | The number of dependant members in the family plus the household head | Number |
| Farm size | The size of land of the farmer | Hectares |
| Farming experience | Number of years of farming | Years |
| Dominant crop type (dummy) | Type of crop currently on farm land | 0 = permanent, 1= otherwise |
| Land ownership (dummy) | The right of ownership | 0 = owned, 1 = others |
| Land tenure security (dummy) | Ability to ascertain control over the desired period on the farm land | Secured = 1, not secure = 0 |
| Farm income | Amount of money derived from the farm activity per annum | Naira |
| Non-farm income | Amount of money derived from other livelihood activities per annum | Naira |
| Preference for trees on farm land | Presence of natural trees on the current farm land | 1 = yes, 0 = otherwise |

Table 3. Mean Distribution of the Socioeconomics Characteristics

| Variable | Mean | S.E Mean | Standard Deviation |
|----------------------------|------------|-----------|--------------------|
| Age (years) | 45.92 | 0.82 | 14.19 |
| Farm Size (ha) | 3.16 | 0.23 | 3.99 |
| Farming Experience (years) | 17.84 | 0.78 | 13.59 |
| Household Size (number) | 6.00 | 0.19 | 3.27 |
| Farm Income (naira) | 510,043.33 | 55,882.79 | 967,918.25 |
| Non-farm Income (naira) | 148,035.80 | 28,765.89 | 498239.90 |

Source: Computed from Field Survey, 2017

within forest reserves are economically active. This supports the age distribution of the nation where the aged are very minimal. An average farm household was calculated to have a farm size of about 3.16 ha. This implies that an average farm household population living within the forest reserves is purely a smallholder farmer. The finding corroborates the claims that most farmers in Nigeria are smallholder farmers (Akinsuyi, 2011; Mgbenka and Mbah, 2016). Most cultivate plantation crops like cocoa, kola nut, oil pam, and so on (Wahab et al., 2014). Most might have been influenced from the state-owned agricultural intervention (Enuoh and Bisong, 2015; FAO, 2016). An average farm household has an average of 18 years' farming experience with a household member of six (6) persons. The finding was supported by National

Bureau of Statistics (NBS) report in 2012. The report indicates that an average rural farm household had about six members. Average annual farm income, and non-farm income were estimated at N510,043 ≅ \$1,762 and N148,035 ≅ \$485, respectively. The income size affirms that they are small scale farmers (Akinsuyi, 2011; Mgbenka and Mbah, 2016). In addition, the size of income distribution shows that most earn their income primarily from farming while others additional income from either from sales of forest products or participation in other non-farm businesses like transportation.

Forestland Use Pattern among Farm Households

Table 4 shows the result of the probit model estimation carried out to examine forest land use access and or practice among forest land dependent households.

Table 4. Factors Determining Forestland Use Pattern among Farm Households

| Independent Variables | Coefficient | Robust Std. Error | Z | P > z | Marginal Effect |
|---------------------------|--------------|-------------------|-------|--------|-----------------|
| Age | 0.0031738 | 0.007531 | 0.42 | 0.673 | 0.001178 |
| Sex | 0.5183659** | 0.2218505 | 2.34 | 0.019 | 0.175264 |
| Education | -0.101142 | 0.0917695 | -1.10 | 0.27 | -0.03753 |
| Marital Status | 0.0215362 | 0.262473 | 0.08 | 0.935 | 0.008019 |
| Household Size | -0.0111507 | 0.0251419 | -0.44 | 0.657 | -0.00414 |
| Farm size | 0.0039848 | 0.0137606 | 0.29 | 0.772 | 0.001479 |
| Farm Experience | 0.0015978 | 0.0075296 | 0.21 | 0.832 | 0.000593 |
| Land Ownership dummy | 0.1617906 | 0.2314129 | 0.70 | 0.484 | 0.058574 |
| Land security dummy | 0.5308681*** | 0.1803362 | 2.94 | 0.003 | 0.203061 |
| Dominant crop type dummy | 0.4237429* | 0.2214477 | 1.91 | 0.056 | 0.14632 |
| Preference for tree dummy | -0.4708893** | 0.1918486 | -2.45 | 0.014 | -0.1639 |
| Farm Income | 2.88E-08 | 1.00E-07 | 0.29 | 0.774 | 1.07E-08 |
| Non-farm Income | 4.38E-07** | 1.75E-07 | 2.50 | 0.012 | 1.62E-07 |
| Constant | 0.191997 | 0.4512867 | 0.43 | 0.671 | |
| Log-Pseudolikelihood | -182.17197 | | | | |
| Wald Chi2 (13) | 33.14 | | | | |
| Pseudo R2 | 0.076 | | | | |
| Prob.>Chi2 | 0.0016 | | | | |
| Predicted Prob (y) | 0.648 | | | | |

***, **, * represent significance level at 1%, 5% and 10%, respectively.

The Log-likelihood function of the estimate model was estimated at -182.17 with associated Chi square value (33.14). The model is statistically significant ($P < 0.01$), implying that the probit model was perfectly fitted for the estimation. From the model estimation, sex and non-farm income are the only personal characteristics that exert influence on their likelihood of contributing to deforestation, while land security, preference for tree on farm on land, and dominant crop type are the community characteristics that exert influence on likelihood of deforestation among farm households. The model shows that over 64% of the population are currently engaged in the use of already opened forest lands for farming. The distribution implies that most of the farmers are currently taking advantage of the open forestland from timber harvest. The coefficients of land security dummy ($P < 0.01$) in the estimation was found to be positive. The marginal effect estimates show that households with secured land status have the likelihood of increasing the use of open forestland by 20.3%. This shows that land security status has the likelihood of contributing to land use change among farm household. Sex ($P < 0.05$) of the household head significantly contributes to the use of open forestland. The female headed households' group are more likely to engage open forestland than the male group. The non-farm income ($P < 0.01$) exerts positive influence on forestland clearance for agriculture. The desire of an average farm household to improve his/her welfare would result into quest to generate more

income. This could mean participating in other forest land degrading activity like fuel wood production, logging, burning for hunting, etc. Preference for tree on farm land ($P < 0.05$) also contributes significantly to how farm households engage the use of forest land. The findings corroborate with the reports of Adekunle et al. (2011) and Borokini et al. (2012). The variable exerts a negative influence forestland use pattern, implying that household with no preference for forest trees will see no reason to ensure sustainable practice on either opened or untapped forest land.

CONCLUSION AND RECOMMENDATION

The study revealed that rural farm households are not the primary cause of deforestation in the study area but rather opportunists. The fact that most of the respondents cultivate open forest land revealed that some agents order than farming activities usually initiate deforestation and thereby leading to land use change process. Over time, attention has been drawn to rural farmers as the agent influencing deforestation. But no distinction was made as to whether they are the primary agent or not. However, the study revealed that rural farm households are rather opportunist and not the primary influencers. Although, rural farm households stand the chance of contributing to land use change. For instance, average farm household within forest reserves with no preference for forest trees on farm plot would contribute more significantly

to unhealthy forestland use practices. Such incidence is expected to increase with positive land security status without effective forestland use policy and thus, result finally into land use change. The study therefore suggests the need to revise forestland use policy among primary forest stakeholders (rural farm households, timber workers, and other relevant beneficiaries), if forest conservation is to be ensured. Forestland could be allotted to merchants who will strategically ensure felling of trees and effective afforestation plan among timber workers. This will prevent rural farm households from gaining access to dominate open forest land. Likewise, a well-established relationship can be ensured between forest merchants and farm households in a way that facilitate sustainable forest land use contract like agroforestry.

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