Determinants of Small-scale Forestry Practice Preferences among Landowners and Land Users in Imo State, Nigeria

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Abstract

Undertaking forestry practices on private land as a land use activities had been submitted to be mostly situational. There is a strong relationship between forestry and livelihood systems. This makes forestry practice a critical decimal in rural land use equation, most especially in tropical dry forest environment where soil nutrient is maintained by rich vegetation cover. But, in Southeastern Nigeria, the situations that can engender voluntary practice of forestry on private lands had not been thoroughly investigated. This paper therefore reports the findings of our investigation on such situation among land owners and users in Imo State, Nigeria. Multistage sampling technique was used in selecting 10% of the households across nine (9) randomly selected local communities in each of the three (3) geo-political districts of Imo State, Southeastern Nigeria. Using rapid rural appraisal technique, an estimated 5,091 households were documented across the selected nine communities out of which 509 were sampled. Data were collected with well-structured questionnaire, which formed the research instrument. The data were analyzed using descriptive statistics and multi-nomial logit regression. Highest preference was expressed by the respondents for raising fruit trees (71.2%) and planting trees with arable crops (60.3%) while lowest preference was for raising woodlot (23.9%). Males showed likelihood for planting medicinal herbs/shrubs (Coeff = 0.897) while females had likelihood for raising woodlot (Coeff = -0.402) within household lands. Within nuclear households, there is tendency for more household preference for planting timber tree species (Coeff = 0.136). This may be adduced to planting of trees within arable cropland to expectedly increase with increase in farm size. The reverse is however the case with raising woodlots on farm land (Coeff = -0.494). The higher energy needs of extended family may be responsible for this. These situations are therefore recommended to be built into planning and policy formulation premise to improve forestry practice for sustainable rural and national development.

Keywords: Sustainable land use, Forestry practices, Rural development

Introduction

Individual's desire to undertake forestry practices within own land as choice land use activities is mostly situational (Arnold, 1997). It is often times linked to exhaustion in the nutrient status of such lands, which the owner lacks the capacity to restore. In Africa, especially in sub-Saharan Africa (SSA), current and reliable information is still lacking on the drivers of the choices made by landowners and users on the use of their lands for forest-based activities (Feridun, 2006; Nkonya*et al.*, 2010).

In southeastern Nigeria, for instance, some studies conducted on land use preferences by individuals and households (Osaghae and Suberu, 2005; Onuoha, 2008; and Nmah, 2011) underpin economic condition as a major underlying factor influencing rapid changes in household interest in land production activities. Considering the high agrarian population in Nigeria and other African countries that are dominantly engaged in crop production activities and given

the skeletal information on forestry related activities undertaken by individuals, households or groups, Chukwuone and Okorji (2008) as well as Dewees (1995) advocated for periodic studies bordering on what informs peoples' choices to undertake such activities as an aspect of development and conservation studies.

There is a strong relationship between forestry and livelihood systems (Brown, 2008; ECA, 2009). A survey of subsistence forestry activity practiced by households revealed their marked potentials for stimulating efficiency in household land production and specialization in different forestry activities. Given the perennial low private participation in forestry and the dominance of the public sector (government) in Nigerian forestry practice where output is officially making little or no contribution to national development (Federal Ministry of Agriculture, 2005;Kalu and Okorjie, 2009), a study on small holder forestry is therefore necessary. This fact had

been reported by Faleyimu *et al*. (2010). They observed the target of low research interest at private, smallholder landowners' interest: a situation which needs to be promptly reversed. Research interest in this direction is expected to be desired by local/international development agencies, many of whom are seeking to identify factors that can successfully improve the attainment of the overall goals of forestry practice, especially at the individual household level.

Land use practices will be sustainable, make more meaning and relevant if some aspects of forestry concerns are incorporated into them. In Nigeria, the forestry sector has mandate to contribute to the achievement of national policies on conservation and food/wood security through agro-silviculture, medicinal plants' production, soil protection, off-farm income generation, employment in small-scale forest based rural enterprises, agro-tourism and recreation (FGN, 2010). This study is geared at analyzing factors that engender or improve small scale forestry practice at household level with the view to providing empirical evidence for informed policy on sustainable rural land use.

Methodology

This study was carried out in Imo State, in the humid southeast region of Nigeria. As observed by Clearfield and Osgood (1986) as well as Abildtrup *et al*. (2006), landowners are almost inseparable from land users because they are not dissimilar agricultural population. Given also that the two population groups/categories are observable within households across farming communities in the study area, the research therefore focused on households that own and also use lands for different purposes.

Multistage sampling technique was used in selecting 10% of the households across nine (9) randomly selected local communities in the three (3) political districts of the State. The communities are Eziobodo, Obinze and Umuguma in Owerri district, Isunweke, Okwuohia and Amainyi in Okigwe district and Njaba, Amaifeke and Uzoagba in Orlu district. There are an estimated 5,091 households across these nine communities. *A prior* consideration from literature on similar studies in other locations identified some variables, which can influence the choice of practice of forestry by individual land users. These are gender (NPRSF, 2008), age (Arua, 1998; Orisakwe and Ozioma, 2011), type of family (Rangel, 2004), education (German *et al*., 2009), ownership/control of land area (Suyanto and Otsuke, 2001), size of own land as well as duration of land lease in the area (NCAER, 1988) and income level (Gilmour, 1987). Data were collected with the use of well-structured questionnaire administered on 509 randomly selected respondents proportionate to the sizes three

communities based on 10% sampling intensity. Out of the 509 respondents administered with the questionnaire, a total of 463 were retrieved.

Data Analysis

Households expressed with the aid of the semi-structured questionnaire their interest/preference to undertake different forestry activities from a list of different forest-based activities.

The categorization of the households according to their preferences to undertake a given forestry activity is the basis for specification and estimation of multi-nomial logit model. It expresses the likelihood of belonging to one category relative to a base category. A multinomial logit model is a polychotomous model (Madalla, 1983; Cramer, 1991). In this regard, it is predicted on the utility derivable by choosing to undertake a given forestry practice based on an individual's interest. The utility derived from being in a certain category is expressed as:

$$U_{ij} = Y_j N_{ij} + \sum_{ij} \quad ....(\text{Equation 1})$$

Where,

U_{ij} = Utility derived by *i*th household in being in *j*th category to undertake forestry development activity

N_{ij} = The set of determinants that is constant across alternative categories

N_1= Gender (1=Male, 0= Female)

N_2= Age (years)

N_3 = Type/form of household (1= Nuclear, 0= Extended)

N_4= Marital Status (1=Married, 0= Otherwise)

N_5= Income level (continuous variable in (₦)

N_6= Educational attainment (1=Formal education, 0= Otherwise)

N_7= Major occupation (1=Farming, 0= Otherwise)

N_8= Household size (Continuous variable)

N_9= Length (duration) of lease of land in the study area (in years)

N_{10}= Size of the farmland (ha)

e_{ij}= Random error

The model is built on j possible categories as j=1, 2, 3...j that are exclusive and exhaustive (Cramer, 1991). In the multinomial logit analysis, the seven (7) categories considered were:

1. Those with interest to plant timber trees
2. Those with interest to plant fruit trees
3. Those with interest to raise woodlot
4. Those with interest to plant medicinal herbs and shrubs
5. Those with interest to plant trees with arable crops

6. Those with interest to raise livestock on lands with trees
7. Those with interest to shed fish pond with trees

The multinomial logit assigns probabilities Pij (1, 2,...7) to the likelihood of an ith respondent belonging to any of the 7 categories. The multinomial logit model as designed by Greene (1993) is given by:

$$P_{ij} = \frac{exp^{y_j N_i}}{1+\sum_{j=1}^{5} exp^{y_j N_i}}$$

j=1,2,...7................................(Equation 2)

Pij is the probability of being in each of the categories (groups) 1, 2,...7

$$P_{i0} = \frac{1}{1+exp^{y_j N_i}}$$

j=0...(Equation 3)

Pi_0 is the probability of being in the reference group/category

In practice, however, the reference category is usually normalized to zero. This is because the probability of belonging to all the landowner/user categories sums up to unity.

The natural logarithm of the odd ratio of equations above gives the estimating equation as

$$In \frac{P_{ij}}{P_{i0}} = y_j N_i \; .... \; .... \; \text{(Equation 4)}$$

This denotes the relative probability of each category to the probability of the reference group. The estimated co-efficient for each choice therefore reflects the effect of Ni's on the likelihood of a landowner/user belonging to a category relative to the reference category.

Results and Discussion

The preference levels of the respondents to undertake different forms of forestry activity are shown in Table 1. Investigating respondents' interest in forestry activities (Table 1), the study revealed raising of fruit trees (71.2%) and livestock on land with trees (58.1%) as the major forestry activities that households would readily incorporate in their household land units. Others are planting of trees with arable crops (60.3%) and planting of medicinal herbs (54.4%) apart from planting of timber species and shading of fish pond with trees (39.0% each). The least readiness (23.9%) was expressed for the incorporation of fuelwood species husbandry in respondents' household land units.

The factors affecting interest of households to engage in different forest-based activities were analysed and presented in Table 2. This contains the multinomial logit estimation in which 6 of the identified forestry-based activities in Table 1 (planting timber trees, raising woodlot, planting medicinal herbs/shrubs, planting trees with arable crops, raising livestock on treed lands and shedding fish pond with trees) were used as dependent variables. Planting fruit trees served as a reference category in this study because it is the least desired expectation.

The parameters were estimated from multinomial logit analysis of 463 observations drawn from a total of 509 households (10% of 5,091) whose responses were targeted in the exercise. The result showed a pseudo R^2 value of 0.3863, chi-square (x^2) value of 150.95. The Log Likelihood ratio value of -908.5962 indicates that all the parameter estimates are not equal to zero. The high and significant Chi-square value displays good fit. Hence, all the included explanatory variables actually accounted for households' use of their land for any of the categories of forest practices.

Planting timber trees

The result in Table 2 shows that socio-economic variables significantly influenced interest for planting of timber trees: they are significantly different from zero (0). These are age, household type (nuclear), formal education and household income. Age (coeff = -0.026) and formal education (coeff = -0.062) have inverse significant relationship while nuclear household type (coeff = -0.136) and income (coeff = 0.00005) had positive significant relationship with the planting of timber tree species. This implies that as respondents advance in age and the higher their formal education, the higher is their likelihood of not having interest in planting timber tree species. This may not be unconnected with the long gestation period associated with reaping the benefits from raising trees to timber size, which can only be fathomed by experienced mind through logical reasoning. Although, formal education may impact logical reasoning, but the thrust of the education inform experience. So, the more formal education respondents are exposed to in the study area, the less attachment they have for nurturing trees to timber size, which though is a long-term high yielding investment, can only be appreciated by respondents with thrust in forestry or related discipline. Planting trees is considered a rural business among the educated respondents who may not have experience beyond their community. Consequently, the non-formally educated ones and the aged tend to be the ones left in the business and so integrally control and direct landholding and land use activities.

Initially, government reservation of some community lands for forestry uses and sanctuaries' establishment across Igbo land many years ago (Arua and Okorji, 1998), had led to

rural households viewing forestry and tree growing as an exclusive preserve of government/public sector (Faleyimu, 2014). But, declining productivity and changing environmental conditions are beginning to force local residents to initiate adaptation measures within their land use practices to minimize adverse environmental condition (Olesen and Bindi, 2002). Thus, the non-formally educated ones within the local environment who often define/control land transactions and uses can be positively influenced to undertake tree growing within their local environment and region as an environmental amelioration activity. This is expected to have a ripple effect on other members of the community in due course, most especially when the financial benefit of such activity starts unfolding.

Table 1: Frequency Distribution of Respondents' Interest to practice Forestry Activities

Forestry activities	Frequency	Percentage	Mode
Planting timber species	181	39.0	
Raising fruit trees	330	71.2	
Raising of woodlot for fuelwood	111	23.9	Raising fruit trees
Planting medicinal herbs/shrubs	252	54.4	
Planting trees with arable crops	279	60.3	
Raising livestock on land with trees	269	58.1	
Shedding fish pond with trees	181	39.0	

Low but positive coefficient for household income influenced interest for timber growing. Rural poverty reduction programmes and strengthening capacity for household to imbibe multiple income generating activities (on farm and off-farm activities) will positively influence timber tree growing within household lands relative to the base category. Again, within the nuclear form of household, there is likelihood of independent decisions on land use choices than in extended households. Some reports show that tree growing and establishment within lands held and managed by multiple owners (as obtained in extended household settings) can incite/fuel unprecedented interests especially in terms of ownership and proceeds sharing (Rangel, 2004). Timber growing in this study area will likely be more compatible on lands held by nuclear family than extended households (Table 2). However, the setting of acceptable conditions for household collaboration on land uses (especially land merging for efficient use) will likely favour sustainable forestry activities like timber tree planting and by extension, general community development and sustainability.

Raising Woodlot

Gender of the household head, form of household (nuclear household) and size of farmland are the variables, which significantly have the probability of influencing interest for raising woodlot among households (Table 2). Woodlot is a vegetation type that is dominantly occupied by short and intermediate species, which serve mainly as fuelwood in addition to other beneficial purposes. It is remarkable to note that though planting timber trees will likely increase as household farm size increases (Coeff = 0.082). However, the reverse is the case with raising woodlot (Coeff = -0.324).

Woodlot raising is a forestry activity not deliberately practice with food crop production. This was reported by Eboh and Achike (2010) that the growing of shrub species, establishment of thicket and by extension woodlot as an uncommon practices or vegetation forms within household lands in southeastern Nigeria. Thus, increasing household capacity to access more land or even expand current size of farm-holding will erroneously not make them have interest in raising woodlot (Table 2) in relation to the base category even though fuelwood is used almost daily as a cheap source of energy for cooking especially in rural villages and communities. However, also worthy of note is that the likelihood of raising woodlot on household lands in the study area is higher among the female respondents (Table 2) who mostly utilize fuelwood for household cooking (Coeff= -0.402).

Planting Medicinal Herbs/Shrubs

Gender of the household head (Coeff = 0.897) and age (Coeff = 0.009) were significant positive determinants of household choice for planting medicinal herbs. This may be linked to males being in charge of providing for major household needs: one of which is ensuring reliable and affordable medication for all dependents. The current spate of high cost of synthetic drugs, which may be unaffordable, may also be responsible for the interest of more male in the planting of medicinal flora (Table 2) relative to the base category. Chen (1996) submission on the significance of health in promoting

happiness and longevity of household members supported these deductions.

Nonetheless, the positive significance of age as shown in Table 2 gives clue on the choice of medicinal herbs as being more associated with older persons than younger ones. This fact was supported by Casas *et al*.(1997) who submitted that growing and using of medicinal herbs will likely be accepted by older persons. Development of alternative herbal remedies (for prevention and treatment) of disease conditions will make more meaning and relevance to older persons especially in local communities. Younger persons hence tend to more readily accept and promote conventional and non-orthodox medicine than older ones. To incite the growing of medicinal herbs/shrubs by youths particularly in terms of its utility, pharmaceuticals will need to provide incentives for instance by offering cash returns for such plants (and parts).

Planting Trees with Arable Crops

Household size (Coeff = 0.021), farm size (Coeff = 0.172) and duration of land lease (Coeff = 0.065) are strong determinants of planting trees with arable crops by respondents' (Table 2). Duration (length of time) for land lease showed significant but low positive coefficient than farm size relative to the base category. Having large household size could also possibly incite respondents' interest for planting trees within arable croplands. Tree planting will readily be accepted on arable lands in as much as there is appreciable number of persons in the household to undertake such a tree planting and its associated tending operations. Comparingrespondents' interest

Raising Livestock on Treed Lands

In Table 2, age (Coeff = -0.027) and household size (Coeff = -0.019) had negative significant influence on respondents' interest in raising livestock on treed lands. On the other hand, duration of land lease (Coeff = 0.085) had significant positive influence on the choice of the same activity. Farming in the study area was observed by Okafor (1979) and Ugwu (2006) to be dominated by the aged who carry out different agricultural crop production activities within mostly compound farms containing varied tree components. Thus, little wonder why older respondents are not be interested in agropastoral system of farming (planting livestock with trees).

That livestock browse on fodder and food crops may negate the benefit of their litter fertilizing the land unless they are closely monitored. Thus, livestock management requires commitment, energy and time, which will more visibly be at the disposal of the younger generation. Also, the smaller the dependents on a given land, the higher the probability livestock surviving on such land while increasing the period of

in pure forestry (planting of timber trees)with incorporating arable crops with forestry (agroforestry) revealthe opportunity cost of sacrificing food crops the former practice, whichmake the difference especially between large and small sized households.

The high cost involved in forest land preparation, tending operations and weeding particularly for shade-loving under growths (arable crops) will be offset by cheap labour readily obtainable in large households. Household farms are almost annually put into different crop cultivation activities in southeastern Nigeria. This was reposed by Okafor*et al* (2009) that reported trees as important component of arable cropland in the rainforest zone of Nigeria. Ability of households to increase size of their holding through acquisition of more farmlands will positively influence interest for planting trees within croplands in relation to base category.

As observed by Hermayulis*et al*. (2012), the terms and conditions for land lease in most developing economies are stringent and unfavourable for sustainable conservation practices. But, landless households and peasants with small or no farmlands could show interest in planting trees if granted land on acceptable leasehold basis. The Forestry Department, government and relevant stakeholders in land deals and transactions should as a matter of urgency facilitate the regulation of landholding with a view to accommodating land tenants especially those with agroforestry interest so as to enable them be part of household forestry development programme and initiatives.

land lease will encourage raising livestock on lands planted with trees relative to the base category.

Shading Fish Pond with Trees

Formal education have negative significant influence (Coeff = -0.018) on the choice of shading fish pond with trees while age (Coeff = 0.008) and household size (Coeff = 0.038) have positive influence on the same choice of activity. With the generally low financial base of most households in Third World countries and low level of land access and formalization processes, residents will likely be willing to make less demanding but sustainable forestry land use option viz: shedding of their fish pond with improved tree/shrub species.

Fish farmers therefore will have an advantage and opportunity of learning the planting and use of multipurpose trees and shrubs (MPTS), which have potentials to offer benefits like saving on fish feed, pond water shedding, turbidity reduction and option of intermediate tree products. In the study, formally educated respondents showed negative significant influence for shedding their fish pond with trees.

Table 2: Summary of Multinomial Logit Regression on Household Socioeconomic Factors Affecting Choice of Forestry Activities

Variables	Planting timber trees		Raising woodlot		Planting medicinal herbs/shrubs		Planting trees with arable crops		Raising livestock on treed lands		Shedding fish pond with trees	
	Coeff.	T-value	Coeff.	T-value	Coeff.	T-value	Coeff.	T-value	Coeff.	T-value	Coeff.	T-value
Constant	0.201	0.23	-0.820	-0.91	-1.060	1.56	0.656	1.02	-1.367	1.38	-1.058	1.00
(S.E.)	(0.881)		(0.898)		(0681)		(0.644)		(0.988)		(1.058)	
Gender	0.302	0.75	-0.402***	2.82	0.897***	3.83	-0.156	0.72	-0.133	0.42	0.209	0.54
(S.E.)	(0.403)		(0.143)		(0.234)		(0.216)		(0.316)		(0.384)	
Age	-0.026**	2.14	-0.004	0.37	0.009***	2.47	0.004	0.17	-0.027**	2.08	0.008**	2.11
(S.E.)	(0.012)		(0.012)		(0.004)		(0.024)		(0.013)		(0.017)	
Marital Status												
(S.E.)	-0.422	1.37	0.034	0.10	0.202	0.74	0.259	1.00	0.036	0.10	-0.576	1.40
	(0.308)		(0.345)		(0.274)		(0.258)		(0.354)		(0.410)	
Household type												
(S.E.)	0.136**	2.07	-0.494**	2.41	0.484	0.16	-0.070	0.25	0.160	0.39	-0.254	0.55
	(0.066)		(0.205)		(0.301)		(0.274)		(0.411)		(0.461)	
Household size												
(S.E.)	-0.0004	0.01	0.005	0.15	0.001	0.06	0.021**	2.55	-0.019**	1.98	0.038***	3.81
	(0.030)		(0.031)		(0.024)		(0.008)		(0.010)		(0.010)	
Farming as dominant occupation	-0.063	0.19	-0.040	0.19	0.171	0.69	0.367	1.58	-0.136	0.35	-0.259	0.56
(S.E.)	(0.328)		(0.343)		(0.248)		(0.232)		(0.391)		(0.460)	
Formal Education												
(S.E.)	-0.062**	2.11	-0.028	0.91	0.009	0.39	-0.023	1.06	0.012	0.32	-0.018**	2.12
	(0.029)		(0.030)		(0.024)		(0.022)		(0.036)		(0.038)	
Farm size	0.082	1.08	-0.324**	2.55	-0.067	0.98	0.172**	2.32	0.034	0.37	-0.120	0.99
(S.E.)	(0.076)		(0.127)		(0.069)		(0.074)		(0.091)		(0.122)	

Length of land lease (S.E.)	-0.008 (0.038)	0.20	0.031 (0.036)	0.86	0.035 (0.027)	1.33	0.065*** (0.024)	2.68	0.085*** (0.031)	2.73	-0.050 (0.055)	0.90
Household Income (S.E.)	5×10^{-5}*** (2×10^{-5})	2.76	-1×10^{-5} (4×10^{-5})	0.33	-1×10^{-5} (3×10^{-5})	0.50	-4.4×10^{-6} (2.5×10^{-5})	0.18	2×10^{-5} (3×10^{-5})	0.88	1.8×10^{-6} (3.5×10^{-5})	0.05

*Significant at 10%   **Significant at 5%   ***Significant at 1%
S.E.= Standard Error   Functional Parameters: Chi-Square = 150.95;   pseudo R^2=0.3863*; Log Likelihood= -908.5

Land hunger in the region appears to not only make land access more stringent but forced most agricultural-based production activities including fishing to be more tenable on leased lands (Udo, 2012). The findings of this study lend credence to the general belief that tree planting tends to confer stronger ownership rights on a given property. This could be the reason for the unwillingness of households in this category who are engaged in fisheries to plant trees around it.

Conclusion

Generally, landowners and users in Nigeria, despite the evident impact of land fragmentation experienced in SE Nigeria, have preferences for a variety of forestry-based activities. Being agriculturally oriented, more of the forestry-based activities they expressed preferences for are those, which are naturally compatibility with their traditional land use activities. Highest preference was expressed for raising fruit trees and planting trees with arable crops while lowest preference was for raising woodlot. Gender, type of household and size of farm-holding were the major determinants of households' preference for forestry activities on their lands. Males showed likelihood for planting medicinal herbs/shrubs while females had likelihood for raising woodlot within household lands. Within nuclear households, there is tendency for more household preference for planting tree for timber production. Planting of trees within arable cropland could increase with increase in farm size. These determinants, if built into planning. will sufficiently improve forestry for rural and national development.

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