Journal of Integrated Sciences
Special Issue, February 2024
ISSN: 2806-4801

FACTORS AFFECTING INTENSITY OF USE OF FOREST MANAGEMENT PRACTICES AMONG FOOD CROP FARMERS IN OYO STATE'S FOREST RESERVES, NIGERIA

Marizu, J.T[1], Raufu, M.O[2*]. and Miftaudeen-Rauf, A. A.[3]

[1] Federal College of Forestry (FRIN) P.M.B 5087 Jericho Ibadan, Oyo State Nigeria.
[2]Department of Agricultural Economics Ladoke Akintola University of Technology, Ogbomoso, Oyo State.
[3]Department of Economics, University of Ilorin, Kwara State.

ABSTRACT

Forest sustainable development requires a certain level of participation in forest management practices. The study aims to identify and analyse the factors that influence the level of participation in forest management practices and the intensity of use of adopted forest management practices in the study area. The study employed a multistage random selection approach to choose study participants. Using a proportional sample method, 223 producers of food crops who resided in the vicinity of the forest reserves were sampled. Sex of the respondents, the heterogeneity index, and the collective work participation index have positive correlations with farm management practices and statistically influence forest management. Similarly, farm size (p=0.032), availability to extension visit (p=0.029), years spent in school (p=0.098), and farm distance (p=0.007) influenced their practices. The study therefore recommended that farmers broaden their horizons in their pursuit of improved chances for forest management techniques.

Keywords: *Forest Reserves, Management Practices, Participation and Intensity of Use.*

Corresponding author: Raufu, M.O can be contacted at morauf@lautech.edu.ng

1. INTRODUCTION

It is impossible to overstate the importance of agriculture, particularly in emerging countries like Nigeria. Agroforestry is a vital component of agriculture because woods continue to play a significant role in the ecology and economics of the nation. In addition to being essential to the planet, our economy, and our entire way of life, trees and forested ecosystems also provide wood for structures, pulp for a variety of industries, including paper manufacture, and lower carbon emissions and cleanse groundwater (NCSU, 2018).

For a significant portion of Nigeria's population, the forest provides fuel, food, and medicine in addition to being an economic resource. Furthermore, it contains about 75% of the world's terrestrial biodiversity, protects soils and water, aids in adapting to climate change, and offers a wide range of goods and services that advance global socioeconomic development. The degree of forest management varies, ranging from a laissez-faire, natural state to a very rigorous regime that involves silvicultural treatments. An effective agro-forestry is one that uses management techniques that are acceptable to the local populace to sustainably manage land by concurrently managing crops, forest trees, and animals on the same piece of land (Kings, 1996 and Barrett, 2002).

Agro-forestry is a natural resource management concept and one of the most dependable ways to assist farmers in resolving issues with their land to increase productivity (International Institute for Tropical Agriculture (IITA 1992). By fulfilling the following goals, this study examined the factors influencing food crop farmers involvement in forest management practices and their intensity of usage of chosen practices in Oyo State:

i. To identify forest management practices by the food crop farmers in the forest reserves.
ii. To analyze the factors that determine the level of participation in forest management practices.
iii. To examine the intensity of use of adopted forest management practices in the study area.

2. REVIEW OF LITERATURE

Agroforestry is an essential part of agriculture as forests are an important part of the country's environment and economy. Trees and forested ecosystems are a critical part of our earth, our economy and our way of life, from reducing carbon pollution and purifying groundwater to providing timber for buildings and pulp for paper products (NCSU, 2018). The inclusion of trees in land use systems can augment the supply of plant material to the soil as above ground liter and pruning deposits and more importantly by the shedding of fine roots. In terms of Social Networks, literature suggest that resources are found in personal relationship that the household maintains and it was observed that the resources are important in agriculture and this may show a prominent input in forest management practices (Mawejje and Holden 2014).

Forest management practices are processes of planning and implementing technologies for the stewardship and use of forests and other wooded land to meet specific environmental, economic, social and cultural objectives. It deals with the overall administrative, economic, legal, social, technical and scientific aspects related to natural and planted forests. It may involve varying degrees of intentional human intervention, ranging

Journal of Integrated Sciences
Special Issue, February 2024
ISSN: 2806-4801

from actions aimed at safeguarding and maintaining forest ecosystems and their functions, to those favoring specific socially or economically valuable species or groups of species for the improved production of forest goods and services (FAO, 2018). To maintain or improve the health and productivity of a forest and to achieve the landowner's objectives for the property, a number of management techniques are used by the forester, such as harvesting, burning and reforestation (NCF, 2018). The table below shows the classification of agroforestry systems and specific practices.

Table 1. Classification of Agroforestry Systems and Specific Practices

General practice type	Land use and agroforestry practice	Brief description
Agrosilvicultue/ silvoarable	Trees integrated in cr op fields (multipurpose trees)	Trees intercropped with annual or perennial crops; trees randomly or systematic ally planted in cropland for the purpose of providing fruit, fuel wood, timber, and other services.
	Hedgerows, shelterb elts, and windbreak systems	Trees as fences around plots and/or an extended windbreak of living trees and shrubs established and maintained to protect farmlands.
	Alley-cropping systems	Rows of trees with a companion crop grown in the alleyways between the rows.
	Improved or rotation al fallow	Land resting system using trees and shrubs to replenish soil fertility and potenti ally yield economic benefits, in rotation with crops as in traditional shifting cultivation.
	Riparian buffer strips	Areas along rivers and streams planted with trees, shrubs, and grasses to protec t water quality.
Silvopasture	Trees/shrubs on past ure (multipurpose trees)	Trees intercropped on pastures; tre es randomly or systematically planted on pasture for the purpose of providing fruit, fuel wood, timber, and other services. Also used for forage/fodder and animal production.
	Meadow orchards	Orchards, including fruit orchards, olive groves, vineyards, and fruit-bearing shrubs, which are grazed or sown with pastures.

	Hedgerows, shelterbelts and windbreak systems	Trees as fences around plots and/or an extended windbreak of living trees and shrubs established and maintained to protect farmlands and animals and/or provide fodder.
Agrosilvipastre	Integrated production of animals (meat and dairy), crops and wood/fuel wood	Production of crops, animal/dairy, and wood products within the same land area, including around homesteads.
Forest farming	Forest farming	Forested areas used for production or harvest of naturally standing specialty crops for medicinal, ornamental or culinary uses.
	Forest grazing	Forested areas with the understory grazed as a Means of providing forage for animal production.
Urban and periurban	Home gardens	Combining trees/shrubs with vegetable production usually associated with periurban or urban areas.
Agroforestry including insects/fish	Entomoforestry	Production combining trees and insects (e.g. bees for honey and trees).
	Aqua-silvo-fishery	Trees lining fish ponds, tree leaves being used as 'forage' for fish.

Source: Atangana et al. (2014).

Social capital has the features of social organizations that facilitate co-ordination and co-operation for mutual benefit of the members and society (Putnam, 1993; 1995; 2001). These features include networks, reciprocity, norms and trust (Bowles and Gintis, 2002; Carroll, 2001; Coleman, 1990; Grootaert and Bastelaer, 2001; Putnam, 2001; Uphoff and Wijayaratna, 2000) that encourage collective action to achieve more sustainable development (Pretty and Ward, 2001). Social capital can be considered as a pre-requisite for the sustainable management of natural resources (Pretty, *2003*). It empowers people in meaningful ways to pursue conservation objectives (Dale and Sparkes, 2007). Since forests are an important part of our state environment and economy, this study therefore sets to investigate the effects of social capital on forest management among cassava- based taungya farmers in Oyo State, Nigeria.

3. RESEARCH METHODOLOGY

The research was done in Oyo State. Oyo State, which was created in February 1976 and has an area of around 28,454 square kilometers after Osun State was added. It used to belong to the western area. Oyo State is an inland state in southwest Nigeria that has its capital in the city of Ibadan. Its boundary is also divided to the west, where it separates partly with Ogun State and the Republic of Benin, and to the east with Osun State, Ogun State to the south and Kwara State to the north are the state's boundaries. In Oyo State, there are thirty-three Local Government Area Councils. Oyo State's population is expected to be 6,617,720 people based on the 2006 census (NPC 2006). The capital can be found in longitude 7.38778oN and latitude 3.89639oS. The vast majority of people in the state are employed as farmers, cultivating arable crops and engaging in other agricultural activities. The Yoruba people comprise the bulk of the state's population, making it a homogenous community. The Yoruba people are predominantly farmers, although they also tend to reside in heavily crowded urban areas. There are several ethnic minority groups that the state also accepts. The indigenous people of the state were majorly Oyos, Ogbomosos, Oke-Oguns, Ibadans, and Ibarapas.

The research employed a multistage random sampling technique to choose its respondents. In the initial phase, three agricultural zones Ibadan, Ogbomoso, and Shaki zones were selected at random. Using purposive sampling, six agricultural blocks in the Ibadan zone and one in each of the Ogbomoso and Shaki zones were selected for the following phase, accounting for the presence of forest reserves in those areas. Using proportionate sampling, 223 food crop producers were chosen in the third stage from the pre-selected blocks in the forest regions, namely Opara in Shaki, Gambari, Ijaye, Olokemeje, Oso, Lanlate and Igangan in Ibadan, and Atoba in Ogbomoso. The list of settlers was supplied by the Ibadan Forestry Department, Ministry of Agriculture Secretariat. The Kabatesi and Mbabazi (2016) formula was used to determine the sample size. The necessary data was gathered using a standardized questionnaire, assisted by certified enumerators.

The different forest management techniques that farmers have chosen were identified, and the socioeconomic characteristics of the respondents were described, using a range of descriptive statistics such as frequency distribution, percentage, mean, and standard deviation. The variables determining the degree of participation in forest management activities and the degree to which adopted practices are used in the research region were examined using the Double Hurdle Model.

First introduced by Cragg in 1971, the Double Hurdle Model offers a versatile option for which outcomes might be determined by separate processes including a probit model in the first step and a truncated regression model in the last. It has been used several times to datasets where the dependent variable, y, is unquestionably non-zero. When it comes to forest management practises (FMP), for instance, a farmer cannot practise farming without utilising one, combining two or three, or utilising all FMPs, which include soil management practices (SMP), agronomic practises (AP), cultivation practices (CP), and structural/mechanical soil erosion practises (SMSEP). This

Journal of Integrated Sciences
Special Issue, February 2024
ISSN: 2806-4801

demonstrates how the double hurdle model is superior to other models, such the Tobit or Multinomial Logit models, where the values of the dependent variable, y, vary from zero to one in the Tobit model and from zero to infinity in the Multinomial Logit models. Not only that, but the phrase "double hurdle" also describes the two-stage decision-making process it uses. Moreover, the research assumes that farmers will use forest management techniques in two stages: initially, they will determine whether or not to employ them, and subsequently, they will determine the frequency and degree of their application.

The first hurdle is then specified by:

$di^* = Z'i\alpha + ui$ (1)
$yi^* = \alpha + Xi'\beta + vi$ (2)
di= 1 if d>0, di= 0 if d*≤0*

The second hurdle closely resembles the Poisson regression model:

$Yi = E(y) + ui$ (3)
Where $E(yi) = \mu = \exp(Xi, \beta), \mu \geq 0$
$\mu = \beta 0 + \beta 1X1i + \beta 2X2i \ ... + \beta kXki$
$Yi = \beta 0 + \beta 1X1i + \beta 2X2i \ ... + \beta kXki + ui$

The model is based on the assumption that the count dependent variable y_i, given the vector of explanatory variables $\boldsymbol{X}_i$, is independently Poisson distributed with density.

$$f(y_i|\boldsymbol{X}_i) = \frac{e^{\mu_i}\mu_i^{y_i}}{y_i!},\ y_i = 0, 1, 2, \dots \qquad (4)$$

Journal of Integrated Sciences
Special Issue, February 2024
ISSN: 2806-4801

With exponential mean function

$$\mu_i = exp(X_i\beta), \mu_i \geq 0, \qquad (5)$$

Where β is a K *x* 1 parameter vector.

Finally, the observed variable yi,, is determined by the interaction of the both hurdles as follows:

$$y = d_i y_i^* \qquad (7)$$

The error terms are assumed to be normally and independently distributed as follow:

$u_i \sim N(0,1)$ $v_i \sim N(0, \sigma^2)$

The first hurdle represents use decision of the forest management practices;

Yi = (1) for use, or Yi = (0) for non-use, Xi represents the vector of explanatory variables included in the model which are listed below;

X1 = Age of farmer in years
X2 = Household size
X3 = Years spent in school
X4 = Farm size in hectares
X5= Access to credit (available=1, otherwise=0),
X6 = Years of farming experience
X7 = Soil fertility (if fertile =1, otherwise=0),
X8 = Farmland topography (if flat= 1, otherwise=0)
X9= Member of social association (if member=1, otherwise=0)
X10=Ownership of farm land (if yes=1, otherwise=0).

4. RESULTS AND DISCUSSION

4.1 Identifications of Forest Management Practices

The outcomes of the most popular forest farming techniques in the research region are displayed in Table 2. The top three practices were forestry (82%) followed by home gardens (66%) and forest farming (61%). The lowest three practices were alley cropping (53.4%) and enhanced rotational farming (53.4%). The remaining practices are as follows: hedgerows (10.68%), meadow orchards (4.37%), trees on pasture (26.70%), forest grazing (29.69%), aquasilvofishery (18.45%), integrated production (21.80%), and riparian buffer (1.94%).

This may be as a result of the farmers realizing the use of insects in plant pollination in their apiaries to produce honey. It could also possibly be a result of the areas' use of edible insects for food. Since home gardens offer homes with vegetables and green crops, this practice was adopted. This indicates that for agricultural households, forest farming operations continue to be a significant source of food production (Ogundiran et al., 2014). Approximately two thirds of the farmers reported using forest management techniques; this may be because they placed a high importance on using forest products for medical purposes.

4.2 Factors that Determine the Participation and Intensity of Use of Forest Management

The factors that influenced the respondents' acceptance and level of usage of forest management practices are displayed in Table 3 double hurdle result. At 10% level of significant, forestry management is positively related with the number of education years completed. This suggests that the respondents are more likely to engage in forest management practices the longer they attended school. If the years of schooling rise by one unit, the participation rate will rise by 5.18%.

This was consistent with research by Oyewole et al. (2015), who suggested that higher education levels would increase the number of farmers participating in forest management practices and that more educated farmers were found to be doing so than less educated farmers. The likelihood that farmers will adopt forest management practices is also positively correlated at the 5% significance level with farm size, access to extension services, and farm distance. This suggests that the bigger the farm, the more extension services available, and the farther the farm is from the farmers' home, the more likely it is that the farmers will participate in farm management practices. Kabwe et al., (2015) noted that the absence of extension visits and land limitations are major factors in the adoption of increased value. This was also at odds with the findings of the Gitonga (2010) study, which claimed that small-scale farmers needed to implement rigorous land management in order to compensate for their lack of space and gain the same benefits from their small farms as larger landowners.

The rate at which forest management practices are adopted will grow by 24.32%, 90.23%, and 14.55%, in that order. On the other hand, at the 5% level of significance, there is a negative relationship between the farmers' experiences, the quality of the forest land, and their involvement in forest management practices. Consequently, the chance of farmers participating in forest management practices decreases with increasing years of expertise, defying a priori expectations. According to Oyewole et al. (2015) who stated that the rate of agroforestry agricultural involvement would rise with farming expertise. An experienced farmer is more likely to be able to anticipate the potential results of a farming system and recognise issues related to a certain farming practice, which increases his involvement in that practice.

4.3 The Intensity of use

The extent to which forest management techniques are used is indicated by the second tier. The intensity of application of forest management practices is significantly correlated with the number of farm units, age, and quality of the forest land. At the 1% level, there is a positive and substantial correlation between the quantity of farm units and the intensity of usage of adopted forest management practices. This suggests that the number of farm units increases along with the intensity of use, which is related to Baffoe-Asare et al. (2013) who stated that that because of economy of scale, a big farm would make it easier to realise the benefits of production. On the other hand, age and the quality of the forest land show an inverse relationship with the intensity of usage at the 10% and 5% significant levels, respectively. This suggests that the likelihood of intensifying the application of the selected forest management practices decreases with age of the farmer and the quality of the forest area. The degree to which adopted forest management techniques are used is decreasing as these variables grow. This somewhat conflicts with the findings of Baffoe-Asare et al. (2013), who discovered that farmers are less likely to intensify the adoption of forest management practices the better the quality of the forest land, and that older farmers are more likely than younger farmers to do so.

5. CONCLUSION AND RECOMMENDATION

In the study, multistage random sampling procedures were used to choose the respondents. Data collected were analyzed using Double Hurdle Model and descriptive statistics. It is recommended that more women be encouraged to participate in forest management practices in order to improve their level of life. It's also a good idea to prevent land fragmentation and support improved extension services, and rural education.

REFERENCES

Atangana, A., Khasa, D., Chang, S., Degrande, A., Atangana, A., Khasa, D., ... & Degrande, A. (2014). Definitions and classification of agroforestry systems. *Tropical agroforestry*, 35-47.

Baffoe-Asare R., Danquah J.A., and Annor- Frempong F. (2013). Socioeconomics Factor Influencing Adoption of Codapac and Cocoa High- Tech Technologies among small holder Farmers in Central Region of Ghans. America Journal of Experiment Agriculture 3(3), 277-292.

Bowles, S. & Gintis, H. (2002). Social capital and community governance. The Economic Journal, 112, F419-F436. Cambridge University Press.

Carroll, T. F. (2001). Social capital, local capacity building and poverty reduction, Manila, Philippines: Asian Development Bank.

Citonga K.C., (2012). Socio Economics Factors Affecting Agroforestry Adoption In Ndabibi Location. Naivasha, Kenya. An Unpublished Master's thesis.

Coleman, J.S. (1990). Foundations of social theory. Cambridge, MA: Harvard University Press.

Dale, A. & Sparkes, J. (2007). Protecting ecosystems: Network structure and social capital mobilization. *Community Development Journal*, *43*(2), 143-156.

Duncker P.S., Barreiro S.M., Hengeveld G.M., Lind T., Mason W.L., Ambrozy S., Spiecker H., (2012), classification of forest management Approaches. A new conceptual framework and applicability to European forestery.

Ecology and society 17(4): 51. http://dx.doi.org/10.575/ES-05262-170451

FAO, (2018): Natural Forest Management. http://www.fao.org/forestry/sfm/85084/en/

Grootaert, C., & Van Bastelaer, T. (2001). *Understanding and measuring social capital: A synthesis of findings and recommendations from the social capital initiative* (Vol. 24). Washington, DC: World Bank, Social Development Family, Environmentally and Socially Sustainable Development Network.

Grootaert, C., and T. Van Bastelaer (2001): "*Understanding and measuring social capital: A synthesis of findings and recommendations from the social capital initiative*". Washington, D.C.: World Bank.

Kabwe G., Bigsby H., Cullen R. (2015). Why is adoption of agroforestry stymied in Zambia? Perspective from the ground up. Afr J. Agric Res 11(46): 4704.

Mawejje, J., & Terje Holden, S. (2014). Does social network capital buy higher agricultural prices? A case of coffee in Masaka district, Uganda. *International Journal of Social Economics*, *41*(7), 573-585.

NCF (2018): Forest management basics. https://www.ncforestry.org/teachers/forest management-basics/ North Carolina Forestry Association Forest Management Basics 2018 North Carolina Forestry Association. All Rights Reserved. NCSU (2018): Forestry and Environmental Resources. Forestry Management. https://cnr.ncsu.edu/fer/undergraduate/forestry-management/ © 2018 NC State University.

Ogundiran, O. A., Monde, N., Agholor, I., & Odeyemi, A. S. (2014). The Role of Home Gardens in Household Food Security in Eastern Cape: A Case Study of Three Villages in Nkonkobe Municipality. *Journal of Agricultural Science*, *6*(1), 129.

Oyewole, S. O., Dahunsi, O. M., & Akintola, A. L. (2015). Socio-economic assessment of farmers' participation in agroforestry system in Ekiti State, Nigeria. *Net Journal of Agricultural Science*, *3*(4), 99-103.

Pretty, J. (2003). Social capital and connectedness: Issues and implications for agriculture, rural development and natural resource management in ACP countries. CTA Working Document.

Putnam, R. (1995). Bowling alone: Americans declining social capital. Journal of Democracy, 6(1), 65-78.

Putnam, R. (2001). Social capital measurement and consequences. In J. F. Helliwell (Ed.), The contribution of human and social capital to sustained economic growth and well-being (pp. 117-135). Ottawa, Ontario, Canada.

Putnam, R., with Leonardi, R. & Nanetti, R. (1993). Making democracy work: Civic traditions in modern Italy. Princeton University Press, Princeton.

Uphoff, N. & Wijayaratna, C. M. (2000). Demonstrated benefits from social capital: The productivity of farmer organizations in Gal Oya, Sri Lanka. World Development, 28(11), 1875-1890.

Journal of Integrated Sciences
Special Issue, February 2024
ISSN: 2806-4801

Appendix

Table 2. Distribution of Respondents According to Forest Management Practices

Forest-Management Practices	Frequency	Percentage
Forest farming		
No	79	38.35
Yes	127	61.65
Entormoforestry		
No	37	17.96
Yes	16	82.04
Forest grazing		
No	145	70.39
Yes	61	29.61
Home garden		
No	140	67.96
Yes	32.04	66.00
AquaSilvo fishery		
No	168	81.55
Yes	38	18.45
Meadow orchards		
No	197	95.63
Yes	9	4.37
Trees on pasture		
No	151	73.30
Yes	55	26.70
Riparian buffer		
No	202	98.06
Yes	4	1.94
Alley cropping		
No	96	46.60
Yes	110	53.40
Improved Rotational Fmg		
No	110	53.40
Yes	96	53.40

Source: Field Survey, 2019

Journal of Integrated Sciences
Special Issue, February 2024
ISSN: 2806-4801

Table 3. Determinants of Adoption of FMP from First Hurdle Probit Model and Marginal Effects after Craggit

Variables	Marginal-effects after craggit Coefficients (dy/dx)	Std errors	P-values
Age	.009621	.01349	0.476
School year	.0517963	.03133	0.098*
Farm size	.2431519	.11341	0.032**
Experience	-.0000229	.00001	0.014**
Forest-Land Quality	-.0277738	.52178	0.958**
Extension Services	.9022538	.41239	0.029**
Farm Distance	.1455354	.07051	0.039**
Farm unit	-.2177341	.3684	0.555
Constant	0.1715954	.0119218	0.000

Field survey, 2019 *Variable significant at 10% ** significant at 5% ***significant at 1%

Table 4. Determinants of intensity of use of forest management from second hurdle model

Variables	Coefficients	Standard errors	P-values
Age	-.0021165	.0012199	0.083*
SchoolYear	.001101	.0022451	0.624
Farm size	.0016646	.0015155	0.272
Experence	-7.76e-06	5.87e-06	0.186
FLQualty	-.1315175	.0561742	0.019**
AccExtsn	.0126153	.0167697	0.452
Farm Distance	-.0003201	.0008381	0.703
Farm unit	.2043096	.0357198	0.000***
Constant	.3590459	.0915372	0.000

Field survey, 2019 * significant at 10% **significant at 5% *** significant at 1%