IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 13, Issue 2 Ser. II (February 2020), PP 16-24
www.iosrjournals.org

Statistical Valuation of the Intagible Benefits of Trees on Farmlands in Ikwerre Local Government Area, Rivers State

Eguakun, F.S. [1], Oyebade, B.A[2]and Osilem C.O.
(Department of Forestry and Wildlife, Faculty of Agriculture, University Of Port Harcourt, Rivers State, Nigeria)

Abstract:
Background*: Valuation of the benefits of trees has emerged as a novel and more direct way of fortifying tree protection and sustenance of environmental quality. This study focuses on the valuation of the intangible benefits of trees on farmland and the farmers' willingness to incorporate trees or retain trees on their farmlands in Ikwerre Local Government Area.*
Materials and Methods*: Five towns were purposively selected in Ikwerre LGA and four villages were randomly selected in each towns. Questionnaire was administered to twenty (20) farmers in each village making a total of 100 farmers in Ikwerre LGA, Rivers State. Data were collected using open and closed ended structured questionnaire. The data were analyzed using descriptive structure (tables and charts) and inferential(binary logistic regression) statistics. Monetary valuation of the intangible benefits of trees was estimated using cost of substitute good.*
Results*: The results reveals that improvement of soil fertility, shade, wind break, climate mitigation and erosion control were the intangible benefits from trees on their farmlands. Also, the actual market price for the substitute goods reveals that farmers can save an average total cost of (₦73,600) annually from the services rendered by trees on their farmlands. Also, the socioeconomic factors influencing farmers' willingness to plant was gender, age and education of which age (41-50) was a significant factor in the study*
Conclusion: *Conclusively, this study demonstrates that trees are present on farmlands and farmers are aware of the benefits of these trees on their farm and as a result are willing to plant trees on their farmlands.*
Key Word*: Environmental service,Farmland, Intagible, Trees, Valuation*

Date of Submission: 10-02-2020 Date of Acceptance: 25-02-2020

I. Introduction

Trees are important natural infrastructure whose benefits are numerous.[20] Noted that environmental services provided by trees has contributed to material welfare, livelihoods, social relations and health of people. Unfortunately, these environmental services provided by trees are intangible and as such neglected. For ages farmers have always maintained some variety of tree species in their farm lands, as these trees offer a range of socioeconomic benefits as well as ecosystem services that may not have been recognized by the farmers. Today, biodiversity loss on farm land is an escalating problem in the country and world at large. Agricultural landscapes in the tropics has shown deteriorating environmental services provided by trees as a result of the rising demands for food, fibre, fodder and energy (wood fuel)[34].Although the environmental benefits of trees has been recognized [11, 22], it is difficult to quantify in monetary terms the benefit gained in maintaining trees around us and as such it has rarely been quantified or valued [(5,10 and 26)].Studies on valuation have revealed the importance of forest resources and provided an enhanced understanding of many ways in which forest resources benefit mankind [(6 and 9)].According to[3]inclusion of trees in farmland is considered very important for flood regulation, nutrient cycling, water regulation, carbon sequestration, and improvement of local climate conditions, biological conservation as well as other economic uses. Since the release of the [20]there has been increased interest in defining and valuing our ecosystem services because, as a direct result of undervaluation, over two thirds of our natural ecosystems have been degraded[(21)]. In order to develop viable strategies for conserving ecosystem services, it is important to statistically estimate the monetary values of the environmental benefit that can be derived. Estimate of the structure, function and value of the trees on farmland is an important step in the sustainable management of trees on farmland.

II. Material And Methods

Study area

The study was carried out in Ikwerre Local Government Area (LGA), Rivers State, Nigeria. Ikwerre LGA was created in 1991 with its headquarters in Isiokpo town. The land area is 530 sqmi (1,380km2) with the longitude of 6°53'3"E and latitude of 5°2'36"N. Its rainfall is generally seasonal, variable, as well as heavy and occurs between the month of March and October through November. The wet season peaks in July sometimes, some parts still receive rainfall during dry period. The temperature throughout the year is relatively constant with little variation throughout the course of the seasons. The Ikwerre LGA is in the coastal sand ridges Zones. The soils are mostly sandy or sandy loams. Various crops are supported including *Cocosnucifera, Elaeisguineensis, Raffia africana and Colocasiaesculenta.*

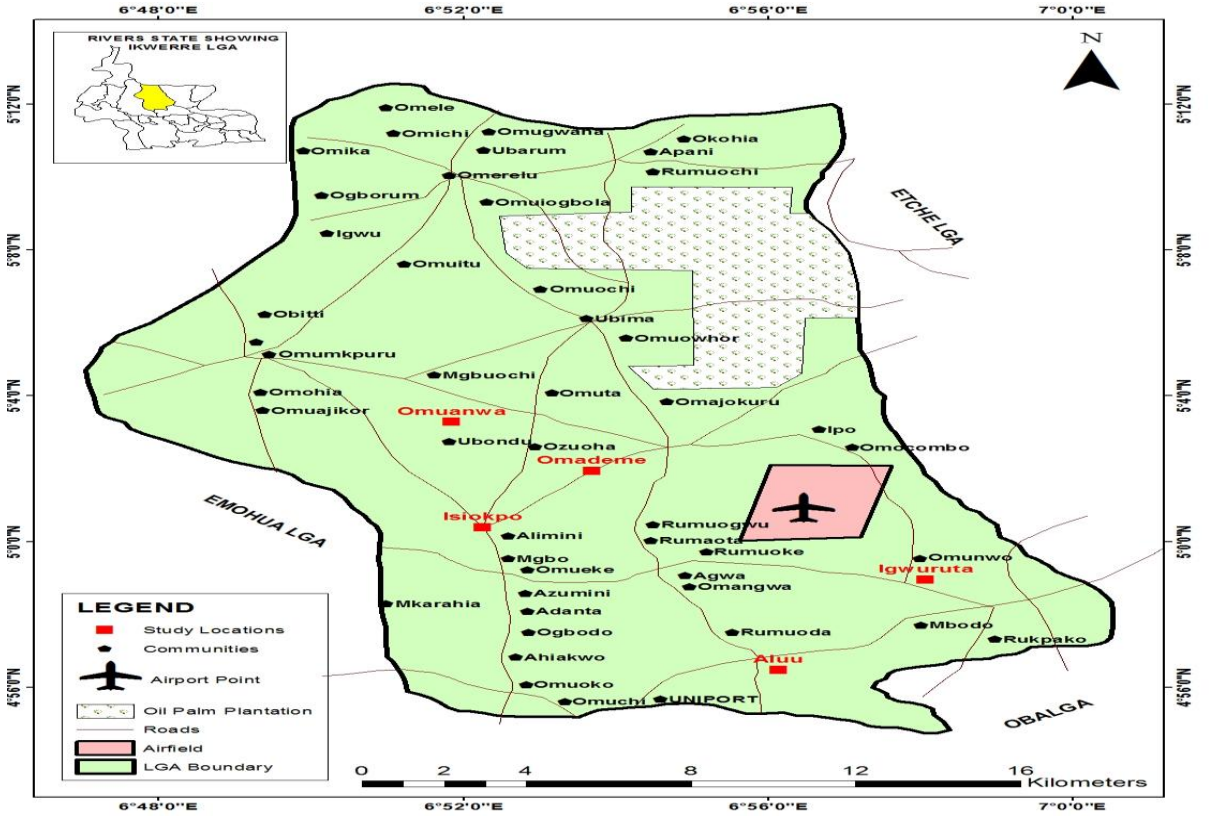

Fig 1: Map of Ikwerre LGA showing the study area

Research Design/ Sampling

Research design is a plan for conducting a study with extreme control over factors that may interfere with the validity of the findings. This research covers questionnaire administration and field observations. Provision/replacement method of valuation was also used as a method of data evaluation. Five towns were purposefully selected out of twelve towns in Ikwerre LGA and four villages were randomly selected in each towns and twenty (20) farmers in each villages were administered a questionnaire making a total of 100 farmers in the LGA.

Data Collection

Reconnaissance survey to study area was done prior to questionnaire administration. Structure questionnaire was administered to individual farmers within the study area constituting the major source of primary data for the study. The questionnaire includes questions on their demographic characteristics and estimating their monetary values on the intangible benefits provided by trees on their farmland by means of the provision/replacement cost valuation Method. Field observation across selected farms was carried out to validate respondents answers provided during questionnaire interviewing. Reconnaissance survey to study area was done prior to questionnaire administration.

Data Analysis

Descriptive statistical tools such as frequencies, means and percentages was used to analyze the variables of interest. Also inferential statistical tools such as binary logistic regression was also employed to find out the relationship between willingness to plant and some selected demographic characteristics of the farmers. The regression model is as follows:

$WTP= f(X_1 +X_2 \ldots X_n+ e)$ ……..(1)

Where

WTP = Willingness to plant

X_1, X_2----X_n= Demographic characteristics

e = error term

Different functional forms was tried in order to choose the one with the best performance.

III. Result

Socioeconomic characteristics of the respondents

A total of 100 questionnaire was administered and retried from respondents in the study area. The results from the demographic characteristics of the respondents show that there are more males (55%) than females (45%) farmers in the study area (Table 1). The result also revealed that the farmers were mostly married people (64%) with majority of their ages ranging 41-50 years (35%). There were more families with the family size of 1-5 (50%) and an educational height of secondary school level (39%) in the study area (Table 1).

Table 1: Demographic characteristics of respondents in the study area

Characteristics		Frequency	Percentage
Gender	Male	55	55.0
	Female	45	45.0
	Total	**100**	**100.0**
Age	≤ 30 years	15	15.0
	31-40 years	32	32.0
	41-50 years	35	35.0
	Above 50 years	18	18.0
	Total	**100**	**100.0**
Marital status	Single	19	19.0
	Married	64	64.0
	Divorced	7	7.0
	Widow/Widower	10	10.0
	Total	**100**	**100.0**
Family size	1-5	50	50.0
	6-10	41	41.0
	Above 10	9	9.0
	Total	**100**	**100.0**
Highest education	No formal education	21	21.0
	Primary school	13	13.0
	Secondary school	39	39.0
	Tertiary school	27	27.0
	Total	**100**	**100.0**
Farming experience	≤10 years	39	39.0
	11-20 years	37	37.0
	21-30 years	13	13.0
	31 and above	11	11.0
	Total	**100**	**100.0**

Tree species found on farmlands in the study area

There were a total number of fifty one (51) treespecies on the farmland in the study area. The trees were classified by the farmers as fruit, commercial, fuel, folder and medicinal trees based on the uses of the tree species to farmers. The result presented in table 3 shows that the frequencies of the fruit, commercial, fuel, folder and medicinal trees are 22,11,18,12 and 8 respectively. The tree species list found on the farmland including their local, common, and scientific name is presented below (table 2).

Table 2: Tree species on farmlands

Local name	Common name	Scientific name	F	P	Type
	Apple tree	*Malus domestica*	10	4.1	Fruit, fodder
Ube-beke	Avocado	*Persia americana*	8	3.3	Fruit, fuel wood
Bambu	Bamboo	*Bambusa vulgaris*	2	0.8	Fuel wood
Akiriulu	Bitter kola	*Garina kola*	3	1.2	Commercial, medicinal
	Black afara	*Terminalia ivorensis*	1	0.4	Commercial

Dogoyaro	Neem	Azadirachtaindca	3	1.2	Medicinal
Ebu		*Alchonea laxifolia*	3	1.2	Commercial, fuel wood
	Ficus	*Ficus spp*	1	0.4	Ornamental
Melina	Gmelina	*Gmelina aborea*	13	5.4	Commercial, fuel wood, ornamental
Ikirike	African elemi	*Canarium schweinfurthi*	2	0.8	Commercial, fodder
Ikpoto	Cotton tree	*Ceiba pentadra*	3	1.2	Fuel wood
Oji	Iroko	*Milicia excels*	10	4.1	Commercial
Aji	Kola nut	*Cola auminata*	4	1.7	
Mkpiri		*Pterocarpus santalinus*	1	0.4	Fodder
Oyiriya	Monkey kola	*Cola pachycarpa*	3	1.2	Fruit
	Moringa	*Moringaoleifera*	1	0.4	Medicinal
Obiriba		*Musanga cecropiodes*	2	0.8	Fuel wood
Obuba		*Nauclea latifolia*	1	0.4	Fuel wood
Odumara		*Cnestis ferruginea*	1	0.4	Fruit, medicinal
Ogba		*Anthonata macrophylla*	1	0.4	Fodder
Igiri-mbalu	Bush mango	*Irvingia gabonensis*	14	5.8	Fruit, medicinal
Aja		*Pterocarpus mildraedii*	12	5.0	Commercial, fuel wood, medicinal
Okpakelebe		*Pentaclethra macrophyla*	2	0.8	Fuel wood, medicinal
Opo		*Dracaena arborea*	2	0.8	Fuel wood, fodder
Arandi	Orange	*Citrus sinensis*	3	1.2	Fruit, fodder
Oturu		*Newbuldia laevis*	6	2.5	Commercial, fuel wood, fodder
Ushishinkwu	Oil palm	*Elaeis guinensis*	7	2.9	Fruit, fuel wood, fodder, Ornamental
Ube	Pear	*Dacrayodes edulis*	12	5.0	Fruit, fodder
Mmimi	Pepper fruit	*Dennettia tripetala*	3	1.2	Fruit
	Plum	*Prunus domestica*	6	2.5	Fruit
	Sand box	*Hura cripitans*	2	0.8	Commercial, fuel wood
	Sunflower	*Tithonia diversifolia*	1	0.4	Ornamental
Odara	Cherry	*Chrysophallum albidum*	11	4.5	Fruit
Ushishi ide	Umbrella tree	*Terminalia mantaly*	4	1.7	Ornamental
	Wall nut	*Juglan sregia*	1	0.4	Fruit
	Yellow oleander tree	*Thevetia peruviana*	1	0.4	Ornamental
Total		**51**	**242**	**100.0**	

Assessment of the intangible benefits of trees

Trees on farmland provide numerous environmental services. Shade provision, improvement of soil fertility, wind break, mitigation of climate change, erosion control were the intangible benefits the farmers derived from the trees on their farmlands. The study found out that majority of farmers (42%) benefits from the shade provided by the trees. While 27% and 10% agreed that they benefit from the soil fertility improvement and wind break respectively Fig: 2: Intangible benefits of trees on farmland as derived by farmers (Fig 2).

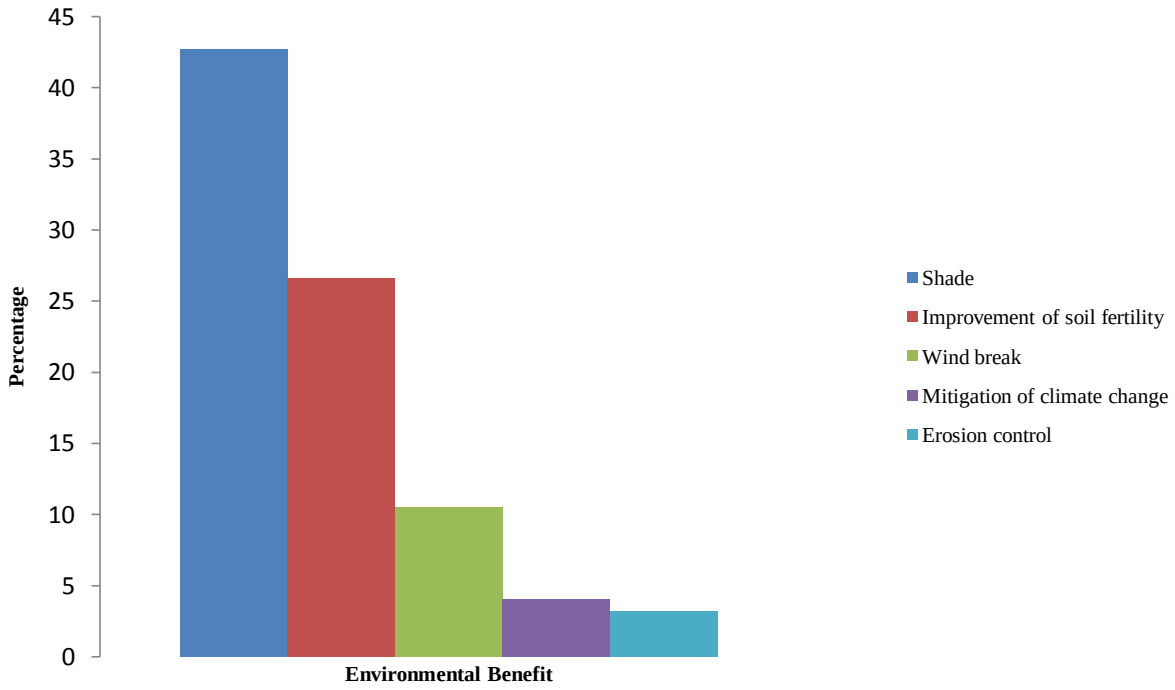

Fig 2: Benefits of trees on farmland as derived by farmers

The level of importance of the environmental benefits as rated by the farmers in the

Ranking the intangible environmental services trees provides to farmers on their farmland, the result shows that farmers allotted the highest importance ton improvement of soil fertility (69%). Erosion control (27%), wind break (41%), shade (41%), mitigation of climate (45%) were ranked by the farmers as very important (table 3).

Table 3: Level of importance of environmental benefits

Environmental benefit	Importance level		
	Not important	Important	Very important
Erosion control	42(42)	31(31)	27(27)
Wind break	28(28)	41(41)	31(31)
Shade	28(28)	41(41)	31(31)
Improved soil fertility	8(8)	23(23)	69(69)
Mitigation of climate	13(13)	45(45)	42(42)

Relationship between farmers willingness to plant trees on farm lands with their demographic characteristics

The result reveals that majority of the farm owners in the study area are willing to plant trees on their farm lands (Fig 3). Demographic characteristic of farmers influences their willingness to plant trees on their farm land. Binary logistic regression was used to determine the relationship between farmer's willingness to plant trees and their demographic characteristics. The result shows that age was a significant demographic characteristic that influences farmer's willingness to plant trees (table 4)

Table 4: Relationship between farmers willingness to plant trees on farmlands with their demographic characteristic

Demographic	Exp(B)	Wald	S.E	P value
Gender	1.342	0.486	0.422	0.486
Age	0.207	3.867	0.800	0.045
Education	0.356	2.546	0.647	0.111

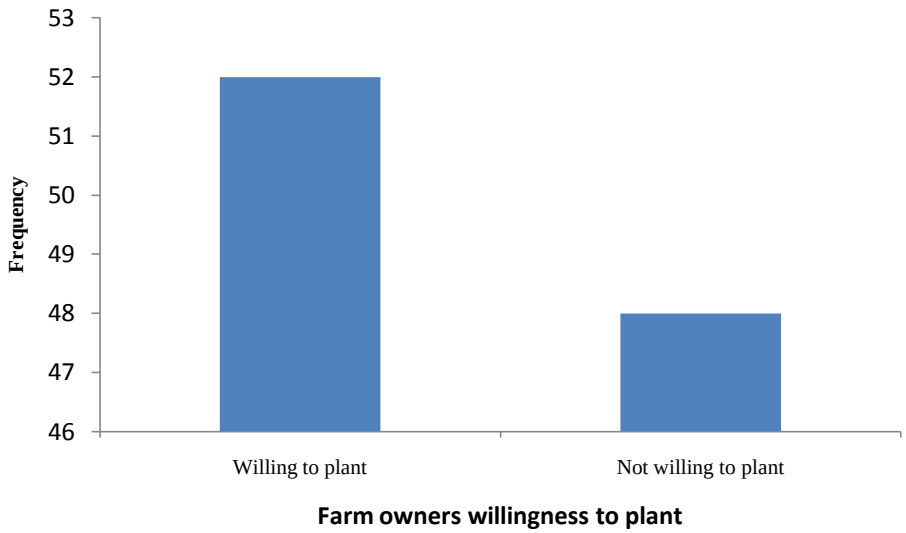

Fig 3: Farm owners willingness to plant trees on farmlands

Estimation of the value of the intangible service functions of trees in farmland.

In order to value the intangible benefits the farmers derive from the trees on their farmlands, cost of substitute goods were used. Table 5 presents the cost of substitute goods that can be used in the absence of the trees. The result reveals that mean cost of substituting other goods in the absence of trees was highest for shade provision (₦10,688). The cost of substitute goods to Improvement of soil fertility, mitigation of climate change, erosion control were ₦6,287, ₦4,833, ₦ 3,375 and ₦9,000 respectively. The total average monetary value was ₦25,183. Also, table 6 presents the actual market price of the substitute goods which was discovered through a market survey and the result reveals the various substitute goods for each environmental benefits and their market prices. The result reveals the market average total monetary value of the intangible benefit as ₦73,600 (table7).

Table 5: Cost of substitute for the intangible environmental benefits derived from trees

Environmental Benefit	Mean (₦)	Minimum (₦)	Maximum (₦)
Erosion control	3,375.00	500.00	9,000.00
Shade	10,688.00	200.00	70,000.00
Improvement of soil fertility	6,287.50	300.00	55,000.00
Mitigation of climate change	4,833.33	500.00	55,000.00
Total	25,183.83	1500.00	189,000

Table .6: Actual market price of substitute goods

Environmental benefits	Substitute goods	Actual market prices (#)
Erosion control	Manual labour for building of ridges on farm	1,000 × 6 = 6,000
		Total = 6,000
Shade/ Mitigation of climate	Tampoline	4,000 × 3 = 12,000
	Bamboo stick	150 × 4 = 600
	Labourer/ Transportation	15,000
		Total = 27,600
Improvement of soil fertility	Fertilizers	
	Urea	10,500
	NPK 20:20:13	8,000
	NPK 17:10;10	9,500
	NPK 15:15	9,000
	Fowl droppings	1,000
	Cow dung	2,000
	Total	**73,600**

IV. Discussion

Gender disparities in rural communities in terms of use and ownership of natural resources cannot be overemphasized. There are more male-headed households than female. This disparities may be due to the prevailing cultural disapproval of females working in the field and generally appearing in public. Majority of the respondent were male (55%) this could be attributed to the difficulties women faces in accessing land for farming unless it a land owned by their husbands. This confirms the observations made by [7] indicating that men domination pose a lot of restriction to women for example when accessing land for farming. Most farmers (35%) were elderly person between the ages of 41-50 while a little fraction (15%) was below 30years. This result indicated that, the elder farmers have gain a good experience in farming and dealing with trees on their farm. It has been observed thatrural communities always experience the migration of literates to towns and city. This might be the reason while the educational level of most farmers (39%) was at secondary school.

Trees are of great importance to man and his environment. During the study it was observed that trees grow and regenerate naturally without any action from the farmer. However, many farmers left trees to grow and spread on their own farms due to so many reasons. Total of fifty-one (51) tree species were mentioned by farmers in their farmlands including *Garcina kola, Persia Americana, Mangifera indica, Moringa oleifera, Ficus spp* etc. the wide array of tree species found on the farm land may be as a result of the numerous benefits accrue from these tree. [18]stated that trees on farms enhanced the socioeconomic livelihood of rural farmers by enhancing income earning potentials and overall food and nutritional security as well as provision of fuel wood, fodder for animal consumption and employment. The tree species found on the farmland are in agreement with tree species found on other farms [30]. Fruit trees were dominant in the study area which agreed to the findings of [25].The dominant fruit trees were guava, mango and bush mango. [28 and 29], pointed out that fruit trees are mostly planted or retained on farms by farmers because of its economic benefits. Other tree species found on the farmland were allowed to grow due to the personal benefits of the farmer which could be income derivation, medicine, shade, improvement of soil fertility among others.

The intangible benefits derived from trees on farm land cannot be overemphasized. Improvement of soil fertility, shade provision, mitigation of climate change, wind breaks and erosion control were the intangible benefits derived from trees on farmlands by farmers. [16], pointed out that trees on farms improves the microclimate which in turn improves the adaptive capacity of land. Soil fertility improvement as an intangible benefit derived from trees was rated as most important by farmers (69%). Fertilizers were used to assess soil fertility on farms though farmers preferred the improved soil fertility rendered by trees because the fertilizers are expensive [12]. Trees on farmland play an important role inerosion control and soil conservation [2].Tree species such as *Irvingia gabonensis, Dacrayodes edulis, Canarium schewenfuthic, Crythrophleum suuaeons, Treculia africana* which were found on farmlands haveanti-erosion properties. Research carried out by [24], found similar trees with anti-erosion property on farmland in Enugu. The effects of large root and mycorrhizal networks holding soil in place by trees assist the soil against erosion control [8]. The conversion of woodlands to crop land is the major reason for soil erosion at many instances. The understanding of the effects of trees on farmlands for different aspects of human well-being including the mitigation of climate change has been mentioned by many authors [e.g. 17, 19]. Climate reduces the productivity of farms [15], this agrees to my findings that farmers who have no tree(s) on their farmland to help mitigate climate change stop work as soon as the changed climate becomes unbearable for them. Farmers also mentioned that tree species are retained to provide various uses such as wind break, fodder, fuel wood, staking material, source of income, soil improvement, medicinal herbs, shade and constructional materials. This is in agrees with the findings of who stated that farmers plant or retain trees on their farm land, both for food, soil improvement, environmental amelioration, income and for shade during harsh weather conditions.

Farmers typically indicated several reasons for planting trees including social, economic and environmental. However some farmers destroy trees found on their land due to lack of enough farming space. Farmers typically cited multiple reasons for trees on their farmland, as found in previous studies in the tropics [4, 30]. In predicting the farmers willingness to integrate trees on their farmlands, binary logistic regression model was used to get the relationship between their demographic characteristics and their willingness to plant trees on their farmlands. Socio-demographic characteristics such as age, gender, education, and social status can be used as proxies for farmers' preferences for things such as risk tolerance and conservation attitude, factors that are otherwise difficult to measure [27].Gender has been found to influence tree planting activity, with male headed households or households with more male members being found to be more active in tree planting [27, 31].The result of this research is in agreement that gender influences the willingness of a farmer to plant tree. In addition, age and education variables are indicators of human capital, which have been found to increase the likelihood of tree planting due to environmental awareness and knowledge of tree planting techniques in some cases [32]. In fact, education is often seen as a key issue for all levels of sustainable forestry [14], and it has been found that there is a positive relationship between formal education and tree planting enthusiasm [33].The study reveals that older farmers are more willing to plant trees on their farmlands than younger farmers. Literature has reported

that age would likely influence participation in tree planting positively [3, 32]. In contrary, [13 and 23] stated that age does not influence the adoption of tree planting.

Valuation of the intangible benefits of trees on farmland using the cost of substitute good enable placing monetary value on these benefits. Sengupta and Osgood (2003) stated that valuation of environmental services in units permit incorporation in planning and policy for the conservation of forest and tree resource. This denotes a strong financial commitment towards the conservation of trees and sustenance of environmental services (ES).The monetary estimate can serve as a strong argument against the conversion of areas with trees to other land uses, especially without the consideration for replacement. Furthermore, ₦73,600 is the annual average total cost of substitute goods that could be saved by the farmers on their farmlands. This reflects a good support of trees to farmers on their farmlands. However, this study has helped incorporate tree planting on farms.

V. Conclusion

Conclusively, this study demonstrates that trees are present on farmlands and farmers are aware of the intangible benefit they derive from these trees on their farm. Some of the intangible benefits derived from the trees are improvement of soil fertility, shade, erosion control and mitigation of climate change. Although age, gender and education level of farmer influences their willingness to plant tree, most farmers were willing to incorporate trees on their farmland due to the intangible benefits they derive. An average yearly total cost of ₦73,600 can be saved if trees are on farmland. Generally, this valuation has the potential of tree conservation.

References

[1]. Adewusi, H.G. Agroforestry Practices and Species Preference in Kano State. Potentials for Improvement. Production Agriculture and Technology (PAT). 2006:2. 2-4.

[2]. Ajake, A. O. Exploitation and managementof forest Resources in Cross River State, Nigeria.Unpublished Ph.D Thesis, Department of Geography, University of Nigeria, Nsukka. 2008; 33.

[3]. Aladi, S.F., Olujobi, O.J. Farmers Perception of Opportunities Preferences and Obstacles of Growing Multipurpose Trees on Farmlands in Kogi State. European Scientific Journal, 2014:10, (14): 607-617.

[4]. Amacher, G.S., Hyde, W.F. &Rafiq, M.. Local adoption of new forestry technologies: An example from Pakistan's northwest frontier province. *World Development* 1993;:21(3): 445−453.

[5]. Amati, M., Brack, C., Ghosh, S., Kachenko, A., McManus, P., Saldariagga, N., Shrestha, K., Wang, M. and Yung, S. H. Understanding the carbon and pollution mitigation potential of Sydney's urban forest. National conference proceedings, 2013 Canberra. The Institute of Foresters of Australia, 2013;139-146.

[6]. Amirnejad H., Khalilian S., Assareh M.H., Ahmadian M. .*Estimating the existence value of north forests of Iran by using a contingent valuation method*. Ecological Economics,2006; 58: 665−675.

[7]. Ardayfio-Schandorf, E., Attua, E. M., Agyei- Mensah, S., Yankson, P. W. K. and Asiedu, A. B. Socio-economic perspectives of off-reserve forest management in the Goaso forest district of Ghana. Woeli Publishing Services, Accra.2007

[8]. Balvanera P, Pfisterer A B and Buchmann N.(2006). Quantifying the evidence for biodiversity effects on ecosystem functioning and services. *Ecology Letters* 2006*;***9:** 1146–56.

[9]. De Groot R.S., Wilson M.A., Boumans R.M.J. (2002). A typology for the classification, description and valuation of ecosystem function, goods and services. Ecological Economics, 2002;41: 393–408.

[10]. Dobbs, C., Kendal, D. and Nitschke, C. R. Multiple ecosystem services and disservices of the urban forest establishing their connections with landscape structure and socio demographics. Ecological Indicators, 2014; 43, 44-55. http://dx.doi.org/10.1016/j.ecolind.2014.02.007

[11]. Ely, M. E. Integrating Trees into the Design of the City: Expert Opinions on Developing More Sustainable Practices for Planting Street Trees in Australian Cities.PhD thesis, The University of Adelaide.2010

[12]. Gladwin, C. H., Peterson, J. S., & Mwale, A. C. The Quality of Science in Participatory Research: A Case Study from Eastern Zambia. World Development, 2002;30(4), 523-543.

[13]. Gockowski, J., Ndoumbe, J. The adoption of intensive horticulture in Southern Cameroon. Agricultural Economics 2004;30:195–202.

[14]. Gordon, J.C., Berry, J.K. & Schmidt, R.The problem and potential solutions.Asummary. In: Schmidt, R., Berry, J.K. & Gordon, J.C. (eds.) 1999. Forests to fight poverty: Creating national strategies. Vail-Ballou Press, USA.1999; 168-181.

[15]. Harvey CA, Chaco´n M, Donatti CI et al. Climate-smart landscapes: opportunities and challenges for integrating adaptation and mitigation in tropical agriculture. Conserve. 2014

[16]. Kandji ST, Verchot LV, Mackensen J, Boye A, Van Noordwijk M et al. Opportunities for linking climate change adaptation and mitigation through agroforestry systems. In: Garrity DP, Okono A, Grayson M, Parrott S (Eds) World Agroforestry into the Future (Edn) World Agroforestry Centre (ICRAF), ISBN 9290591846, Nairobi, Kenya.2006

[17]. Luedeling, E**.,** & Neufeldt, H**. (2012).** Carbon sequestration potential of parkland agroforestry in the Sahel. *Climatic Change*, 2012;*115*(3-4), 443-461.

[18]. Maren O. and Carolyn E.S. Climate Change Adaptation using Agroforestry Practices: A Case Study from Costa Rica. Stefano Casalegno (Ed.) Global Warming Impacts - Case Studies on the Economy, Human Health, and on Urban and Natural Environments, ISBN: 2011;978-953-307-785-7, InTech, DOI: 10.5772/2417

[19]. Mbow**, C.,** Smith, P., Skole, D., Duguma, L., & Bustamante, M. **.**Achieving mitigation and adaptation to climate change throughsustainable agroforestry practices in Africa. *Current Opinion inEnvironmental Sustainability*, 2014;*6*, 8-14.

[20]. Millennium ecosystem assessment (MA). Ecosystems and human well-being: A framework for assessment. Available at: http://www.maweb.org/en/Framework.aspx.2005a

[21]. MA . Ecosystems and Human Well-being: Current state and trends, Volume 1. R. Hassan, R. Scholes, and N. Ash (eds.). Island Press, Washington DC.2005b

[22]. Moore, G. Urban trees: worth more than they cost. In: Lawry, D., Gardner, J. & Bridget, M., eds. Proceedings of the 10th National Street Tree Symposium, 2009. University of Adelaide, Australia, 2009;7–14.

[23]. Odera, M. M., Kimani, S. K., Musembi, F. Factors influencing adoption of integrated use of manure and inorganic fertilizer in central highlands of Kenya. In Collaborative and Participatory Research for Sustainably Improved Livelihoods, Proceedings of the 7th Biennial Scientific conference, Kenya Agricultural Research Institute (KARI) Nairobi, Kenya, 2000;58–64.
[24]. Ojukwu, N. B. Promoting Agroforestry in Ihenwuzhi –An Approach towards achievingsustainable land and Resource management. Unpublished M.Sc. Thesis, Enugu State University of Science and Technology, Enugu. 1998
[25]. Oke, D and Odebiyi, K.A. Traditional cocoa-based agroforestry and forest species conservation in Ondo State, Nigeria. *Agriculture, Ecosystems & Environment.* 2007:122;305-311
[26]. Pandit, R., Polyakov, M. and Sadler, R.Valuing public and private urban tree canopy cover. Australian Journal of Agricultural and Resource Economics, 2014;58, 453-470. http://dx.doi.org/10.1111/1467-8489.12037
[27]. Pattanayak, S. K., Mercer, D. E., Sills, E., & Yang, J. C. Taking stock of agroforestry adoption studies.*Agroforestry Systems* 2003;57(3): 137-150.
[28]. Prasad K. Prospect of agroforestry in India. Paper submitted in XII World Forestry Congress, Canada. 2003
[29]. Reppin S., S. Kuyah, Andreas de Neergaard, Myles Oelofse, Todd S. Rosenstock. Article Contribution of agroforestry to climate change mitigation and livelihood in Western Kenya. Agroforest Syst (https://doi.org(10.1007/s/0457.019.00383-7. 2019
[30]. Salam, M.A., Noguchi, T. and Koike, M. Understanding why farmers plant trees in the homestead agroforestry in Bangladesh. *Agroforestry Systems 2000;*50(1): 77–93.
[31]. Scherr, S.J. Economic factors in farmer adoption: patterns observed in Western Kenya. *World Development 1995;*23: 787–804.
[32]. Shaikh, S.L., Sun, L., van Kooten, G. C. Are Agricultural Values a Reliable Guide in Determining Landowners' Decisions to Create Forest Carbon Sinks? Canadian Journal of Agricultural Economics, 2007;55, 97-114.
[33]. Simmons, C.S., Walker, R.T. & Wood, C.H. (2002). Tree planting by small producers in the tropics: A study of Brazil and Panama. *Agroforestry Systems 2002;*56(2): 89–105.
[34]. Thacher, T., Lee, D.R., &Schelhas, J.W. Farmer participation in reforestation incentive programs in Costa Rica. Working paper 97-11.Department of Agricultural, Resource and Managerial Economics; Cornell University, Ithaca, New York. 1997
[35]. World Resource Institute.. Assessing Forest Governance. The Governance of Forest Initiative Indicator Framework.http://www.wri.org/ourwork/project/governance-forest-initiative/tools#project-tabs.(Accessed 2014, June 4). 2007

Eguakun, F.S. "Statistical Valuation of the Intagible Benefits of Trees on Farmlands in Ikwerre Local Government Area, Rivers State." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 13(2), 2020, pp. 16-24.