AGROFORESTRY PRACTICES AND GENDER RELATIONSHIPS IN TRADITIONAL FARMING SYSTEMS IN SOUTHEASTERN, NIGERIA.

[1]Uwaga, M. A* [2]Nzegbule, E. C. and [3]Egu. E. C
[1,3]Department of Forestry and Environmental Management, College of Natural Resources and Environmental Management,
[2]Department of Environmental Management and Toxicology, College of Natural Resources and Environmental Management,
Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria
**Corresponding Author Email: uwaga.monica@mouau.edu.ng*

ABSTRACT

Farming systems in Southeastern Nigeria are becoming less productive because of climate change and lack of access to resources. As a way to overcome these challenges, the study on agroforestry practices and gender relationships in traditional farming systems in southeastern Nigeria was conducted to evaluate land preparation methods, preferences in the adoption and, the productivity of traditional agroforestry systems. Nine communities were randomly selected, where on-farm assessments were made using three agroforestry systems: (traditional home garden; cassava with multipurpose woody species; and yam with multipurpose woody species) and a 7-year fallow plot was used as a control plot. A transect of 100m ×15m was cut in each plot and 5m × 5m quadrats laid to identify and enumerate agroforestry species and yield of crops. A total of 216 households were interviewed using a structured questionnaire. Data obtained were analyzed using descriptive statistics and species diversity index method. The result showed that female (37.5%) and male (20%) farmers practiced zero tillage. Female (42.5%) and male (37.5) farmers prepared their lands leaving multipurpose woody plants to grow with their arable crops. Multipurpose species that were common to both male and female farms were: Elaeis guinensis, Dialium guineense, and Anthonatha macrophylla. Multipurpose species occurring only in male farms were: Raphia hookeri and Spondias mombin and that found only in the female farms was Cola species. Multipurpose species were established mainly from natural regeneration, and economic value is more a priority than the environmental value in the choice of species in both male and female farms.

Keywords: Farming systems, Gender, Sustainability, Agroforestry

INTRODUCTION

A farming system is a collection of individual and homogeneous farming activities that have broadly similar resource bases, enterprise patterns, household livelihoods, and constraints, and for which similar development strategies and interventions would be appropriate (Patel *et al*., 2019; Swoyambhu, *et al*., 2018). Sustainable farming system involves farming ecologically by promoting methods and practices that are economically viable, environmentally sound, and protect public health. Land preparation methods are focal in land-use systems with great implications on productivity and food security. The land-use system, however, influences agroforestry with the latter playing a vital role in combating land degradation and desertification and ensuring soil restoration (Viswanath, *et al*., 2018). Many land preparation methods in traditional farming systems do not encourage increased agroforestry. This was the scenario in the southeast, Nigeria. In southeast Nigeria, agricultural practice ranges from the extensive shifting cultivation to a more permanent and specialized type of farming called compound farms. In many communities in southeast Nigeria, shifting cultivation involved using the 'slash-and-burn" method to clear land and followed it with a fallow period. The clearing is done using axes or machetes and the cleared vegetation is burnt when dry before planting on the cleared area. Viswanath, *et al*., (2018) and Babalola (2000) posited that the "slash-and-burn" method of land clearing has been an integral part of shifting cultivation and widely practiced by over 90% of farmers in southeastern Nigeria. This land preparation method is believed to be very effective in reducing weed infestation that would compete with crops for sunlight, water, and soil nutrients, while the ash deposits after burning increase the pH of the soil and help to fertilize the soil (Dhanya *et al*., 2014; Singh *et al*., 2014; Lim *et al*., 2016). Farmers in this area hold tenaciously to this land preparation practice which they believed was inherited from their ancestors. They pay little or no much attention to the implications of the trees/shrubs they cut down and burnt during the land clearing process.

In the past, shifting cultivation was environmentally convenient when the population pressure on land was low and the fallow period was relatively long, thereby helping to maintain soil fertility by recycling soil nutrients. Currently, this scenario has changed and due to population pressure, high demand for cereals, and growth of urban markets for forest products, shifting cultivation has been replaced with reduced fallow periods from 25 years to less than 3-4 years. Studies by Luoga, (2000), Mwampamba, (2009), Dhanya *et al* (2013), and Rane *et al*., (2014) shared this view. These

shortened fallow periods no longer allow for appropriate maintenance of soil fertility through soil nutrients recycling and this poses a great danger to agroforestry. Holden, (2001) and Singh and Singh (2017) posited that the shortening of the fallow period has introduced adverse effect on the environment such as severe deforestation, soil erosion due to loss of forest cover, loss of biodiversity contributing to climate change, flooding, siltation, land degradation and change of forest vegetation from primary to secondary and eventually to grassland.

In Nigeria, there is strong evidence that both men and women engage in farming with the latter playing a dominant role in agricultural production as confirmed by the FAO, (2011) and World Watch Institute, (2002). There is a demonstrated increase in women's participation in agricultural production due to greater male participation in non-farm activities and waged employment as well as the breakdown of the traditional farming pattern. Male dominance in farming in Nigeria has changed with women now playing a vital role in farming and their position in meeting the challenges of agricultural production and development are quite dominant and prominent. However, gender responsibilities and differences have not been clearly defined in traditional agricultural production systems to maximize achieving sustainability and productivity in the system. This makes studying gender dimensions in land preparation very important. Gender differential in land preparation has become a serious concern in modern agroforestry studies. This is because traditional agriculture in Africa is characterized by gender division of labor according to tasks and preferences for crops and livestock production. Men and women typically have very different roles in food production and processing and this has implications for food security. Gender roles and preferences in the pattern of land preparation adopted in rural communities have different outcomes in terms of productivity and environmental conservation (Ram *et al*., 2017). Choices are made to adopt clear-cutting before tillage or adoption of various agroforestry practices among women and men farmers (Hager *et al*., 2015). In Southeast, Nigeria women and men own land through various land acquisition processes, prepares them for planting, and produce different crops of interest. There exists a difference in the pattern of land preparation between male-owned farmlands and female-owned (through inheritance from husbands, lease, or outright purchase) farmlands in the area. This difference influences the nature of agroforestry in the area. The current emphasis on agroforestry is not only on the farming system and food production but on the sustainability of the farming system. There is little or no study that had examined the performance and profitability of the traditional system to identify the gender-associated farmer's preference and the performances of the methods. It becomes imperative to carry out this research on agroforestry practices and gender relationships in traditional farming systems in southeastern, Nigeria. The study evaluated preparation methods, the gender preferences in the adoption and productivity of traditional agroforestry systems. The outcome of the study will provide a basis for policies and programs that are essential in promoting agroforestry through traditional land preparation methods along gender lines.

MATERIALS AND METHODS

The study was carried out in southeast Nigeria (Figure 1). Southeast Nigeria is one of the six geopolitical zones in the country and is made up of five states viz Abia, Anambra, Ebonyi, Enugu, and the Imo States. The area is within the rainforest zone on latitudes 5° 45' 00"N of the Equator and longitudes 8° 30' 00"E of the equator. The total surface area of the region is approximately 76,000 square kilometers. Southeast Nigeria has an average rainfall of 2,000- 3000mm, an average minimum temperature of 22.9^{o}C, and a relative humidity range between 80-90% (NRCRI, 2013). The population in the area is above 16,381,729 (NPC,2006). The area is predominantly agrarian with a high dependency on subsistence crop production by both males and females.

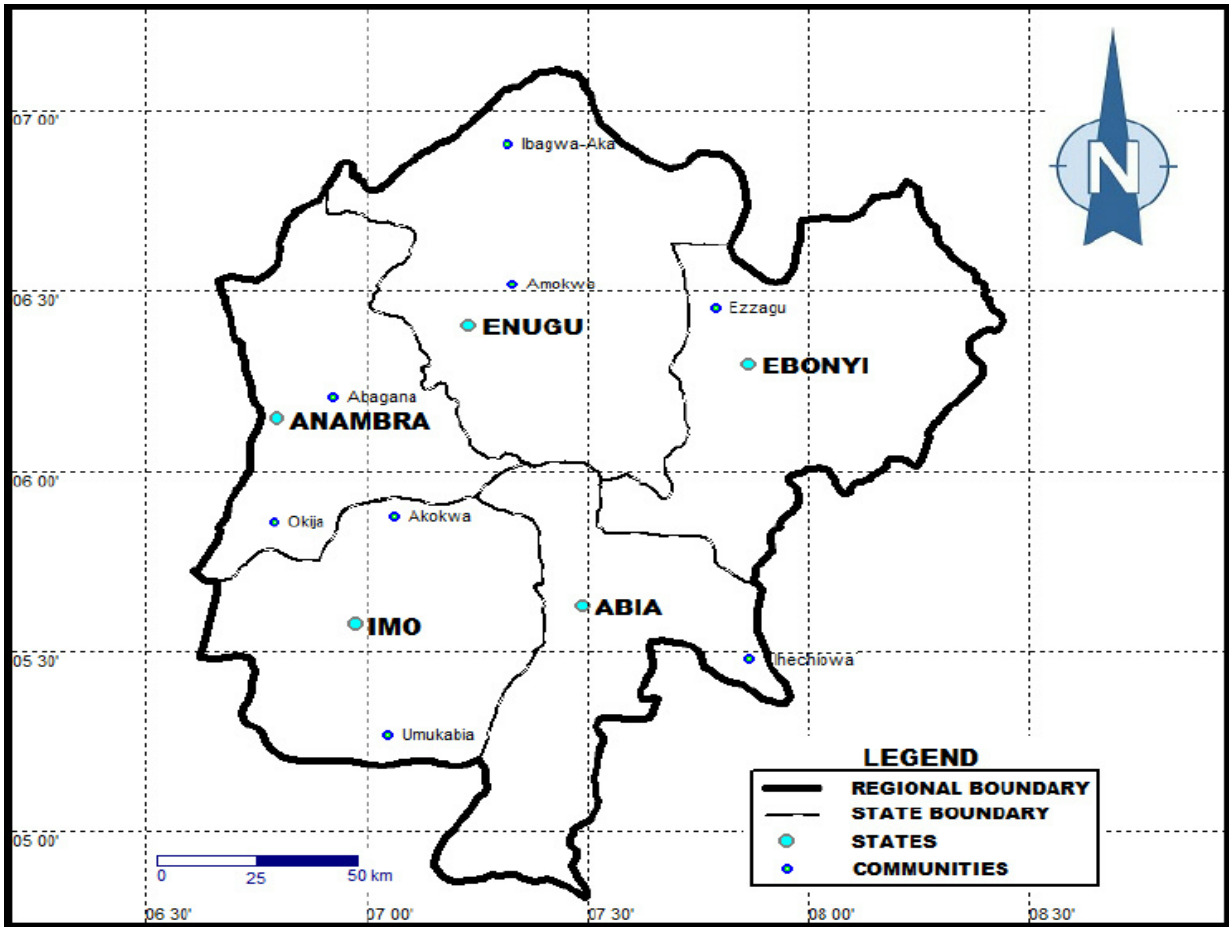


Fig 1: A Map of Southeast Nigeria showing the study area

Out of the six states, three (Ebonyi, Abia, and Imo) were selected through multistage sampling techniques. Each state has three senatorial zones. In each zone, a Local Government Area (LGA) was selected to give a total of nine LGAs. One rural community was purposively selected from each LGAs based on their active involvement in crop production under the agroforestry system of growing their arable crops alongside woody species. This gave a total of 9 communities that were used for the study. A total of twenty-four (24) respondents comprising of twelve (12) male-headed household farmers (50%) and twelve (12) female-headed households' farmers (50%) were drawn from each of the selected rural communities for the study. This gave a total of two hundred and sixteen (216) farmers that were used for the study and questionnaires was administered based on this arrangement. Data on land preparation methods were collected through on-farm assessments with the use of a well-structured questionnaire and an in-depth interview of individual farmers who have good knowledge of the area and are practicing farmers. Nine communities were randomly selected where on-farm assessments were made using three agroforestry systems: (traditional home garden; cassava-based agroforestry system; and yam-based agroforestry system) and a 7-year fallow plot used as control. A transect of 100m ×15m was cut in each plot and 5m × 5m quadrats lay to identify and enumerate agroforestry species and yield of crops. The type of species and densities were determined in each quadrat. Identification of plant species was made in the field and specimen samples of those that could not be identified were collected with secateurs, clearly labeled, placed in a plant press, and subsequently taken to the Herbarium laboratory of the Department of Forestry and Environmental Management of Michael Okpara University, Umudike, where they were properly identified by the taxonomists. The plant species were classified based on family (USDA, 2005). The species abundance of the four different farm sites in nine locations was determined by Menhinick's Species Abundance/ Richness Index.

$$D = \frac{S}{\sqrt{N}} \ldots (1)$$

Where D = Species richness index; S = Number of species; and N = Total number of individuals. While Simpson's Species Diversity Index was used to calculate species diversity of sampled plots;

$$D = \sum_{i-1}^{s} P^2_i \ldots (2)$$

Where $P^2_i = \left(\frac{N_{i2}}{N_r}\right) \ldots (3)$

Pi = the relative abundance of the i^{th} species; N_i = number of the i^{th} species; N_r = total number of individuals.

Data obtained in the study were analyzed using descriptive statistics such as frequency, percentages, and standard deviation, two-tail t-test, Menhinick's Species Abundance/Richness Index, and Simpson's Species Diversity Index Formula/Method in R-statistical package and Microsoft Excel.

RESULTS

Socio-economic characteristics of the respondents by gender

Table 1 shows the socioeconomic characteristics of the respondents in southeast Nigeria. The result in Table 1 showed that the mean age of the male and female farmers were approximately 53 years and 46 years respectively. Exactly 22.5% males and 25% females constituting 47.5% of the entire respondents were within the age range of 31-45 years old, implying that the respondents are still in their active stages in life where they can adopt appropriate land preparation method that will contribute to sustaining productivity and agroforestry in the traditional farming system in the study area. However, the male farmers were older than the female farmers in the study area. Thirty percent of males and 50% of females had farming as their primary occupation. The result showed that 35.6% of males and 12.5% of females were married.

Table 1: Socioeconomic characteristics of the respondents by gender

Variable	Responses	Male (=108)		Female (n=108)	
		Freq.	%	Freq.	%
Age group (years)	18 – 30	23	10.6	6	2.8
	31 – 45	47	21.8	52	24.1
	46 – 60	27	12.5	27	12.5
	> 60	11	5.1	23	10.6
	Mean	52.7		45.6	
Occupation	Trading	30	13.9	5	2.3
	Farming	68	31.5	97	44.9
	Civil servant	10	4.6	6	2.8
Marital status	Single	7	3.2	2	0.9
	Married	77	35.6	27	12.5
	Divorced	12	5.6	17	7.9
	Widowed	12	5.6	62	28.7
Household size	1 – 5	86	39.8	94	43.5
	6 – 10	18	8.3	12	5.6
	> 10	4	1.9	2	0.9
	Mean	6.1		4.8	
Educational status	No school	21	9.7	37	17.1
	FSLC	66	30.6	57	26.4
	WAEC	11	5.1	2	0.9
	OND/NCE	4	1.9	5	2.3
	HND/B.Sc.	6	2.8	7	3.2
Farming experience	1 – 5	19	8.8	12	5.6
	6 – 10	34	15.7	33	15.3
	11 – 15	50	23.1	55	25.5
	16 – 20	4	1.9	5	2.3
	>20	1	0.5	3	1.4
	Mean	12.4		13.9	
Monthly Income (₦'000)	< 15	18	8.3	52	24.1
	15 – 30	82	38.0	53	24.5
	31 – 45	8	3.7	3	1.4
	Total	108	50.0	108	50.0
	Mean	156		114	

The average household sizes of the male and female respondents were 6 and 5 persons per household respectively Most of the respondents were literate. The mean years of farming experience of the male and female farmers in the study area were 12years and 14years respectively and were significantly different at a 5% level of significance. The average monthly income of the respondents from the sale of their farm products were ₦17, 750.00 and ₦12, 350.00 for the male and female respondents respectively.

Farm size, fallow period, and land preparation Methods

The distribution of respondents by farm size, length of fallow, and land preparation methods in the study area is presented in Table 2. The result in Table 2 shows

that the mean farm size of male and female farmers in the study area was 1.60hectares and 1.55hectares respectively with a grand mean farm size of 1.57hectares. There was no significant difference in the mean farm size of the male and female farmers in the study area. Most male farmers (36.6%) and female farmers (41.7%) had farm sizes of between 1.1hectares and 2.0 hectares, implying that both male and female farmers in the study area are smallholders' farmers. Land fragmentation to keep generational inheritance and population pressure on farmland in southeast Nigeria may give justification to the low farm sizes cultivated by both male and female farmers in the study area. Farmland fallow period of 7 – 9 years was mostly practiced by the respondents along gender lines as reported by 31.0% males and 33.8% females and this accounted for 64.8% of the entire respondents. The short fallow period in the studied area may be due to population pressure on lands in the area. This will not allow the soil to rejuvenate its fertility and thus sustain productivity in a traditional farming system in the studied area.

Table 2: Farm size, length of fallow, and land preparation methods by gender

Variable	Male		Female	
	Freq.	%	Freq.	%
Farm size (ha)				
0.1 – 1.0	12	5.6	9	4.2
1.1 – 2.0	79	36.6	90	41.7
2.1 – 3.0	17	7.9	9	4.2
Total	108	50.0	108	50.0
Mean ±SD	1.60±0.50		1.55±0.10	
Farm Land Fallow Period				
1 – 3 years	11	5.1	7	3.2
4 – 6 years	30	13.9	28	13.0
7 – 9 years	67	31.0	73	33.8
Total	108	50.0	108	50.0
Mean ±SD	6.56±2.02		6.83±1.82	
Land Preparation Methods				
a) Land Tillage (Ploughing)				
Ridge making	5	2.3	6	2.8
Mound making	59	27.3	21	9.7
Zero tillage	44	20.4	81	37.5
Total	108	50	108	50
b) Growing arable crops with multipurpose woody plants				
Yes	81	37.5	92	42.6
No	27	12.5	16	7.4
Total	108	50.0	108	50.0

The shortened fallow period is a negative influence on agroforestry as these farmlands are under pressure of constant pruning during land preparations. The situation is increasing land degradation challenge in the study area. The land tillage method practiced by a majority of the male respondents (20.4%) and female respondents (37.5%) was zero tillage, implying that zero tillage is predominantly the land tillage method practiced in the study area. Zero tillage has an advantage over conventional tillage systems by being beneficial in terms of soil, water, and agroforestry conservation. The result showed that 37.5% male farmers and 42.6% female farmers prepare their lands for planting leaving shrubs and trees, while few of the male respondents (12.5%) and female respondents (7.4%) adopted complete clear-cutting land preparation methods. The practice of leaving shrubs and trees while clearing was practiced by more women than men in the study area.

Occurrences of Agroforestry Species in Farmlands in Southeast Nigeria

The results on the identification and assessment of densities of common agroforestry species in farmland derived using questionnaire survey collected from male and female-headed household farmers in the studied area is presented in Table 3 below. The result showed that there are different economic shrub(s)/tree(s) in farmland in southeast Nigeria indicating the people of south-eastern Nigeria traditionally practice agroforestry in farmlands in southeast Nigeria. The identified agroforestry species in farmland as presented in Table 3 revealed that the most common tree/shrubs on farmland managed by male farmers were *Elaeis guinensis* (nkwu) (44.0%) and *Dialium guineense* (icheku) (34.7.0%). This was followed by such trees/shrubs as *Anthonatha macrophylla* (37.0%), *Musa spp.* (37.0%), *Spondias mombin* (Ijikara/Isikala) (30.1%), *Raphia hookeri* (Wine palm), etc. Among the rarely occurring agroforestry species on the male-owned farms were *Pterocarpus soyauaxiii* (Awo) (2.3%), *Alchornea cordifolia* (2.5%), and *Bambusa spp*. (2.3%).Similarly, the most common agroforestry

species in female-owned farmland in the study area were *Elaeis guinensis* (nkwu) (44.0%) and *Anthonatha macrophylla* (Ubabaiepa) (39.4%). This was followed by such trees/shrubs as *Musa spp.* (Plantain/Banana) (34.7%) and *Dialium guineense* (34.7%).

Table 3: Common agroforestry species in farmland in southeast Nigeria by gender

Tree/Shrub specie	Male		Female	
	Freq.	%	Freq.	%
Elaeis guinensis (Nkwu)	95	44.0	95	44.0
Pentaclethra macrophylla (Ugba)	50	23.1	40	18.5
Dacroydes edulis (Ube)	40	18.5	30	13.9
Treculia africana (Ukwa)	55	25.5	45	20.8
Citrus sinensis (Orange)	10	4.6	8	3.7
Magniferia indica (Mango)	30	13.9	15	6.9
Cola spp. (Oji)	50	23.1	50	23.1
Cocos nucifera (Coconut tree)	20	9.3	10	4.6
Raphia hookeri (Wine palm)	65	30.1	45	20.8
Triplochiton scleroxylon (Obeche)	40	18.5	15	6.9
Persea americana (Avocado pear)	15	6.9	18	8.3
Pterocarpus soyauaxiii (Awo)	5	2.3	12	5.6
Dialium guineenses (Icheku)	95	44.0	75	34.7
Millicia excelsa (Iroko tree)	15	6.9	5	2.3
Musa spp. (Plantain/Banana)	80	37.0	75	34.7
Anthonatha macrophylla (Ubabaiepa)	80	37.0	85	39.4
Nauclea diderrichii (Opepe)	50	23.1	40	18.5
Carica papaya (Pawpaw)	15	6.9	5	2.3
Alchornea cordifolia	5	2.3	20	9.3
Chrsophyllum albidum (Udara)	15	6.9	21	9.7
Annona muricate	10	4.6	5	2.3
Bambusa spp. (Bamboo)	5	2.3	16	7.4
Garcinia kola (bitter kola)	35	16.2	30	13.9
Dennettia tripetala (Mmini)	45	20.8	5	2.3
Tetrapleura tetraptera (Oshogho)	15	6.9	12	5.6
Theobroma cacao (Cocoa)	10	4.6	5	2.3
Spondias mombin (Ijikara/Isikala)	65	30.1	45	20.8

The rarely identified agroforestry species in female-owned farmland were *Millicia excelsa* (Iroko tree) (2.3%), *Carica papaya* (Pawpaw) (2.3%), *Annona muricate* (2.3%), and *Theobroma cacao* (Cocoa) (2.3%). Thus, the most commonly found agroforestry trees/shrubs in both male and female farmlands in southeast Nigeria included, *Elaeis guinensis* (nkwu); *Dialium guineenses* (Icheku); *Anthonatha macrophylla* (Ubabaiepa); *Musa spp.* (Plantain/Banana); *Raphia hookeri* (Wine palm); *Spondias mombin* (Ijikara/Isikala); *Treculia africana* (Ukwa), *Cola spp.* (Oji), *Pentaclethra macrophylla* (Ugba), and *Nauclea diderrichii* (Opepe). The study showed that most of the agroforestry species allowed to grow on farmland managed by both the male and female farmers were those species that serve as food or of economic importance to the farmers. This may be due to the need to ensure a regular source of food. According to Aju and Labode (2005), the need to ensure a regular source of food was the major consideration in the choice of tree/shrub species for planting and or protection on fallow and farmlands in traditional farming systems in south-eastern Nigeria. Most of the trees/shrubs found on farmlands in the study area had food values either for human consumption or for animals as well as had economic values as a means of generating income in solving the day-to-day needs of the farm households. The findings of this study are similar to the reports by FAO (1990) and Kang and Van Den Beldt, (1988). Thus, the value of farmland in the study area was not only dependent on size but also on the economic value of the arable crops and agroforestry species found on such farms.

On-Farm Assessment of Agroforestry Species Composition and Density.

The results of on-farm comparison of the abundance and diversity of agroforestry species found on 4 different types of farm settings (traditional home garden, cassava-based cropping system, yam-based cropping system, and 7-year fallow) are presented in Table 4. There were variations in the species composition of plant species enumerated in the four farm settings. Eighteen (18) plant species each occurred in the traditional home garden farms managed by both males and females, with a total of 1371 plants per hectare. The most occurring plant species in traditional home gardens managed by both males and females was *Alchornia cordifolia* while the

least was *Anthocleista vogeli*. In cassava-based cropping system farmlands managed by female farmers, 24 different agroforestry species were found with a total of 2385 plant species per hectare while in the yam-based cropping system farmlands managed by male farmers, 19 different agroforestry species were found with a total of 2013 agroforestry species per hectare. In the 7-years old fallow plots (control plot), 21 plant species were found having a total of 2374 plants per hectare. In the 7-years old fallow plot, the most occurring plant species was *Dalium guineense* and the least was *Musa paradisaca*. The dominance of Dialium guineense in the flora of the fallow plot may be connected to the farmer's preference of leaving this particular species in their farms for use as stakes or source of firewood. The plant's species found in both male and female farms were mainly indigenous woody species, viz., *Spondias mombin, Cnestis ferruginea, Alchornia cordifolia, Dialium guineense, Baphia nitida, Anthonatha marcophylla, Mallotus oppositfolius, Anthocleista vogeli, Vitex doniana,* and so on (Table 4).

Table 4: Species richness and diversity of trees/shrubs at farm sites in southeast, Nigeria

			Number of trees/shrubs ha^{-1}				
Family	Species	Common Name	Traditional home garden	Cassava with multipurpo	Yam with multipurpo se woody	7 Years old Fallow plot	Total
Acanthaceae	*Asystasia gangetica*	Creeping foxglove	67	200	280	110	657
Anacardiaceae	*Magnifera indica*	Mango	105	15	89	39	248
	Spondias mombin	Golden apple	200	225	12	60	497
Burseraceae	*Dacryodes edulis*	African pear	-	90	45	42	177
Caesalpinaceae	*P. macrophylla*	African oil bean	-	60	49	50	159
Connoraceae	*Cnestis ferruginea*		73	60	65	125	323
Euphorbiaceae	*Alchornia cordifolia*	Christmas bush	315	260	335	205	1115
	Mallotus oppositfolius		60	220	110	120	510
Lauraceae	*Persea americana*	Avocado pear	-	50	18	65	133
Leguminosae	*Dialium guineense*	Icheku	10	100	520	285	915
	Baphia nitida	Camwood	20	60	26	75	181
	A. macrophylla		12	140	145	275	572
	Parkia biglobosa		-	30	98	90	218
Lonaniaceae	*Anthocleista vogeli*	Cabbage tree	15	175	20	120	330
Marantaceae	*T. dianielli*		-	90	34	145	269
Musaceae	*Musa paradisaca*	Plantain	125	60	45	12	242
	Musa cicyntum	Banana	131	90	23	-	244
Palmae	*Elaeis guinensis*	Palm tree	17	67	34	70	188
	Cocos nucifera	Coconut tree	29	45	-	-	74
	Raphia hookeri	Palm wine tree	78	56	-	61	195
Sterculiaceae	*Cola nitida*	Kolanut	67	40	-	189	296
	Cola cepidota	Kolanut	22	67	-	87	176
Tiliaceae	*Glyphaea brevis*		-	40	-	-	40
Verbanaceae	*Vitex doniana*	Black plum	25	145	65	149	384
Total Number of Individual Trees/shrubs			1371	2385	2013	2374	8143
Total Number of Trees/shrubs Species			18	24	19	21	24
Menhinick's Species Richness Index			0.486	0.491	0.423	0.431	0.266
Simpson's Species Diversity Index			0.112	0.061	0.131	0.067	0.065

Note: The cassava with multipurpose woody species farmlands is mostly managed by females, the yam with multipurpose woody species farmlands is mostly managed by males, while the traditional home garden is managed by both males and female farmers in the study area.

The total density of multipurpose woody species was more in female farms than in male farms. Some of the woody species occurring in both male and female-managed farms have edible economic value. Some are not edible and are used locally for stakes. The agroforestry species observed in both cassava-based farmlands managed by females and yam-based farmlands managed by males were those that showed adaptation to slash and burn farm practice and those used as stakes or harvested as firewood. In the cassava-based farms managed by females, the most abundant multipurpose

woody species was *Alchornia cordifolia* (Christmas bush) while the least was *Magnifera indica* (mango tree). In the yam-based farms managed by males, the

most abundant plant species was *Dialium giuneense* while the least was *Spondias mombin* (Golden apple tree). The species richness index (SRI) in the traditional home garden, cassava-based farms managed by females, yam-based farms managed by males, and 7-years fallow plot (control plot) were 0.486, 0.491, 0.423, and 0.431 respectively. The cassava-based farms managed by females were having a comparatively higher agroforestry species presence than in the yam-based farms managed by males. The Simpson's species diversity index for the traditional home garden, cassava-based farms managed by females, yam-based farms managed by males, and 7-years fallow plot (control plot) were 0.112, 0.061, 0.131, and 0.067 respectively. The abundance and diversity of the agroforestry species are characteristic of advancing communities with flora of varying taxonomic groups exhibiting the ability to survive amidst diverse and competing individuals (Nzegbule, Onyema, and Ndelekwute, 2013). The result indicates that cassava-based farms managed by females had the highest abundance of wood species compared to other sites while species diversity was highest in yam-based farms managed by males.

Multipurpose Species Establishment and Choice of Woody Species allowed to Grow in Farms by Gender

Table 5: Multipurpose species establishment and choice of woody species allowed to grow in farms by Gender

Multipurpose species establishment and choice of woody species allowed to grow in farms	Total		Male		Female	
	Freq.	%	Freq.	%	Freq.	%
1) How woody species were introduced in farms?						
a. Planted by self	44	20.4	28	13.0	16	7.4
b. Natural regeneration	172	79.6	80	37.0	92	42.6
2) Choice of woody species allowed in farms						
a. Economic value	159	73.6	76	35.2	83	38.4
b. Environmental value	57	26.4	32	14.8	25	11.6
Total	216	100.0	108	50.0	108	50.0

The results in Table 5 show that the establishment o multipurpose woody species in farmlands managed by both male and female farmers in the study area was mainly through natural regeneration as accounted for by 79.6% of the respondents comprising 37.0% of the male farmers and 4.6% of the female farmers. This indicated that there is less stunting of these woody species in the area that allows for its self-regeneration after pruning them down during the land preparation period. Also, it is noted from the study that there is a poor attitude of deliberately planting woody species among the farmers (both male and female) but it is worst among female farmers. The result further revealed that economic value is more a priority than the environmental value in the choice of species in both male and female farms as accounted for by 73.6% of the respondents comprising 35.2% of the male farmers and 38.4% of the female farmers.

Gender roles in farm activities under agroforestry system in southeast Nigeria

The result of the assessment of the gender responsiveness of farmers in farm activities under the agroforestry system is presented in Table 6.

The result showed that male farmers in the study area dominated in farm activities such as maintenance of trees/shrub (42.5%), stacking of climbers such as yam stake (37.5%), stumping of stunted shrubs (32.5%), transplanting of seed from nursery to farmland (40%), application of herbicides (30%), transporting of farm produce (22.5%), and harvesting of fruit crop (37.5%). Men in farming households are engaged mostly in farm management activities that are perceived to be more strenuous and risk-demanding.

Table 6: Gender roles in farm activities under agroforestry system

Gender responsibility in farm activities	Total		Male		Female	
	Freq.	%	Freq.	%	Freq.	%
Choice of seeds for planting	65	30.1	45	20.8	90	41.7
Actual planting of food crops	85	39.4	25	11.6	90	41.7
Maintenance of tree/shrubs	100	46.3	85	39.4	15	6.9
Maintenance of food crops	90	41.7	20	9.3	90	41.7
Stacking of climbers such as yam stake	105	48.6	85	39.4	10	4.6
Gather of debris and burning	80	37.0	35	16.2	85	39.4
Stumping of stunted shrubs	100	46.3	65	30.1	35	16.2
Sowing	110	50.9	15	6.9	75	34.7
Transplanting of seed from nursery to farmland	105	48.6	80	37.0	25	11.6
Fertilizer/animal manure application	100	46.3	15	6.9	85	39.4

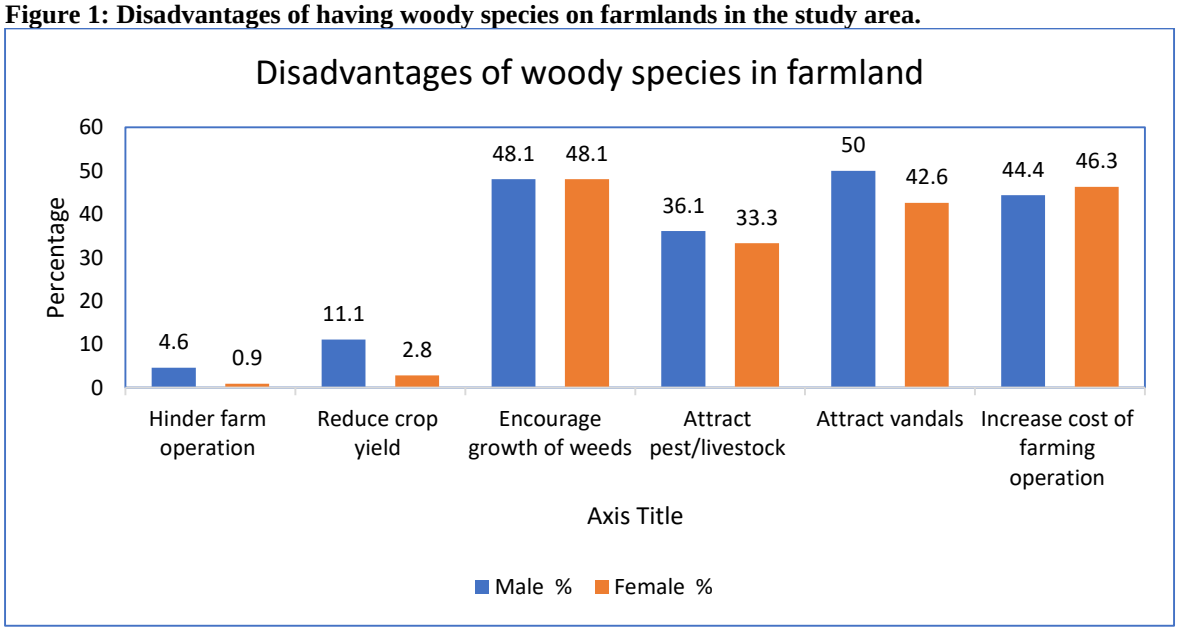
Weeding of farmland	110	50.9	10	4.6	100	46.3
Application of herbicides	140	64.8	80	37.0	60	27.8
Harvesting of food crops	85	39.4	30	13.9	55	25.5
Harvesting of fruit crops	80	37.0	75	34.7	5	2.3
Threshing	105	48.6	45	20.8	60	27.8
Transporting of farm produce	85	39.4	55	25.5	30	13.9
Storing of farm produce	65	30.1	15	6.9	50	23.1
Processing of harvested crops	105	48.6	47	21.8	58	26.9
Processing of harvested fruit seeds	105	48.6	38	17.6	67	31.0
Marketing of produce	45	20.8	5	2.3	40	18.5

Women farmers dominated farm activities such as making the choice of seed for planting (41.7%), actual planting of food crops (41.7%), maintenance of food crops (41.7%), gathering of debris and burning (39.4%), sowing (34.7%), fertilizer/animal manure application (39.4%), weeding of farmland (46.3%), harvesting of food crops (25.5%), threshing (27.8%), storing of farm produce (23.1%), processing of harvested crops (26.9%), processing of harvested fruits seeds (31.0%) and marketing of produce (18.5%) (Table 6). The female farmers engage more in processing, marketing, and farm supervision and maintenance roles in under agroforestry farming system in the study area than their male counterparts. The greater involvement of females in processing, farm maintenance, and marketing roles may be due to the less strenuous nature of these activities. Studies (Nzeakor, 2014; Ibeagwa *et al.*, 2012) had reported that females engaged mostly in processing and marketing roles in farming due to their patience in carrying out these functions and this makes them more technically efficient than their male counterparts in such activities. Although most farming activities are jointly performed in rural areas, the various roles played by men and women in land preparation in the study area are sufficiently differentiated. The dominance of men in more tasking activities in agroforestry farming practices may be as a result of their being stronger physically and a greater voice in decision-making than women. However, the ability of the women to exhibit patience and concentration while processing and maintaining farmlands and crops planted therein aids in ensuring that they sustain productivity and remain relevant in the traditional farming system in southeast Nigeria.

Perceived Demerits of Trees/Shrubs on Farmland by Gender

Investigation into the disadvantages of having woody species on farmlands in the study area is presented in Table 7 below. The three most rated disadvantages of having multipurpose woody species in the farm as presented by both male and female farmers were: encouraging the growth of weeds (96.3%); attracting vandals (92.6%); and increasing the cost of farming operation (90.7%) (Table 7). The most rated disadvantage of woody species in male-owned farmlands was that woody species attracts vandals (50.0%). This was followed by 48.1% and 44.4% of the male respondents who indicated that woody species in farmlands encourage the growth of weeds and increasing the cost of farming operations respectively.

Figure 1: Disadvantages of having woody species on farmlands in the study area.



Similarly, the most rated disadvantages of multipurpose woody species in female-owned farmlands in the study area were that woody species encourage the growth of weeds, increase the cost of the farming operation and attract vandals as indicated by 48.1%, 46.3%, and 42.6% of the respondents respectively. This implies that the existence of woody species in farmland in the study area is to an extent a disincentive to successful farming in the study area. The study revealed that woody species in farms do not distort farm operations, nor reduce crop yield.

Agroforestry Systems Predominantly Practised by Men and Women Farmers in Southeast Nigeria

Figure 2: Agroforestry Systems Predominantly Practised by Men and Women Farmers in Southeast Nigeria

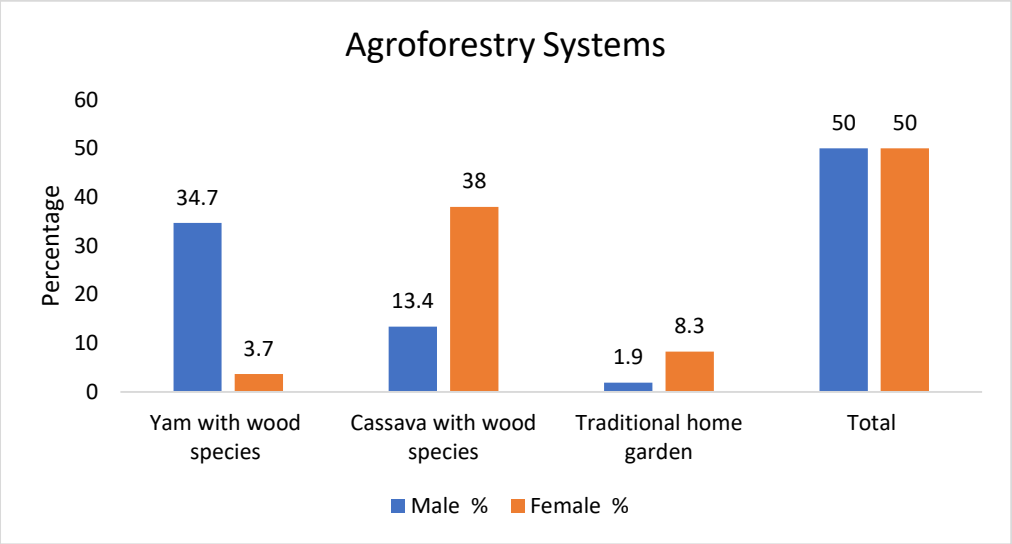


Fig. 2 shows that male farmers dominated the yam-based agroforestry farmlands in southeast Nigeria as accounted for 34.7% of the total 38.4% of the entire respondents practicing this form of an agroforestry system. Only 13.4% and 1.9% of male farmers practiced cassava-based agroforestry systems and traditional home gardens respectively. Female farmers in southeast Nigeria were found to dominate the cassava-based agroforestry system in southeast Nigeria as accounted for 38.0% of the total 51.4% of the entire respondents practicing this form of an agroforestry system. Only 3.7% and 8.3% of female farmers practiced the yam-based agroforestry system and traditional home garden respectively. The dominance of men in the yam-based agroforestry system in the study area may be because yam is regarded traditionally as men crop in southeast Nigeria while the dominance of female farmers in the cassava-based agroforestry system in the study area is on the fact that cassava is regarded as women crop in Nigeria.

The yield of yam and cassava under agroforestry system in southeast Nigeria

The mean value of cassava and yam yield under cassava-based agroforestry system managed by females and yam-based agroforestry system managed by males in southeast Nigeria is presented in Table 7.

Table 7: Yield of yam and cassava under agroforestry system in southeast Nigeria

Yields by Agroforestry systems(t/ha)	Total	Male	Female
Yam-based agroforestry system	12.9	10	2.9
Cassava-based agroforestry system	21.8	7.3	14.5
Traditional homegarden (cassava yield)	10.8	4.2	6.6
Traditional homegarden (yam yield)	8.7	6.5	2.2

The result showed that the average yield of cassava under the cassava-based agroforestry system managed by females was 14.5t/ha while yam yield was a paltry 2.9t/ha. The average yield of yam under the yam-based agroforestry system managed by males in southeast Nigeria was 10t/ha while cassava yield under this agroforestry system was 7.3t/ha. In the traditional home garden farming setting, yam and cassava yields were 6.5t/ha and 4.2t/ha in the male managed farms while in the female managed farms, cassava and yam yield under the traditional home garden agroforestry system were 6.6t/ha and 2.2t/ha respectively. There is a significant difference in the yield of yam and cassava in farms managed by men and women farmers in the study area. in general, women appear more productive than their men counterparts in the agroforestry system in southeast Nigeria.

4.0 CONCLUSION AND RECOMMENDATIONS

The study has shown that trees/shrubs occupy a vital place in the traditional farming systems in southeast Nigeria. The average farm size of both men and women farmers was between 1.1-2 hectares and the average number of fallow years observed by both men and women farmers is 7 years. The result showed that more men and women farmers in the study area practiced zero tillage. Both female and male farmers prepared their lands leaving multipurpose woody plants to grow with their arable crops. Women leave an average of 10% more trees/shrubs than men in farmlands in the studied area multipurpose species that were common to both male and female farms were *Elaeis guinensis, Dialium guineense, and Anthonatha macrophylla.* Multipurpose species occurring only in male farms were *Raphia hookeri and Spondias mombin* and that found only in the female farms was C*ola* species. Multipurpose species were established mainly from natural regeneration, and economic value is more a priority than the environmental value in the choice of species. Men farmers dominated strenuous farm activities. The greatest disincentive of having multipurpose wood species in their farms was that it encourages weeds and intruders. Female-managed traditional agroforestry farms were more productive and provided greater environmental services than their male counterparts. Trees/shrubs contribute to ensuring a better standard of living for both men and women farmers in the area through the provision of a substantial part of their food requirement in each growing season and household income making them a liable factor for ensuring sustained productivity among farmers irrespective of gender. It is recommended that farmers in the area particularly men should be oriented on the benefit of allowing agroforestry plant species to grow along with their food crops as this will increase productivity and environmental conservation. Governments at the Federal, State, and Local levels should discourage extensive deforestation and depletion of forest species in the forest, farmland, watersheds, and community/ village squares. This will encourage sustainable biodiversity conservation and management as well as enhance soil erosion control and management.

REFERENCES

Aju, P.C and Popoola, L. (2005). Trees in the traditional farming systems in Southeastern Nigeria. A case study of Imo State. *Journal of Environmental Extension* 5: 25-31. Doi:10.4314/ 5i1.2745

Peterman, A., Quisumbling A., Behrman, J. and Nkonya, E (2011). Understanding the complexities surrounding gender differences in agricultural productivity in Nigeria and Uganda *Journal of Development Studies.* 47:10,1482-1509, 2011

Babalola, O. (2000). Soil Management and Conservation in Nigeria. In: Akoroda, M. O. (ed). Agronomy in Nigeria. University of Ibadan, Nigeria. Pp 216-222

Dhanya B., Sathish B. N., Viswanath S., and Purushothaman S. (2014). Ecosystem services of native trees: experiences from two traditional agroforestry systems in Karnataka, Southern India, International Journal of Biodiversity Science. Ecosyst. Serv. Manage. 10: 101-111.

Dhanya B., Viswanath S. and Purushothaman S. (2013). Does litterfall from native trees support rainfed agriculture? Analysis of Ficus trees in agroforestry systems of the southern dry agroclimatic zone of Karnataka, Southern India. J. for. Res., 24: 333-338.

Dike, M. C. (2005). Assessing the ecological status of woody plant species at eroded sites of Abia and Imo States, Nigeria. *Global Journal of Environmental Sciences* 4(1):77-85.

FAO, (2011). Save and Grow: A Policymaker's Guide to Sustainable Intensification of Smallholder Crop Production. FAO, Rome, Italy, 102.

Häger A, Fernández O. M, Stuhlmacher M.F, Acuña C. R, Contreras A. A. (2015). Effects of management and landscape composition on the diversity and structure of tree species assemblages in coffee agroforests. Agriculture, Ecosystems & Environment.;199:43–51.

Holden, S. (2015). A Century of Technological Change and Deforestation in the Miombo Woodland of Northern Zambia. Angelsen, A and Kaimowitz, D (Editors). Agricultural Technologies and Tropical Deforestation. CABI and CIFOR publications, pp. 251-269

Lim, S. L., Lee, L. H., and Wu, T. Y. (2016). Sustainability of using composting and vermicomposting technologies for organic solid waste biotransformation: recent overview, greenhouse gas emissions, and economic analysis. Journal of Cleaner Production, 111, 262-278.

Luoga, E. J. (2000). Subsistence Use of Wood Products and Shifting Cultivation within Miombo Woodland of Eastern Tanzania, with special notes on commercial uses. South African Journal of Botany 66:72-85

Mwampamba, H.T. (2009). Forest Recovery and Carbon Sequestration under shifting

cultivation in the Eastern Arc Mountains, Tanzania: Landscape and land-use effects.

NPC, (2006). Census Provisional Result. National Population Commission, Abuja. Nigeria

NRCRI, (2013), Report of Meteorological Department, National Root Crop Research Institute, Umudike,

Nzegbule *et al.(*2013). *Journal of Tropical Ecology* 54(2):205-212. ISSN 0564-3295

Ram, A., Dev, I., Uthappa, A. R., Kumar, D., Kumar, N., Chaturvedi, O. P., and Meena, B. P. (2017). Reactive Nitrogen in Agroforestry Systems of India. The Indian Nitrogen Assessment: Sources of Reactive Nitrogen, Environmental and Climate Effects, Management Options, and Policies, 207.

Rane A. D., Sowmya C. and Viswanath S. (2014). Culm Emergence and Soil Properties in Dendrocalamus stocksii under different land-use systems in Central Western Ghats. J. Tree Sci. 33: 48- 52.

Singh, A. K., A. Arunachalam, S. V. Ngachan, K. P. Mohapatra, and J. C. Dagar. (2014). From shifting cultivation to integrating farming: Experience of agroforestry development in the northeastern Himalayan region. In Agroforestry Systems in India: Livelihood Security &Ecosystem Services (pp. 57-86). Springer, New Delhi.

Singh, R., and Singh, G.S. (2017). Traditional agriculture: a climate-smart approach for sustainable food production. Energy, Ecology and Environment 2(5): 296-316.

Swoyambhu, M.A, Edwin C. and Ian N. (2018). Agroforestry systems and practices in Nepal (revised edition).Sopan Press Pvt. Ltd., Dillibazar, Kathmandu, Nepal.

Viswanath S., Lubina, P. A., Subbanna, S., and Sandhya, M. C. (2018). Traditional Agroforestry Systems and Practices: A Review. *Advanced Agricultural Research & Technology Journal* 2(1); 18 -29.