Izvirni znanstveni članek / Original scientific article

UNDERSTANDING COMMITMENT TO AGROFORESTRY: A CROSS-SECTIONAL STUDY AMONG A SAMPLE OF NIGERIAN FARMERS

RAZUMEVANJE PREDANOSTI KMETIJSKO-GOZDARSKIM SISTEMOM: PRESEČNA RAZISKAVA VZORCA NIGERIJSKIH KMETOVALCEV

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ABSTRACT

Agroforestry is strategic in reconciling food production with forest biodiversity conservation. The methodical investigation of the beneficial and ecological imperativeness that informs smallholder farmers' commitment to agroforestry is called for. This work is therefore an attempt to examine the relative importance of farmers' attitudes towards forest loss and perceived benefits of agroforestry in farmers' commitment to agroforestry among a group of farmers in Oyo State, southwestern Nigeria. The study is a cross-sectional survey that featured the interview administration of 400 structured questionnaires among crop farmers that were selected through clustered purposive sampling. Respondent's agreement with sets of relevant statements was elicited and used in the assessment of variables. Independent samples *t*-test and one-way ANOVA were used to examine the significance of the difference in respondents' commitment to agroforestry across sub-groups of gender and age/education respectively. The Pearson correlation coefficient was used to examine the relationship between variables. Results indicate that 57.8% exhibited a 'high' commitment to agroforestry. Gender, age and education had main effects on commitment ($p < 0.05$). There is no significant relationship between attitude towards forest loss and commitment to agroforestry ($r = 0.038$, $p > 0.05$) but not perceived benefits ($r = 0.426$, $p < 0.05$). Being male, middle-aged and poorly educated are significantly more predisposing to exhibiting lower commitment to agroforestry. There is hardly an ecological or forest restoration motivation for agroforestry in the study area. Ecologically smart agriculture or the restorative importance of agroforestry appears to be poorly entrenched among farmers in the study area.

Keywords: forest loss, attitude, perception, agroforestry, commitment.

IZVLEČEK

Kmetijsko-gozdarski sistemi imajo strateško vlogo pri usklajevanju pridelave hrane z ohranjanjem biotske raznovrstnosti gozdov. Nujno je metodološko transparentno raziskati koristi in ekološke vidike, ki so temelj predanosti malih kmetovalcev k kmetijsko-gozdarskim sistemom. Ta raziskava je zato poskus analize relativnega pomena percepcije kmetov do izgube gozdov in koristi kmetijsko-gozdarskih sistemov v kontekstu predanosti kmetov kmetijsko-gozdarskim sistemom v populaciji kmetovalcev v državi Oyo na jugozahodu

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Nigerije. Študija je presečna raziskava, v kateri je bilo med poljedelci, izbranimi z namenskim vzorčenjem v skupinah, izvedenih 400 strukturiranih intervjujev. Za analizo spremenljivk je bilo ocenjeno strinjanje anketirancev s sklopi trditev. Za preverjanje značilnosti razlik v predanosti anketirancev kmetijsko-gozdarskim oblikam med podskupinami glede na spol in starost/izobrazbo sta bila uporabljena t-test neodvisnih vzorcev in enosmerna ANOVA. Pearsonov korelacijski koeficient je bil uporabljen za preučevanje razmerja med spremenljivkami. Rezultati kažejo, da je 57,8 % anketirancev izrazilo "visoko" predanost kmetijsko-gozdarski obliki gospodarjenja. Spol, starost in izobrazba so imeli vpliv na predanost ($p < 0,05$). Med odnosom do izgube gozdov in predanostjo zavezanostjo kmetijsko-gozdarski obliki gospodarjenja ni pomembne povezave ($r = 0,038$, $p > 0,05$), to pa velja za povezavo z zaznanimi koristmi ($r = 0,426$, $p < 0,05$). Biti moški, srednjih let in slabo izobražen, bistveno močneje pogojuje manjšo predanost kmetijsko-gozdarski obliki gospodarjenja. Na preučevanem območju skorajda ni ekološko pogojenih vzgibov oziroma motivacije za bodisi kmetijsko-gozdarsko obliko gospodarjenja ali obnovo gozdov. Zdi se, da je ekološko ‚pametno' kmetijstvo ali obnovitvena vloga kmetijsko-gozdarske oblike gospodarjenja med kmeti na preučevanem območju slabo uveljavljeno.

Ključne besede: izguba gozdov, odnos, zaznava, kmetijsko-gozdarski sistemi, predanost

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1 INTRODUCTION

The importance of agroforestry cannot be overemphasized in modern society. Agroforestry is the combination of crop/livestock and trees/shrubs production-cum-management (Martinelli *et al*., 2019). Intensive agricultural production is the greatest threat to forest biodiversity (FAO and UNEP, 2020). Invariably, it is responsible for about 30% of the global emissions of greenhouse gases and it causes the highest utilization of freshwater (Fraser and Campbell, 2019). The provision of food for human survival is a principal cause of biodiversity loss (Erisman *et al*., 2016; Chaudhary, Pfister and Hellweg, 2016; Dudley and Alexander, 2017; Lanz, Dietz and Swanson, 2018). "Anthropogenic land use to produce commodities for human consumption is the major driver of global biodiversity loss" (Chaudhary, Pfister and Hellweg, 2016: 3928). From 2000 to 2010 for instance, 40% and 33% of tropical deforestation were on the account of commercial and subsistence agriculture respectively (FAO and UNEP, 2020). The human race is indeed confronted with the need to balance food production and forest biodiversity conservation, to guarantee environmental sustainability. This balancing may vary from "land-sparing" to "land-sharing" approaches. The former relies on technologies to promote high-yielding agriculture such that land is spared for conservation. Contrarily, agroforestry is a land-sharing approach that necessitates the combination of production and conservation in land use (Ibid).

Agroforestry is an indigenous agricultural practice in Africa (Gonçalves *et al*., 2021). Cardinael *et al*. (2018) as well as Rosenstock *et al.* (2019b) identified several categories of agroforestry including silvopasture, alley cropping, windbreaks, agrisilviculture, parklands, fallows, multistrata, hedgerows, etc. Agroforestry is ecologically significant because it can be on of the strategies of restoring degraded forest. The rate of forest loss is now highest in Africa where

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3.94 million hectares of forest area was lost from 2010 to 2020 (FAO and UNEP 2020). This rate of loss was 4.74 million hectares globally within the same decade (Ibid). Halting forest loss also means less loss of forest biodiversity. Forest biodiversity enhances human adaptation to the environment and it is an essential element of environmental sustainability (Mori, Lertzman and Gustafsson, 2017). Unfortunately, the human environment is profoundly transformed by various forms of human-caused, anti-environmental activities. For instance, forest lands are indiscriminately cleared in favour of agricultural production. Croplands now constitute one-third of the earth (Rosenstock *et al*., 2019a). Agricultural production increases the amount of greenhouse gases in the atmosphere, which aggravates the occurrence and intensity of extreme weather events (Intergovernmental Panel on Climate Change-IPCC, 2014). The attitude of especially farmers towards forest loss is, therefore, a subject of interest. This attitude is suggestive of the evaluation of the imperativeness of forest as a land-use option, which is ideally, a motivator for agroforestry. Forest conservation is one of the salient desirable outcomes of our time. Losing forests is tantamount to losing lifelines. About 75% of new infectious diseases originate from animal/man interaction, which typically happens with increasing forest loss (Austin, 2021; UNFFS, 2021). The deforestation could also be related to the development of infectious diseases that creates public health concerns (Brock *et al.*, 2019; Guégan *et al.*, 2020; Ellwanger *et al.*, 2020). Even the current covid-19 pandemic that the world is battling is argued by some authors to be related to forest loss (Brancalion *et al.*, 2020; Austin, 2021; UNFFS, 2021). Further, 25% and 80% of modern medicines in advanced and developing countries are plant-based respectively (UNFFS, 2021).

The commitment of resource-poor smallholder farmers to agroforestry would be beneficial for several reasons. Agroforestry enables the diversification of income, improvement of yields and therefore the mitigation of poverty in developing countries (Pandey, 2007; Quinion *et al*., 2010; Pratiwi and Suzuki, 2019). More importantly, agroforestry is ecologically beneficial. It presents ecosystem services including improvements in air and water quality, climate change mitigation and biodiversity (Duguma *et al*., 2019; Chapman *et al*., 2020). Noordwijk (2020: 1) described agroforestry as "an interface of specific concerns of 'Agriculture' and 'Forestry' with wider perspectives on rural and peri-urban livelihoods and landscapes as reflected in all the 17 Sustainable Development Goals". Farmers' commitment to agroforestry is truly a sustainable development gain. The adoption of agroforestry is a decision-making process that is informed by the interaction of complex factors, including the perceived benefits of agroforestry and the perceived imperativeness of forest as a land-use option. These variables are possible barriers and enablement to adoption, which calls for methodical investigation in the interest of optimal agroforestry practices. It is argued that farmers would commit themselves to agroforestry depending on the extent to which they evaluate benefits accruable from the same as well as how well they maintain pro-forest conservation attitudes. The motivations for agroforestry traverse ecological and non-ecological gains. These motivations are indications of people's evaluation of the ecological imperativeness of agroforestry. Understanding these motivations are important ways to understanding the complexity of the decision to commit to agroforestry among farmers. This work is therefore an attempt to examine the relative importance of farmers' attitudes towards forest loss and perceived benefits of agroforestry in the degree of farmers' commitment to agroforestry in southwestern Nigeria. The influence of socio-demographic variables on this commitment was also examined. These variables are represented in the conceptual framework in figure 1. The research questions attempted in this work include the following:

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1. What is the respondent's attitude towards forest loss? How do they perceive the benefits deriving from agroforestry? How committed are they to agroforestry?
2. What is the influence of gender, age and education on the respondent's commitment to agroforestry?
3. What is the correlation between pairs of attitudes to forest loss, perceived benefits of agroforestry and commitment to agroforestry among respondents in the study area?

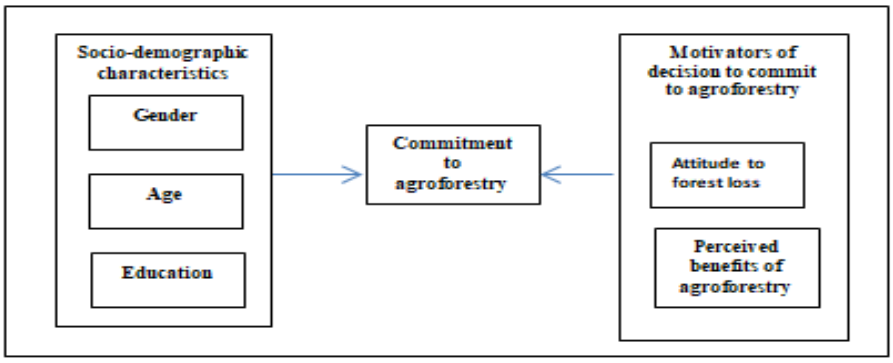

Figure 1: Conceptual framework of the study

2 MATERIAL AND METHODS

2.1 STUDY AREAS/RESEARCH DESIGN

The Oyo West and the Oyo East Local Government Areas (LGAs) of Oyo State, southwestern Nigeria constituted the study areas (see figure 2). Nigeria is a vast, West-African country in sub-Saharan Africa, extending up to 923,773 km^2, which is about 14% of the total land area of West Africa. Nigeria's population of over 200 million is projected to exceed 300 million by 2050 (Ogbonnaya *et al*., 2019). The southwestern region is one of Nigeria's six geo-political zones and the motherland of the Yorùbá people. Oyo state is one of the six states that make up the southwestern region. There are 33 geopolitical units known as Local Government Areas (LGAs) in Oyo state while Ibadan is the capital city of the state. Ibadan comprises of 11 LGAs— five urban and six peri-urban LGAs. The other 22 LGAs are rural in outlook, though many parts show features of semi-urban areas (Gbadegesin and Olorunfemi 2012). Oyo West and Oyo East LGAs are representative of the remaining 22 LGAs. The total land area of Oyo West and Oyo East is 526 km^2 and 144 km^2 respectively. The coordinates of the LGAs are 7°56'29.65"N 3°49'18.48"E and 7°52'43.61"N 4°01'16.75"E respectively. There are 10 and 9 political wards in Oyo West and Oyo East LGAs respectively. According to the latest Nigerian censuses of 2006, the population of Oyo West and Oyo East LGAs are 136,236 and 123,846 respectively (National Population Commission 2007). Farming is the dominant occupation of the people of the study area.

The design is a cross-sectional survey that targeted crop farmers in the study area. Hence, the study was a snapshot in time.

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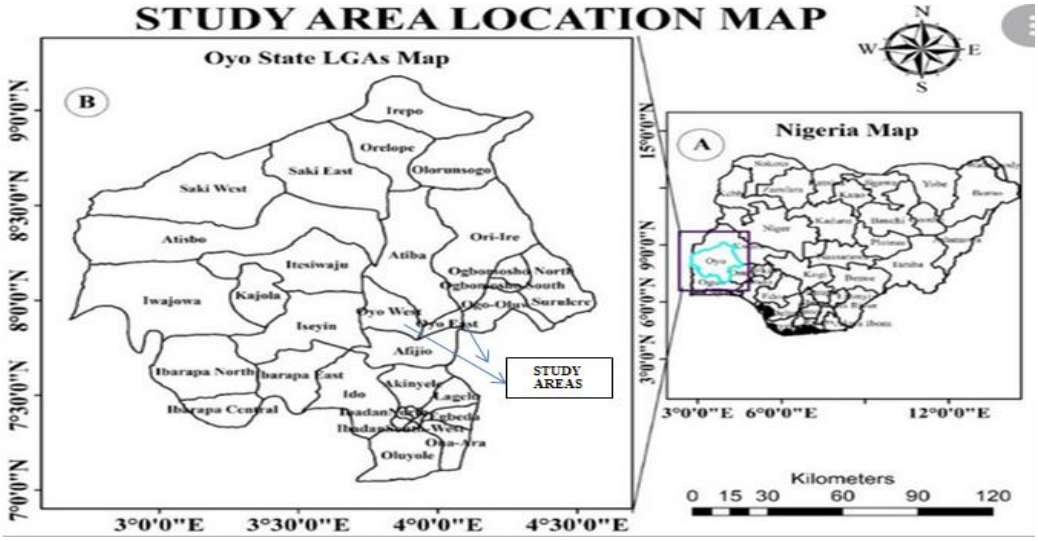

Figure 2: A map showing the study areas

2.2 SAMPLING PROCEDURE

Oyo West and the Oyo East Local Government Areas (LGAs) of Oyo State, southwestern Nigeria were purposely selected in the initial phase of sampling. The population of Oyo West and Oyo East (136,236 + 123,846 = 260,082) was projected to estimate the 2021 population of the study area, using equation below:

$$P = P_0 \times e^{rt}$$

Where P is the final population, Po is the initial population, e is the exponential function, r is the growth rate, and t is the time interval (15 years). The 2021 projected population was 384,136. This figure was taken as the total population (N). This is because farming is the principal occupation in the study area and population-level statistics regarding people's occupation in the study area is unavailable. The N was used in the calculation of the required sample size using the modified version of the Cochran formula below:

$$\mathrm{n} = \frac{\boldsymbol{Npqz^2}}{\boldsymbol{e^2(N-1)+pqz^2}}$$

Where n is the required sample size, N is the population = 384,136, *p*, the assumed proportion of the population who exhibit the sentiment of interest, 50% = 0.5; *q* is 1–*p*; *z* is obtained from 95% confidence on *z* table as 1.96; and *e* is the precision level (i.e., the margin of error) = 5% or 0.05. The required sample size was 384 but this was increased to 400. Four wards were randomly selected from each LGA that was selected. In Oyo West, Iseke, Isokun, Ajokidero and Fasola/Soku were selected. In Oyo East, Alaodi/Modeke, Oke Apo, Ajagba and Apaara were randomly selected. Villages and communities of the randomly selected wards were identified and two villages/communities were selected therefrom. Hence, in Oyo West, Obanoko, Oloya, Apogidan, Ogunda, Soku, Ejemu, Orowole and Fasola were selected. In Oyo East, Jakan, Ogbagba, Imeleke, Obede, Ago-ana, Onsa, Gudugbu-orile and Abu were selected. Data collection took place in the 16 villages/communities. The help of farmer associations was sought in the random selection of respondents. The list(s) of members was obtained and used as sampling frames. The systematic random sampling principle informed the sampling intervals

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(k) that enable making a list for selection of respondents. In a few instances, prospective respondents were unavailable and were replaced with willing but unselected respondents. In each of the sixteen communities, 25 copies of the questionnaire for the study were administered.

2.3 MEANS OF DATA COLLECTION – VARIABLES AND MEASURES

The questionnaire was used to collect data and was administered to respondents via structured interview. A version of the questionnaire in Yorùbá language was developed to ease the process of communicating with respondents who do not speak the English language. The response rate was 100% when data collection took place in August/September 2021. *Attitude towards forest loss* was operationally defined as the respondent's assessment of the favourability or unfavourability of reduction in forest cover. It was measured with an authors-developed list of 6 statements linked to a Likert scale with possible responses 'strongly agree' (4), 'agree' (3), 'disagree' (2) and 'strongly disagree' (1), making the possible total score for all statements to range from 6 to 24. The higher the score, the more pro-forest conservation the attitude towards forest loss. The scale was found to be reliable with a Cronbach's alpha score of 0.901. *The perceived benefit of agroforestry* is the respondent's evaluation of the advantages of engaging in agroforestry. It was assessed with an authors-developed list of 13 statements. Response categories included 'strongly agree' (4), 'agree' (3), 'disagree' (2) and 'strongly disagree' (1). The total score could range from 13 to 52. The higher the score, the more advantageous the perceived benefit of agroforestry. Cronbach alpha was 0.735. *Commitment to agroforestry* is the extent to which farmers are dedicated to the practice of agroforestry. The commitment was measured using an authors-developed list of 8 statements. Response categories also included 'strongly agree' (4), 'agree' (3), 'disagree' (2) and 'strongly disagree' (1). Respondents could score from 8 to 32. The higher the score, the higher the commitment to agroforestry. Cronbach alpha was 0.884. See Table 2 for all authors-developed statements.

2.4 DATA ANALYSES

The distributions of socio-demographic characteristics of respondents were assessed by means of descriptive statistics (absolute and relative frequencies). The summary of items in the scales of attitude towards forest loss, perceived benefits of agroforestry and commitment to agroforestry were examined with means and standard deviations. Univariate analyses of variables were conducted by using the mean of data to categorize respondents into two: those who scored below the mean were regarded as exhibiting weak attitude, weak perception and low commitment. On the other hand, those who scored the mean and above were regarded as having a strong attitude, strong perceived benefit and high commitment. Kolmogorov Smirnov test was used to assess the normality of distributions of variables and the distributions were normal ($p > 0.05$). Independent samples *t*-test and one-way ANOVA were used to examine the significance of the difference in respondents' commitment to agroforestry across sub-groups of gender and age/education respectively. Levene's test was the tool for examining the homogeneity of variance across sub-groups of gender, age and education. Post-hoc multiple comparison test (Tukey HSD) was used to identify homogenous means. Linearity test was conducted and its output determined whether Eta and eta^2 or R and R^2 were used to examine effect size. Pearson correlation coefficient was used to examine the relationship between pairs

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of attitude towards forest loss, perceived benefits of agroforestry and commitment to agroforestry. Statistical Package for Social Sciences (version 24) was used for data analyses.

3 RESULTS

3.1 SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Male and female respondents constituted 77% and 23% of the sample respectively. The age of respondents is close to a normal distribution. More than a third, the highest proportion of respondents (34.5%) were aged from 36 to 45 years. This suggests that farmers are likely to be middle-aged persons in the study area. The mean age of respondents was 43.1 (range is 16 to 80 years). The distribution of the highest educational qualification shows that about 1 in every 3 (33.8%) respondents had no formal education. Further, respondents who completed primary (27.0%) and secondary school (23.8%) were the second and third highest proportions respectively. Higher education is rather uncommon among respondents: those who had post-secondary education (8.5%), first degree (4%) and postgraduate degree (3%) were rather marginally represented in the sample. There is a limitation of formal educational achievement among respondents in the study area. The distribution of the socio-demographic characteristics of respondents is in Table 1.

Table 1: Socio-demographic characteristics of respondents (N = 400)

Socio-demographic characteristic	Sub-groups	Frequency	Percentage
Gender	Male	308	77.0
	Female	92	23.0
Age*	16-25	34	8.5
	26-35	81	20.3
	36-45	138	34.5
	46-55	87	21.8
	56-65	41	10.3
	66-above	19	4.8
Education	No formal education	135	33.8
	Primary education	108	27.0
	Secondary education	95	23.8
	Post-secondary education	34	8.5
	Bachelor's degree**	16	4.0
	Postgraduate education	12	3.0

*The mean ±SD of age was 43.13 ± 12.95, minimum = 16, maximum = 80.

3.2 ANALYSES OF ITEMS

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Means and additional statistics on items in the scales that were used in the assessment of variables are given in Table 2. The extent of respondent's agreement with the six items on a scale of attitude towards forest loss was strong: the mean scores of the items ranged from 3.65 to 3.79. These means generally signify a high level of negative (pro-forest conservation) attitude towards forest loss. On the scale of perceived benefits, the items which affirmed that agroforestry 'alleviates climate change' (mean = 3.81) and 'enhances rural dwellers' quality of life' (mean = 3.77) reflects most agreements. The extent of respondent's agreement with the positions that agroforestry 'enables income diversification' (mean = 3.67), 'increases total farm income' (mean = 3.66) and 'protects the environment' (mean = 3.62) was comparable and high. The means of the scores given to the premise that agroforestry 'increases soil quality' and 'enhances the diversity of agricultural products' (3.46) were the same and relatively high. Respondent's evaluation of agroforestry's capability to 'provide recreational opportunities' (mean = 3.30), 'enable scenic beauty of the environment' (mean = 3.31) and 'maximize the use of agricultural lands' (mean = 3.33) was also quite high and very simlar. Respondent's assessment of the potential of agroforestry to 'increase resilience against pests' (mean = 2.48), 'reduce the overall use of chemicals' (mean = 2.20) and 'reduces farm odours' (mean = 2.19) were poorest. These means are proxy indicators showing the areas in which the farmer's confidence regarding agroforestry are poorest. Respondent's appraisal of the eight items in the commitment to agroforestry scale was very similar. Mean scores of the items ranged from 3.41 to 3.58. These means superficially but strongly suggests the high extent of the farmer's dedication to agroforestry in the study area.

Table 2: Descriptive statistics of respondents' level of agreement with statements on forest loss, benefits of agroforestry, commitment to agroforestry, and indications of reliability

Attitude towards Forest Loss	Mean ±SD	Minimum	Maximum	Cronbach's alpha
Human progress is hampered when forests are lost	3.70±0.46	3	4	0.901
Losing forests is catastrophic for the human race	3.65±0.48	3	4	
Losing forests endangers human health	3.70±0.46	3	4	
The future generations of human beings will suffer if we continue to lose our forests	3.69±0.46	3	4	
Losing forests is one of the worst things that can happen to our environment	3.71±0.45	3	4	
A society that loses its forests loses its treasure	3.79±0.43	1	4	
Perceived Benefits of Agroforestry (*The planting of trees along with crops*)				
Increases soil quality	3.46±0.50	3	4	0.735
Enhances diversity of agricultural products	3.46±0.50	3	4	
Increases resilience against pests	2.48±0.98	1	4	
Alleviates climate change	3.81±0.40	2	4	
Protects the environment	3.62±0.51	1	4	
Reduces farm odours	2.19±0.91	1	4	
Reduce the overall use of chemicals	2.20±0.95	1	4	
Enables scenic beauty of the environment	3.31±0.53	2	4	
Maximizes the use of agricultural lands	3.33±0.63	2	4	
Provide recreational opportunities	3.30±0.55	2	4	

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Enhances rural dwellers' quality of life	3.77±0.42	3	4	
Increases total farm income	3.66±0.47	3	4	
Enables income diversification	3.67±0.74	3	4	
Commitment to Agroforestry				
I would be very happy to spend the rest of my farming career planting trees along with crops	3.58±0.62	2	4	0.884
I enjoy discussing the planting of trees along with crops with people who are not even farmers	3.45±0.51	2	4	
I feel as if the problems that are usually encountered in the planting of trees along with crops are my own	3.44±0.66	2	4	
How I wish many more farmers will plant trees along with crops	3.41±0.50	3	4	
Planting trees along with crops has a great deal of personal meaning for me	3.47±0.59	2	4	
I could take a loan to ensure the success of planting trees along with crops	3.47±0.51	2	4	
It is important for farmers to prioritize the planting of trees along with crops	3.49±0.51	2	4	
I take a lot of pride in the planting of trees along with crops	3.54±0.50	3	4	

3.3 UNIVARIATE ANALYSES OF ATTITUDE TOWARDS FOREST LOSS, PERCEIVED BENEFITS OF AGROFORESTRY AND COMMITMENT TO AGROFORESTRY AMONG RESPONDENTS

The mean ±SD of attitude towards forest loss is 22.2±2.2 (min = 18, max = 24). The mean score is close to the maximum score, suggesting the generally high score that respondents obtained on the scale of attitude. Figure 3 indicates that 69.0% (276) of respondents showed a 'strong' agreement towards negatives of forest loss, indicating a high level of pro-forest conservation attitude. 124 respondents (31%) who had a 'weak' attitude represent a noticeable limitation to the prevailing pro-forest conservation attitude towards forest loss in the study area. The mean ±SD of the perceived benefit of agroforestry is 42.3±4.0 (min = 33, max = 52). This mean score is quite high. Figure 3 also shows that 227 (56.8%), as opposed to 173 (43.3%) respondents, maintained a 'strong' as opposed to a 'weak' perception of the benefits of agroforestry. Hence, the perceived benefit of about 6 of every 10 respondents is robust in the study area. The mean ±SD of commitment to agroforestry is 27.8±3.3 (min = 21, max = 32). The extent of this commitment is also quite high, with 231 (57.8%) respondents exhibiting a 'high' commitment to agroforestry. Meanwhile, 169 (42.3%) demonstrated 'low' commitment. Commitment to agroforestry is palpable in the study area, and close to 6 of every 10 exhibits the same in high proportion.

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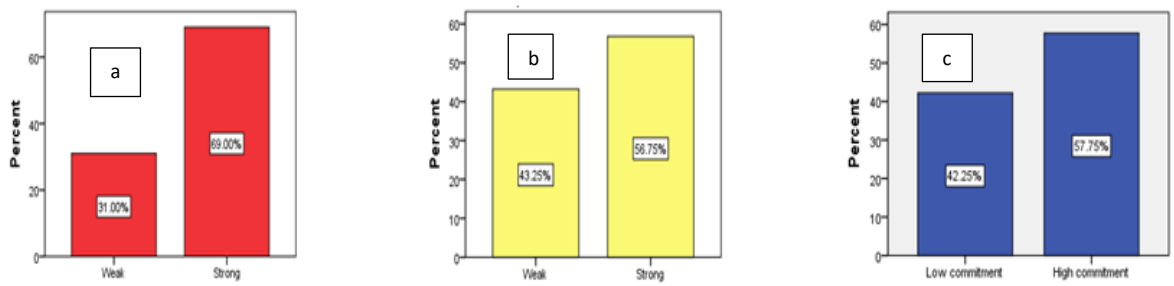

Figure 3: Dimensions of attitude towards forest loss (a), perceived benefit of agroforestry (b) and commitment to agroforestry (c).

3.4 EFFECTS OF GENDER, AGE AND EDUCATION ON COMMITMENT TO AGROFORESTRY

The presentation of the summary of results obtained in the bivariate analyses of socio-demographic characteristics and commitment to agroforestry is given in Table 3. Men exhibit stronger commitment (mean = 28.1) when compared with their women counterparts (mean = 27.1). This difference in mean scores was significant ($p < 0.05$) and homogeneity of variance between gender sub-groups was not rejected ($p > 0.05$). Eta is 0.126 and eta^2 is 0.016. Hence, just 1.6% of the variance in commitment to agroforestry is explained by gender.

The degree of commitment to agroforestry initially tended to increase with increasing age but then there are limitations to this position: commitment was lowest among respondents who were of age between 16 and 25 (mean = 25.9) but commitment was very high and comparable among those who aged from 26 to 35 (mean = 28.0), 46 to 55 (mean = 28.3) and 56 to 65 (mean = 28.5). ANOVA revealed that means across sub-groups of age were significantly different ($p < 0.05$). Levene's test affirms the validity of this significant difference because it indicates homogeneity of variance across sub-groups of age ($p > 0.05$). The result of posthoc multiple comparison test shows that the 16-25 y. is significantly different from the 26-35 y. ($p = 0.001$), the 36-45 y. ($p = 0.002$), the 46-55 y. ($p = 0.000$), the 56-65 y. ($p = 0.001$) but not the 66-above y. ($p = 0.274$) age subgroups. This implies that the manifestation of commitment to agroforestry across age sub-groups resemble an inverted U distribution that is low at the extremes of age sub-groups and high for age sub-groups in between. The effect of age on commitment deviated from linearity ($F = 3.454$, $p = 0.009$). Eta is 0.208 while eta^2 is 0.043. Hence, 4.3% of the variance in commitment is explained by age.

The extent of commitment to agroforestry among respondents who had no formal education (mean = 28.2), primary education (mean = 28.0) and secondary education (mean = 28.3) is high and very similar. The mean commitment score among respondents who were bachelor'sdegree holders was 26.4. Respondents who held post-secondary education (mean = 25.9) and postgraduate degree (mean = 25.8) had the lowest commitment. Means across sub-groups of education were significantly different ($p < 0.05$) and homogeneity across sub-groups of education was confirmed ($p > 0.05$). Hence, education has an effect on commitment to agroforestry. The separation of means revealed that the non-formal education sub-group is not significantly different from the primary ($p = 0.648$) and the secondary ($p = 0.839$) sub-groups. However, the non-formal education sub-group is significantly different from the post-secondary ($p = 0.000$), the first degree ($p = 0.031$) and the postgraduate degree ($p = 0.011$) sub-

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groups. The effect of education on commitment was linear (F = 14.084, p = 0.000). R was -0.183 while R^2 was 0.034. These indicate the inverse relationship between education and commitment to agroforestry, and 3.4% of the variance in commitment is explained by education.

Table 3: Effects of gender, age and education on commitment to agroforestry by means of tests of equality of means and assessment of effect sizes

Socio-demographic variable	Sub-groups	Mean±SD	Levene's test for homogeneity of variances		Independent samples *t*-test		ANOVA		Eta	Eta^2	R	R^2
			Levene's statistic	*p* value	*t* statistic	*p* value	F statistic	*p* value				
Gender	Male	28.1±3.3	0.664	0.416	2.54	0.012	-	-	0.126	0.016		
	Female	27.1±3.1										
Age	16-25	25.9±3.3	1.330	0.249	-	-	3.549	0.004	0.208	0.043		
	26-35	28.0±3.3										
	36-45	27.9±3.3										
	46-55	28.3±3.2										
	56-65	28.5±3.0										
	66- above	26.9±2.6										
Education	Non-formal	28.2±3.3	1.330	0.250	-	-	5.050	0.000	-	-	-0.183	0.034
	Primary	28.0±3.2										
	Secondary	28.3±3.2										
	Post-secondary	25.9±2.7										
	First degree	26.4±3.2										
	Postgraduate	25.8±2.1										

3.5 RELATIONSHIP BETWEEN ATTITUDE TOWARDS FOREST LOSS, PERCEIVED BENEFIT OF AGROFORESTRY AND COMMITMENT TO AGROFORESTRY

The result of bivariate correlation in Table 4 shows that the relationship between attitude towards forest loss and commitment to agroforestry is positive, very weak and insignificant (r = 0.038, $p > 0.05$). On the contrary, the relationship between perceived benefits of agroforestry and commitment to agroforestry is positive, quite strong and significant (r = 0.426, $p < 0.05$). The stronger the perceived benefits of agroforestry, the stronger the commitment to agroforestry. Incidentally, there is a positive and insignificant relationship between attitude towards forest loss and perceived benefits of agroforestry.

Table 4: Relationship between pairs of attitude towards forest loss, perceived benefits of agroforestry and commitment to agroforestry

		Attitudes towards forest loss	Perceived benefits of agroforestry	Commitment to agroforestry
Attitudes towards forest loss	*R*	1	0.033	0.038
	p value	-	0.505	0.450
Perceived benefits of agroforestry	*R*	0.033	1	0.426*
	p value	0.505	-	0.000
Commitment to agroforestry	*R*	0.038	0.426*	1

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	p value	0.450	0.000	-

*Significant correlation

4 DISCUSSION

The finding of generally high means in the item analysis of attitudes signifies a high level of pro-forest conservation attitude towards forest loss. This is in line with the finding reported by Meijer *et al*. (2015: 59) who asserted that their respondents, a group of farmers in Malawi, "generally have negative attitudes towards cutting down trees from the forest". Meijer *et al*. (2015) further reported that their respondents generally opined that people in their communities would frown at tree cutting. The indirectly relevant report of Ansong and Røskaft (2011) also showed that forestry stakeholders in Ghana generally held positive attitudes towards forest management. The current attitude towards forest loss indicates the popularity of pro-forest conservation among respondents in the study area. This is probably borne out of the cultural capital of the people of the study area. Ibrahim (2021: 497) asserted that "the forest is a classical locale of traditional culture among many peoples including the Yorùbá of southwestern Nigeria". The generally strong perceived benefit of agroforestry in the current study is similar to the finding reported by Ruheza *et al*. (2012). They reported that 87% of their respondents in Uluguru Mountains, Tanzania, believed that agroforestry is beneficial on varying accounts. Elbakidze *et al*. (2021) similarly reported that 81% of their respondents selected agroforestry landscapes as their favourite environments because of their belief that agroforestry enhances the quality of life. Awazi and Avana-Tientcheu (2020) also reported that 100%, 98%, 86% and 76% of their respondents, a group of farmers in Cameroon, believed that agroforestry was beneficial with regard to food, fuelwood, building materials and shade respectively. Krcmárová *et al*. (2021) also reported that 79%, 75%, 58% and 36% of a group of Czech farmers anticipated that agroforestry contributes to the environmental beauty, reduces erosion, ameliorates microclimate and helps in the diversification of income, respectively. The current study and other findings generally impress the idea that agroforestry is popularly conceptualized as beneficial by farmers. This resource could be harnessed in interventions for increased adoption of agroforestry. Item analysis also indicates strongly high extent of the farmer's dedication to agroforestry in the study area. Studies regarding farmers' commitment to agroforestry are seemingly scarce but related findings support the high extent of commitment reported in the current study. Meijer *et al*. (2015) reported that a group of Malawian farmers generally maintained a positive attitude towards tree planting. Islam *et al*. (2021) also reported that 76.25% and 68.7% of their respondents, a group of farmers in the Coastal Belt of Sundarbans, Bangladesh, affirmed that they liked agroforestry and held a favourable attitude towards agroforestry respectively. However, Olagunju *et al*. (2020) reported that only 41% of their respondents, a group of farmers in Kaduna state, northern Nigeria, held favourable attitudes towards agroforestry. Borremans *et al*. (2016) also reported that only 55% of the farmers they studied in Flanders, the northern region of Belgium were conversant with agroforestry. Borremans *et al*. (2016) further reported that respondent's attitude to agroforestry was poor (mean = 2.95, minimum = 1, maximum = 7). Current findings support the position that farmers are generally faithfully committed to agroforestry. This warrants optimism regarding the pervasiveness and expansion of agroforestry in the study area.

Gender has a main effect on commitment to agroforestry, which is in disfavour of women. This is probably a reflection of socio-cultural structures which typically favours men when

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compared with women. For instance, the study of gender and power dynamic in farming households undertaken by Kalanzi *et al*. (2020) in the eastern highlands of Uganda indicates that men typically amass so much power in agroforestry-related decision-making when compared with their female counterparts. The strong manifestation of commitment to agroforestry in the middling age sub-groups shows that middle-age farmers are significantly predisposed to engage more in agroforestry. Middle-aged respondents appears to be resourceful for agroforestry expansion in the study area. Commitment to agroforestry is significantly high among farmers with none or poorer education while this commitment is significantly low among farmers havin post-secondary education and higher. This is counter-intuitive considering that education typically predisposes individuals towards holding and exhibiting responsible positions. This finding will surely benefit from further studies.

Attitude towards forest loss is not correlated to the extent of the farmer's dedication to agroforestry. This is contrary to expectations. Meanwhile, related findings are seemingly non-existent but indirectly relevant findings support this finding. Borremans *et al*. (2016) reported that the farmers they studied in Flanders were quite confident about the positive effects of agroforestry, but they tended to believe that adopting and maintaining agroforestry would be rather difficult. Other indirectly relevant finding shows that the reverse of the expectation that attitude towards forest loss will bear significance for farmer's commitment to agroforestry might stand the test of time. Rahman *et al*. (2017) questioned whether the adoption of agroforestry reduces pressure on forests by comparing some livelihood activities of swidden agriculture practitioners and practitioners of agroforestry. Swidden agriculture is also called slash-and-burn farming or shifting cultivation which is responsible for a high rate of deforestation and forest degradation and is therefore unsustainable. Rahman *et al*. (2017) reported that among the farmers they studied in west Java, Indonesia, those who practiced swidden agriculture and agroforestry cleared 0.29 hectare and 0.09 hectares of forest area in the five years before their study. The former also collected 33 kg of firewood from the forest as opposed to 5.65 kg that was collected by the latter in the one month before the study. The finding of Rahman *et al*. (2017) shows that the practice of agroforestry resulted in a reduced extent of forest-degrading behavior which causes forest loss. Current findings suggest that the link between forest conservation/forest loss and agroforestry appears to be poorly understood in the study area. Contrarily, current findings indicate that the stronger the perceived benefits of agroforestry, the stronger the commitment to agroforestry A related report is supporting this finding. Meijer *et al*. (2015) reported that the attitude of a cohort of Malawian farmers towards agroforestry was generally positive and this attitude significantly influenced tree planting.

5 CONCLUSIONS

Gender, age and education are significant socio-demographic variables in matters of farmer's commitment to agroforestry: women, youngest and oldest as well as highly educated farmers tend to maintain a significantly lower commitment to agroforestry. While attitude towards forest loss is inconsequential for commitment to agroforestry, perceived benefits of agroforestry bear increased commitment to agroforestry among farmers in the study area. The expectation that farmers would commit themselves to agroforestry depending on the extent to which they evaluate benefits accruable from the same is therefore justified in this study. Focusing on these benefits while promoting the widespread adoption of agroforestry is therefore of great importance. On the contrary, the expectation that farmers will be committed

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to agroforestry as much as they maintain pro-forest conservation attitudes to forest loss is not justified in this study. There is hardly an ecological or forest restoration motivation for agroforestry in the study area. Hence, environmental intervention should impress the restoration of lost forests as a motivation for agroforestry.

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