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ENVIRONMENTAL RISK PERCEPTION AND FOREST CONVERSION BEHAVIOUR AMONG FARMERS OF AFIJIO LOCAL GOVERNMENT AREA OF OYO STATE, NIGERIA

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ABSTRACT

Conversion of forest land for agricultural purposes is a huge source of loss of forest land but the role of environmental risk perception in the exhibition of this behaviour is under-explored. Hence, this study was designed to examine the environmental risk-perception of forest conversion and how this perception is associated with forest conversion behaviour among farmers in Afijio Local government area (LGA), Oyo State, Nigeria. The research design was a cross-sectional survey targeted at crop farmers. Random sampling was used to select 320 respondents. Environmental risk-perception and forest conversion behaviour were assessed with author-developed, four-item Likert scale and three-item index respectively. Data collection featured the interview-administration of a structured questionnaire among respondents in the study area. Chi-square was used to assess the significance of associations between socio-demographic characteristics and behaviour as well as between perception and behaviour. Contingency coefficient was used to assess the extent of significant associations. Results indicate that 70% of respondents seek opportunities to convert forestland for agricultural purposes. Gender is not associated with the level of forest conversion behaviour($p> 0.05$) but age and education are ($p< 0.05$). Environmental risk perception is not significantly associated with forest conversion behaviour ($p> 0.05$).Age and education are consequential socio-demographic factors associated with forest conversion behaviour but gender is not. Environmental risk perception is not significantly consequential for forest conversion behaviour among respondents. Hence, the control of conversion of forest land for agricultural purposes requires beyond people's environmental risk-perception in the study area.

Keywords: Environmental risk perception, forest conversion, land expansion, forest degradation.

Introduction

Forests are refuge to most of the earth's terrestrial biodiversity. Man's interaction with, and use of forests is therefore determinant of the conservation of the world's biodiversity (FAO and UNEP, 2020).Biodiversity is central in ensuring the preservation of ecosystem services, and it guarantees the adaptability of the environment (Corral-Verdugo *et al*., 2009, Fusaro *et al*., 2018). Unfortunately, Africa is losing its forest progressively whereas this loss is retrogressive in other regions of the world: from 2010 and 2020, 4.74 and 3.94 million

hectares of forest area were lost globally and in Africa respectively (FAO and UNEP, 2020). Although a conglomeration of factors is responsible for forest loss, the conversion of forest area for agricultural purposes is singled out as germane in developing societies like Nigeria (Miyamoto, 2020). Olorunfemi *et al*. (2021) asserted that agricultural expansion accounts for 70 to 80% of forest loss in Africa. Between 2000 and 2011, 40% of tropical deforestation was on account of commodity crop production and sub-Saharan Africa is top of the three regions experiencing the highest rates of expansion in cropland (Ordway *et al*., 2017).This showcases the significance of agricultural expansion in environmental sustainability.

The pursuit of environmental sustainability must keenly feature human dispositions because the essence of sustainable development center on peoples' environmentally-preserving orientations cum behaviours which does not compromise the ability of future generations to meet their needs. Peoples' environmental orientations have assumed center stage in contemporary times because environmental challenges are largely anthropogenic in character, with the implication that ameliorating such challenges must be human-dependent. Although several factors including economic motivations and farm physical conditions could predispose farmers towards converting forest land for agricultural purpose (Howley *et al*., 2015), the perception of environmental risk should ideally direct the course of farmers' decision-making. Environmental sensitivity is a sentiment that ought to be exhibited by all peoples especially farmers. Agriculture features prominently in the quest for sustainable development because it is the single, foremost driver of global environmental change and therefore a fundamental threat to global sustainability (Melchior and Newig, 2021).So, farmers' perception of environmental risk of forest conversion behaviour is certainly a subject of considerable importance to sustainable forestry.

Environmental risks are hazards that the environment is exposed to. Examples are flooding, extreme temperatures, draught, etc. How people make sense of these hazards is the thrust of environmental risk perception. Environmental risk perception is the interpretation of environmental events and/or environmental change as potentially hazardous situations (Magalhães *et al*., 2019). The systematic study of risk perception is beneficial because it aids the understanding of what individuals count as local environmental challenges which ultimately inform subsequent environment-related behaviour. For instance, the conversion of forest land for agricultural purposes could be linked to people's assessment of the environmental risk of such conversion. In this light, this study was designed to examine environmental risk-perception of forest conversion and how this perception is associated with forest conversion behaviour among farmers in AfijioLocal government area (LGA), Oyo State, Nigeria.

Methodology

Study area

The study area was Afijio Local Government Area (LGA) of Oyo State, Nigeria. Oyo State has the largest landmass of about 29,000 km^2,out of the six States in the southwestern geo-political zone (Fasona *et al*., 2020). Forests of Oyo State are vastly exploited: forest land area was 16% of total land area in 1986 but this reduced to 14.5% by 2006 and reduced sharply to 4% by 2016 (Fasona *et al*., 2020). Oyo State is made up of thirty-three

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LGAs, five of which are core urban and make up the capital city, Ibadan. Another six are at the outskirts of Ibadan and are peri-urban LGAs. The remaining twenty-two LGAs are rural/semi-urban (Gbadegesin and Olorunfemi, 2012). Afijio is one of the remaining twenty-two LGAs. Its landmass is about 1.365km^2 (Adeoye *et al*., 2020) and it consists of six districts—Akinmorin/Jobele, Ilora/Oluwa-tedo, Awe, Fiditi, Imini and Iware. The last Nigeria population census shows that the population of the LGA is 134,173 (National Population Commission, 2007). Farming is very popular in the study area; the people usually plant food crops like yams, maize and cassava as well as vegetables.

Sampling procedure and data collection

The study design was a cross-sectional survey that was targeted at crop farmers. The available latest population of Afijio LGA was used to as the total population for the study because agriculture is the predominant occupation among the people and this is the best available information. The population was projected to determine the required sample size with the use of the formula below:

$P = P_0 \times e^{rt}$ … Equation 1

P= final population, Po= initial population, e= exponential, r= growth rate, t= time interval (15 years). The 2021 projected population at 2.6% growth rate was therefore198,171. This was taken as the total population (N) for the study. The required sample size was determined with the Cochran formula below:

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

n is the required sample size, N is the population = 198,171, *p*, the assumed proportion of the population which exhibit the attribute 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) = 5.5% or 0.055. The required sample size was therefore 317 but it was rounded up to 370. Three (Awe, Akinmorin/Jobele and Fiditi) of the six districts that make up the LGA were randomly selected. The villages of the selected districts were identified and five of the same were randomly selected. Aba-Ogunremi, Aba-Bara, Aiyekale, Awe and Asipa were selected in Awe. In Akinmorin/Jobele, Jagun, Aba-Ibadan, Jobele, Oniyanrin and Akinmorin were selected while Agbaakin, Bello, Egbejoda, Adekunfe, and Ijaiye were selected in Fiditi. There is a lack of information regarding the population of each community to allow for proportional selection of prospective respondents. Therefore, in each of the fifteen communities, twenty-one copies of the questionnaire were administered while five more copies were administered at Jobele.

The questionnaire was used to collect data and was administered via structured interview. It was translated into the local language for the sake of prospective respondents who do not speak the English language. The response rate was 100% after data collection in April 2021.Environmental risk-perception of forest conversion is defined as the extent to which respondents see forest conversion for agriculture as hazardous to the environment. It was assessed with a four-item author-developed Likert scale. Response categories were “strongly agree (4)”, “agree (3)”, “disagree (2)” and “strongly disagree (1)”, making the total score range from 4 to 16.The mean score was used as the criteria to categorize respondents into those exhibiting weak and strong perception. The scale was found to be reliable considering its

Cronbach's alpha score of 0.760.Forest conversion behaviour was defined as the level to which respondents engage in farmland expansion by clearing vegetation of forest land. It was assessed with a three-item author-developed index whose responses were "no (0)" and "yes (1)", making the total score range from 0 to 3. Respondents who scored 0, 1, 2 and 3 were regarded as demonstrating naught, low, medium and high forest-conversion behaviour respectively.

Analytical techniques

Descriptive statistics including frequencies and percentages were used to assess distributions of data. Analyses of responses to the items in the scale of environmental risk perception were attempted using mean and standard deviation while respondents were generally categorized according to the strength of this perception (weak versus strong).Bar-chart was used to visualize the distribution of respondents according to the degree of their environmental risk perception and their level of forest conversion behaviour. Cross-tabulations were used to depict the cross-distributions of socio-demographic characteristics, categories of perception and categories of behaviour. Chi-square was used to examine the significance of associations between socio-demographic characteristics and behaviour as well as between perception and behaviour. The degree of significant association was assessed using contingency co-efficient. Data analyses were done using Statistical Package for Social Sciences (version 24).

Results and Discussion

Socio-demographic characteristics of respondents

More respondents were male (61.9%) while female respondents constituted 38.1% of the study sample. There is a preponderance of male farmers in the study area. In terms of age, the majority (40.9%) of respondents were within the chronological age bracket of 46 to 60 years. The age of 3 of every 10 respondents (29.7%) and another 1 of every 10 (9.7%) ranged from 61 to 75 years as well as 76 and above respectively. The mean±SD of age was 57.29±14.12 (minimum= 19, maximum= 85). These showcase the ageing population of farmers in the study area. Most respondents (30.6%) had post-secondary education while 22.5% of them had primary education. The proportions of those who had no formal and secondary education were 14.7% and 15.9%. Meanwhile, 9.1% and 5.0% of respondents had a first degree and post-graduate education respectively. The distribution of respondent's gender, age and education is presented in table 1.

Table 1: Distribution of respondents' gender, age and education (N = 320)

Socio-demographic characteristic	Sub-groups	Frequency	Percentage
Gender	Male	198	61.9
	Female	122	38.1
Age*	16-30	13	4.1
	31-45	50	15.6
	46-60	131	40.9
	61-75	95	29.7
	76-above	31	9.7

Education	No formal education	47	14.7
	Primary education	72	22.5
	Secondary education	51	15.9
	Post-secondary education	98	30.6
	B.Sc./HND	29	9.1
	Postgraduate	16	5.0
	No response	7	2.2

*The mean ±SD of age was 57.29±14.12, minimum= 19, maximum= 85.

Item analyses of the scale of environmental risk perception and index of forest conversion behaviour

The analyses of responses to items in the scale of environmental risk perception in table 2 show that respondents' agreement with the position that 'converting forest land for agriculture is an abuse of the environment' was strongest (mean ±SD = 3.13±0.85). Respondents' agreement with the idea that forest conversion for agricultural purposes is a cause of numerous environmental problems; one of the biggest causes of environmental problems today and the idea that more of this conversion bears more environmental problems is generally close and fairly high. The means of the items were 2.89, 2.86 and 2.72.It appears that the idea of associating forest conversion with environmental abuse resonates more with respondents.

The distribution of responses to items in the index of forest conversion behaviour is presented in table 3. More than 4 of 10 respondents (42.5%) have cleared forest-land for agricultural purposes in the year of the survey. Up to 6 of 10 respondents (59.1%) converted forest-land to have the plot(s) that they cultivate currently while 7 of 10 (70%) respondents seek opportunities to convert forest-land for agricultural purposes. These are strong indicators of a high level of forest conversion behaviour in the study area.

This is congruent with the report of Kamwi *et al*. (2015), who stated that agricultural expansion is the foremost perceived driver of land use/cover change in the Zambezi region of northern Namibia. Abbas (2009) also reported that cultivated land is the most prominent land-use converted from natural vegetation in Nigeria. In addition, Arowolo *et al*. (2018)used global land-cover maps to estimate the land-use change in Nigeria from 2000 and 2010. They reported that cultivated land area and built-up land area were the only land-use types that increased and the former was higher. The rate at which cultivated land expanded was 1.92% per annum, causinga total growth of 46,892.80 km^2in cultivated land from 2000 to 2010. Further, the loss of forest area and savannah was 9.60% and 5.33% respectively between 2000 and 2010 (Arowolo *et al*., 2018). More specifically, Fasona *et al*., (2020) reported that agricultural land area increased drastically from 21% in 1986 to 37% by 2016 in Oyo state, Nigeria. The current study and existing literature reflect an alarming rate of forest conversion behaviour which constitute a huge threat to biodiversity and of course, environmental sustainability.

Table 2: Distribution of responses to items in the scale of environmental risk-perceptionof forest conversion

Environmental risk perception*	Mean ±SD	Minimum	Maximum	Indicator of reliability (Cronbach'salpha)
Converting forest land for agriculture is an abuse of the environment	3.13±0.85	1	4	0.760
Converting forest land for agricultural purposes is a cause of numerous environmental problems	2.89±0.91	1	4	
The more forest land is converted for agriculture, the more environmental problems are created	2.72±0.95	1	4	
Converting forest land for agricultural purposes is one of the biggest causes of environmental problems today	2.86±0.95	1	4	

*Responses included 'strongly agree (4)', 'agree (3)', 'disagree (2)' and 'strongly disagree (1)'; making the total score range from 4 to 16.

Table 3: Distribution of responses to items in the index of forest conversion behaviour

Items*	Yes Frequency (%)	No Frequency (%)	No response Frequency (%)
I converted forest-land to have the plot(s) that I cultivate currently	189 (59.1)	129 (40.3)	2 (0.6)
I seek opportunities to convert forest-land for agricultural purpose	224 (70.0)	90 (28.1)	6 (1.9)
I have cleared forest-land for agricultural purpose this year	136 (42.5)	176 (55.0)	8 (2.5)

*Responses were scored 0 (no) and 1 (yes) making the total score range from 0 to 3.

Univariate analyses of environmental risk perception and forest conversion behaviour

Environmental risk perception was weak among 134 (41.9%) and strong among 186 (58.1%)respondents. These dimensions of risk perception are visualized in figure 1. Forest conversion behaviour was medium among most (189, 59.1%) respondents. The behaviour was low, high and naught among 78 (24.4%), 31 (9.7%) and 22 (6.9%) respondents respectively. The lowest proportion of respondents (6.9%) has zero levels of conversion behaviour, with the implication that an overwhelming majority (92.9%) exhibit varying levels of forest conversion behaviour. The levels of forest conversion behaviour are visualized in figure 2.

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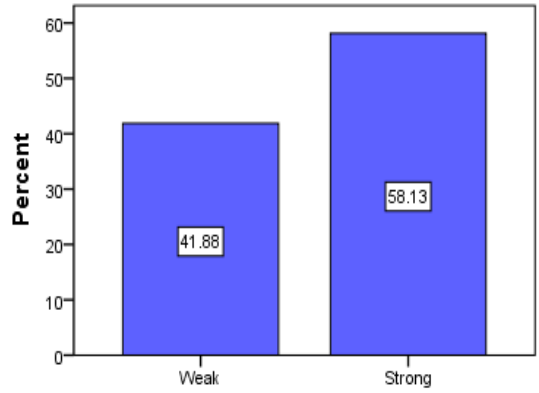

Figure 1: Environmental risk perception among respondents*

*Range of possible score on the scale of environmental risk-perception of forest conversion was 4 to 16. The minimum and maximum scoreswere4 and 16 respectively. The mean ± SD environmental risk perception is 11.59±2.79. Respondents who scored below the mean (4 to 11) and above the mean (12 to 16) were categorized as exhibiting weak and strong environmental risk perception respectively.

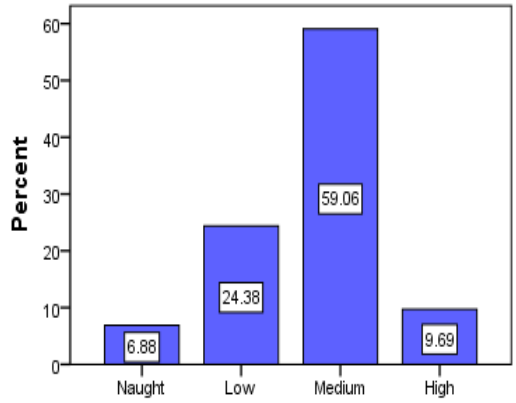

Figure 2: Forest-conversion behaviour among respondents*

*Total score in the index of forest-conversion behaviour ranged from 0 to 3. Respondents who scored 0, 1, 2 and 3 were regarded as demonstrating naught, low, medium and high forest-conversion behaviour respectively.

Socio-demographic characteristics and forest-conversion behaviour

More male respondents (61.1%) exhibited a medium level of forest conversion behaviour when compared with their female counterparts (55.7%). However, more female respondents (11.5%) exhibited a high level of this behaviour when compared with their male counterparts (8.6%). The chi-square of this cross-analysis is 1.524 (p> 0.05). Hence, gender is not associated with the level of forest conversion behaviour. This showcase the neutrality of gender concerning forest conversion behaviour in the study area. This is quite contrary to expectation considering that customs and traditions typically bestow ownership of land to more men rather than women, and such ownership tends to predispose people to use the forest indiscriminately (Marin and Kuriakose, 2017). Another partly related finding showcases the irrelevance of gender in forest conservation behaviour: Soe and Yeo-Chang (2019) found that sex was not a significant

factor determining willingness to participate in forest conservation in South-Central Myanmar.

About half of the respondents who had no formal education (51.1%) and primary education (50.0%) exhibited a medium level of forest conversion behaviour. With marginal limitation, the proportion of respondents who exhibited the medium level of forest conversion tended to increase among respondents as their education increased: 68.6% among those with secondary education, 58.2% among those with post-secondary education, 69.0% among holders of first degree and 75.0% among holders of postgraduate qualification. This is an indication that forest conversion behaviour becomes higher with increasing education. The chi-square of this cross-analysis is 28.700 (p<0.05). Hence, education is significantly associated with the level of forest conversion behaviour. The extent of this significant association is 29.0% (contingency coefficient= 0.290, p< 0.05).In contrast to this finding, Soe and Yeo-Chang (2019) found that education is not significantly related to willingness to participate in forest conservation. The current finding suggests the ineffectiveness of general education in stemming the tide of forest conversion.

Among respondents who exhibited medium forest conversion behaviour, those who belonged to the youngest age category (16 to 30) were 38.5% while this proportion increased rapidly to 70.0% among the next age category (31 to 45 years). From this point henceforth, the proportion of respondents who exhibited medium forest conversion decreased sequentially in the subsequent older age categories: 68.7% among the 46-60 years sub-group, 58.9% among the 61-75 years sub-group, and finally 9.7% among the 76 and older age sub-group. This is an indication that forest conversion yields an inverted U distribution across age sub-groups such that lower age and advanced age are less associated with such conversion. The chi-square is 56.663 (p < 0.001). Hence, age is significantly associated with forest conversion behaviour. The contingency coefficient (0.388, p< 0.001) indicated that the degree of this significant association is 38.8%.Contrary to the current finding, Howley *et al*. (2015) found that age is not significantly related to the conversion of land to forestry among a group of Ireland farmers. The summary of results obtained in the analyses of gender, education, age and forest-conversion behaviour is presented in table 4.

Table 4: Socio-demographic characteristics and forest-conversion behaviour among respondents

Socio-demographic characteristics	Sub-groups	Forest-conversion behaviour				
		Naught Frequency (%)	Low Frequency (%)	Medium Frequency (%)	High Frequency (%)	Total Frequency (%)
Gender	Male	12 (6.1)	48 (24.2)	121 (61.1)	17 (8.6)	198 (100.0)
	Female	10 (8.2)	30 (24.6)	68 (55.7)	14 (11.5)	122 (100.0)
	Total	22 (6.9)	78 (24.4)	189 (59.1)	31 (9.7)	320 (100.0)
*Highest educational qualification	No formal education	4 (8.5)	15 (31.9)	24 (51.1)	4 (8.5)	47 (100.0)
	Primary	6 (8.3)	23 (31.9)	36 (50.0)	7 (9.7)	72 (100.0)
	Secondary	1 (2.0)	7 (13.7)	35 (68.6)	8 (15.7)	51 (100.0)
	Post-secondary	5 (5.1)	25 (25.5)	57 (58.2)	11 (11.2)	98 (100.0)
	B.Sc./HND	6 (20.7)	2 (6.9)	20 (69.0)	1 (3.4)	29 (100.0)

	Postgraduate	0 (0.0)	4 (25.0)	12 (75.0)	0 (0.0)	16 (100.0)
	Total	22 (7.0)	76 (24.3)	184 (58.8)	31 (9.9)	313 (100.0)
*Age	16-30	2 (15.4)	4 (30.8)	5 (38.5)	2 (15.4)	13 (100.0)
	31-45	2 (4.0)	11 (22.0)	35 (70.0)	2 (4.0)	50 (100.0)
	46-60	10 (7.6)	17 (13.0)	90 (68.7)	14 (10.7)	131 (100.0)
	61-75	7 (7.4)	25 (26.3)	56 (58.9)	7 (7.4)	95 (100.0)
	76-above	1 (3.2)	21 (67.7)	3 (9.7)	6 (19.4)	31 (100.0)
	Total	22 (6.9)	78 (24.4)	189 (59.1)	31 (9.7)	320 (100.0)

*Significant associations.

Gender: Chi-square = 1.524, df = 3, p =0.677.
*Education: Chi-square = 28.700, df = 15, p =0.018, Contingency coefficient= 0.290 (p = 0.018).
*Age: Chi-square = 56.663, df = 12, p =0.000, Contingency coefficient= 0.388 (p = 0.000).

Environmental risk perception and forest-conversion behaviour among respondents in the study area

The cross-analysis of dimensions of environmental risk perception and levels of forest conversion behaviour in table 5 shows that among respondents whose perception was weak and strong, 56.0% and 61.3% exhibit medium levels of conversion. In addition, 10.4% and 9.1% of those having weak and strong perception exhibited a high level of forest conversion. The chi-square is 2.926 (p> 0.05). Hence, environmental risk perception is not significantly associated with forest conversion behaviour. Previous findings are in support of this finding: the nationally representative survey of Ireland farmers by Howley *et al*. (2015) shows that environmental orientation was insignificantly related (p> 0.05) to farmers' conversion of land for forestry purposes.

The mixed-methodology study of Malima (2020) which was designed to explore how radio propaganda affects deforestation in Rufiji, Tanzania indicates that though the radio communicates the environmental threats and dangers of deforestation, it is marginally successful in influencing community members' forest conservation behaviour. Malima (2020) further reported that the radio merely implored people but does not provide alternative income-generating means, i.e. how to make a living without forest destruction. However, Zeng *et al.*(2020) used secondary data collected among 14,097 University students in China and found that the relationship between environmental risk perception and pro-environmental behaviour was positive and significant (p< 0.001). Toma and Mathijs (2007) also reported that environmental risk perception was a significant determinant of the tendency to participate in organic farming among a cohort of Romanian farmers. Current findings affirm the position that environmental risk perception is inconsequential in farmers' forest conversion behaviour. This suggests that suppressing forest conversion requires extra-environmental orientation measures.

Table 5: Environmental risk perception and forest-conversion behaviour among respondents

Dimensions of environmental risk perception	Sub-groups	Forest-conversion behaviour				
		Naught Frequency (%)	Low Frequency (%)	Medium Frequency (%)	High Frequency (%)	Total Frequency (%)
	Weak	7 (5.2)	38 (28.4)	75 (56.0)	14 (10.4)	134 (100.0)

Strong	15 (8.1)	40 (21.5)	114 (61.3)	17 (9.1)	186 (100.0)
Total	22 (6.9)	78 (24.4)	189 (59.1)	31 (9.7)	320 (100.0)

Chi-square = 2.926, df = 3, p =0.403

Conclusions

Farmers' forest conversion behavior for agricultural purposes is high in the study area and gender is an inconsequential demographic factor in the dynamics of this behaviour. Belonging to the youngest/oldest age categories and middling age categories is significantly associated with lower and higher levels of forest conversion respectively. Similarly, belong to the category of those having higher education is also significantly associated with higher level of forest conversion. Environmental risk perception is not significantly associated with forest conversion behaviour. Efforts to check forest degradation through conversion of forest land for agricultural purposes must seek beyond peoples' environmental risk-orientation.

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