Drivers of Environmental Threats and Influence on Farming Activities of Arable Crop Farmers in Kano State, Nigeria

Akinyemi Mudashiru[1], Gusau, S. M[2], Usman Abubakar Sadiq[3]

[1, 2, 3]Department of Agricultural Economics, Federal University Dutsin - Ma Katsina State, Nigeria

[1]Corresponding author: *makinyemi[at]fudutsinma.edu.ng*
+2348150606588

Abstract: *Farming activities in sub - Saharan Africa encounter sundry challenges that culminate in pooryield performance. This study examines the determinants of environmental threats on the farming activities of arable crop farmers in Kano state Nigeria. A multi - stage sampling technique was employed to select 100 respondents for the study with the aid of well - structured and pre - tested questionnaire. Descriptive analysis of the Age of the farmer reveals that majority (29%) of the arable farmers fall within 37 - 45 years of age while 27% of them were between 19 - 27 years. Sex of the farmers in risk aversion categories was negatively significant (P<0.10). This indicates that the probability of risk aversion increases by the female arable farmers. Age of the arable crop farmers risk neutral categories was positively significant (P<0.05). This implies that age increase the probability of being risk neutral. Educational level of risk aversion groupwas positively significant (P<0.05). This implies that the farmers' education decreases the probability of being risk aversion. Access to credit for risk neutral categories is positively significant (P<0.05). This signifies that the farmers' Access to credit increase the probability of being risk neutral. The farm income was positively significant (P<0.05) for risk aversion categories. This means that farm income increase the probability of risk aversion. Off farm income was positively significant (P<0.10) for risk aversion group. The extension agents' contact to the farmers risk neutral was negatively significant (P<0.01). This connotes that extension agents visitation to the farmers decrease their probability of being risk neutral to environmental threat. The labour employed by the farmers was negatively significant (P<0.05). This shows that labor employed decrease the probability of being risk neutral. Labour employed by the farmers was positively significant (P<0.01). This implies that labour increase the probability of being risk aversion. Farmers' ability to source formal and informal institution credit was positively significant (P<0.05). This shows that Farmers' ability to source formal and informal institution credit increase the probability of being risk neutral. The study concluded that the arable crop farmers encountered diverse environmental threats in their farming activities. The study recommended that effort should be geared towards training the farmers on the appropriate farming strategies with emphasis on the need for the farmers to use innovation that will enhance their farming practices in the study area.*

Keywords: Arable - crop - farmer, Environmental - threats, Farming - activities, Kano - state, Nigeria

1. Introduction

Agricultural practice in sub - Saharan Africa is basically rudimentary and undeveloped. Small scale farmers encounter sundry challenges that culminate in poor yield performance, thus making farming unprofitable and susceptible to slight natural phenomenon. Environment is a major determinant of farming activities and livelihood earning of the poor rural - based subsistence farming which characterized agricultural practice in low income countries. Farming environment is vastly experiencing vicissitudes and vagaries occasioned from man's longing for improved livelihood, economic activities and technological development. Farming in Nigeria, like some other countries of the world is experiencing various forms of environmental threats ranging from flooding, rodents that affect the crops, pest infestation on post - harvest storage, conflict with livestock farmers, soil erosion, pest and disease among others.

Nigeria loses N30 billion value of crops through environmental mislaid annually. The blight of crop destruction by animal is daily increasing in Nigeria causing annual crop losses amounting to billions of naira. The conflicts have not only heightened the level of food insecurity, but have also demonstrated high potential to exacerbate the food crisis in Nigeria and other affected countries due to loss of lives of the farmers, animals, crops and valuable properties (Aminu, Balogun and Oke, 2019). Flood has with it numerous and multifaceted impact which are capable of causing mortalities, displacement of people and property as well as damage to the environment which may also severely endanger the economic development (Mohammed, 2015). Flood disasters are responsible for over 50% of all casualties and more than 30% of global economic losses from natural disasters (Salami, Giggins, Salami and Meding, 2016). Damage emanating from flooding poses negative effects on livelihood. conflict with livestock farmers, has led to destruction of crops by cattle and other property (reservoirs, irrigational facilities and infrastructure), productivity had turned to misfortune owning to negative effect on the environment which impact adversely to the farming activities of rural farming household. Pests also cause damage to various crops and commodities on farm and post - harvest stages which will cause food insecurity. It is on this basis, that this study was conceived to identify the major causes of environmental threats to arable farmers and find out the determinants of the arable crop farmers' attitude to risk imposed by environmental threat.

2. Materials and Methods

The Study Area
The study was conducted in Kano state. The state is located in north - west Nigeria. It is bordered with Katsina to the North West, Jigawa state to the north east, Bauchi state to the south east and Kaduna state to the south west, the capital of the state is in Kano. The 2006 Nigeria national population census revealed that Kano is the most populous state in Nigeria, with 9, 383, 682 million people (NPC 2006). The state has an extensively irrigated farming system. The dry season is usually from October to April, while the rainy season begins from April to September with an annual rainfall of 134.4mm. The crops grown in the area are rice, wheat, maize, guinea - corn, beans, tomatoes, onions, sugar - cane, cucumber, cabbage and water melon.

Primary data for the study was collected using a structured questionnaire. This was administered by the researcher and trained enumerators. The data was collected on socio economics characteristic of the respondents. The major sources of environmental threats of the arable farmers, the strategies adopted by arable crop farmers in managing allied threats and problems associated with arable farming were collected.

Multi - stage sampling procedure was adopted for this study. In the first stage, Kura local government was purposively chosen from forty - four local government in the state because of the largest concentration of arable crop farmers in the local government. The second stage was a random selection of five villages from the list of thenineteen villages (Danhassan, Dukawa, Gamadam, Gundutse, Imawa, Imawakore, Karfi, Kosawa, kunshama, Kura, Mudawa, Rugar Duka, Sadauki, Sayawa, Shafawa, Tofa, Yakasai, and Yalwa) in Kura local government area. In the third stage, 100 arable crop farmers were randomly selected proportionate to the population of the respective villages using the proportionate formular below.

Proportionate Sampling $= \frac{n}{N} XS$
 n = Number of farmers in each village
 N = Sampling Frame
 S = Sample Size (desired)

Analytical Techniques
Descriptive statistics was used to achieve objective (I, II& IV). Likert scale andmultinomial regression model was used to achieve objective III

Likert Scale Techniques Model Specification
Likert scale was used to determine the risk attitude of respondents. A five - point Likert scale was used to measure the farmers' attitude towards risk. The farmers were asked questions graded on a 5 - point scale, the responses will be Strongly Disagree (SD), Disagree (D), Undecided/Neutral (U), Agree (A) and Strongly Agree (SA). The responses will be given scores of 5, 4, 3, 2 and 1respectively. The sums of all the responses of the environmental risk in the column divide by number of the row to get the mean expectation.0 - 0.3=risk neutral, 0.31 - 0.60=risk averse and 0.61 - 0.99=risk seeking.

Multinomial logistic Regression Model Specification
Risk response models involving more than two possible outcomes are either multinomial or multivariate. Multinomial models are appropriate when individuals can choose only one outcome from among the set of mutually exclusive, collectively exhaustive alternatives. Therefore, in order to determine the how the risk status of the farmer is affected by environmental threats, the multinomial logistic regression model was used. The choice of this method is based on the fact that the risk behaviour (dependent variable) is a categorical variable which can take three (3) levels (0, 1, and 2) as previously discussed (Pennings and Garcia, 2001; Ayinde et al., 2010). The probability that the ith farmer belongs to the jth risk behaviour group reduces to:

$$p_{ij} = \frac{e^{s_j x_i}}{1 + \Sigma_{k=j}^{j} e^{s_k x_i}} \qquad (1)$$

The generalized multinomial model is expressed as (Babcock et al., 1995):

$$p_{ij} = \frac{e^{s_j x_i}}{1 + \Sigma_{k=0}^{j} e^{s_k x_i}} \qquad (2)$$

While the probability of being in the base outcome group or group 2 is

$$p_{ij} = \frac{1}{1 + \Sigma_{k=0}^{3} e^{s_k x_i}} \qquad (3)$$

Where i = 1, 2 …. . n variables; k = 0, 1,. . j groups; and βj = a vector of parameters that relates Xi's to the probability of being in group j where there are j+1 groups. The various independent variables included in the final model are
X_1= Age (Years)
X_2 = Sex of farmer (1 if male; 0 otherwise);
X_3= Educational level (years)
X_4 = Marital status (1 if married; 0 otherwise);
X_5= Household size (No of people)
X_6 = Farm size (ha);
X_7 = Farming experience (years);
X_8= Cooperative membership (1 if a member; 0 otherwise);
X_9= Access to credit (1 if yes, 0 otherwise);
X_{10} = Total labour employed (mandays);
X_{11} = Income (₦);
X_{12}= off - farm income (₦);
X_{13}= credit from formal and informal institution (₦);
X_{14}=number of extension contact (Number)

3. Result and Discussion

Socio - economic Characteristic of Arable Crop Farmers
The socio - economic characteristics of the sampled arable crop farmers discussed in this section include age, sex, marital status, education, experience, household size, farm size, access to credit and membership of cooperative. It is shown from the table below that majority (29%) of the arable farmers fell within 37 - 45 years of age while 27% of them were between 19 - 27 years; also 26% of them were between 28 - 36 years, 12% of them were between 46 - 54 years, 3% of them were between 55 - 63 and 3% of them were between 64 - 72 years. The result show that majority of the respondents were male (80%). This implies that males are more engaged in farming than females (20%). the marital status shows that 75% of the respondents are married and 18%, 3%, 2% and 2% are single, divorced widow and

widower respectively. The implication of this is that depending on the number of people in the family, there will be labor available for use on the farm and also the arable crop farmers will have reasons to make some off farm spending on their children and wives. Education is an important socio - economic characteristic that relates to usage of technology. The study, as presented in the table also reveals that about 27% of the respondents had Arabic education also 19%, 24%, 23% and 7% had no formal education, primary, secondary, and tertiary respectively. This shows that majority of the Arable crop farmers in the study area had at least Arabic education. Farming experience is another socio - economic characteristics considered in the study area. As presented on table below, majority of the respondents had between 2 - 10 years arable crop farming experience.11 - 19, 20 - 28, 29 - 37, and 38 - 46 had 36%, 21%, 12% and 3% respectively. The number of people in a household is also very important in terms of family labour sourcing. Table equally shows that most of the Arable crop farmers (about 51%) had household size of between 7 - 13 people depending on the age composition, labour availability will usually guarantee labour for farming. Furthermore 19% of the respondents have household size of between 0 - 6 and about 24% had 14 - 20 people within their household size, while 5% had 21 - 27 household size and 1% had 28 - 34 household size. Majority (62%) of Arable crop farmers have farm size between 0 - 1 hectares of farm land and just a few (about 1%) had 6 - 7ha for crop farming, furthermore, about (36%) of Arable crop farmers have the 2 - 3ha and1% had 4 - 5ha. This shows that most of the Arable farmers in the study area are cultivating crops consumption and few for sales purpose. The study shows that majority of the respondents (about 65%) have access to credit while 35% of the respondents have access to credit.
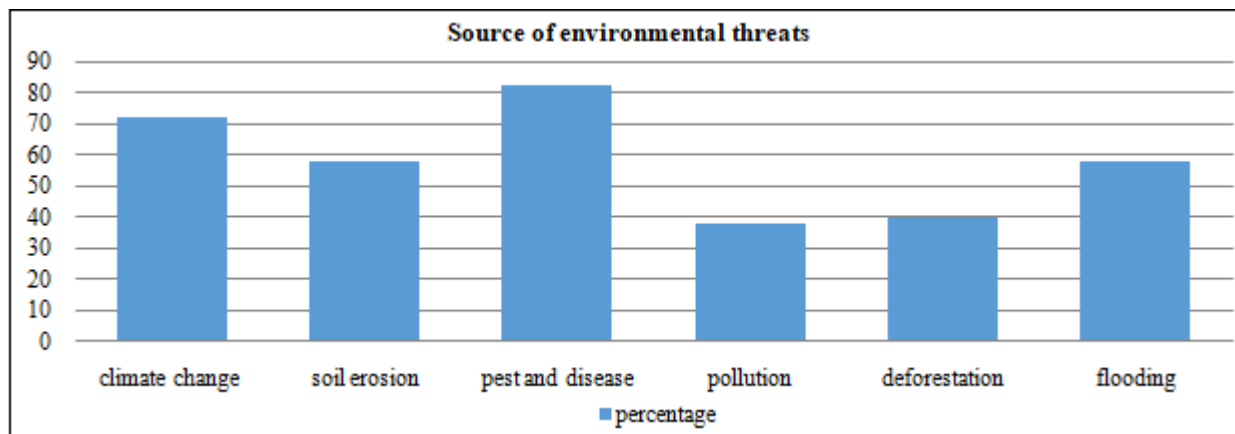
Table 2: Distribution of Respondent according to Socio - economic Characteristics

Variable	Measurement	Frequency	Percentage %
Sex	Male	80	80
	Female	20	20
Age	19 - 27	27	27
	28 - 36	26	26
	37 - 45	29	29
	46 - 54	12	12
	55 - 63	3	3
	64 - 72	3	3

Marital status	Single	18	18
	Married	75	75
	Divorced	3	3
	Widow	2	2
	Widower	2	2
Education	No formal education	19	19
	Arabic education	27	27
	Primary	24	24
	Secondary	23	23
	Tertiary	7	7
Experience	2 - 10	38	38
	11 - 19	36	36
	20 - 28	21	21
	29 - 37	12	12
	38 - 46	3	3
Household size	0 - 6	19	19
	7 - 13	51	51
	14 - 20	24	24
	21 - 27	5	5
	28 - 34	1	1
Farm size	0 - 1	62	62
	2 - 3	36	36
	4 - 5	1	1
	6 - 7	1	1
Access to credit	Yes	65	65
	No	35	35
Membership	Yes	55	55
	No	45	45

Source: Field Survey 2021

Major Sources of Environmental threats to Arable Farmers

The result showed that 72% of the sampled respondents believed that source of environmental threats are climate change, while 58% believed is soil erosion, while majority 82% believed its pest and diseases, while 38%, 40%, and 58% believed its pollution, deforestation, and flooding respectively. This implies that pest and diseases is the major sources of environmental threats in the study area and the respondents indicated that pollution is not a major source of environmental threats in the study area. The distribution of respondents according to sources of environmental threats in the study area is shown in Figure 1.

Figure 1: Identification of Environmental threats affecting Arable farmers
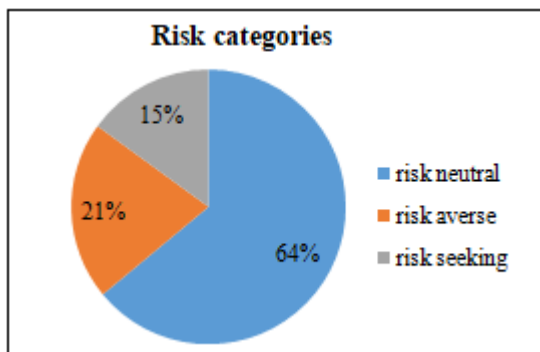Source: Field Survey 2021

Figure 2: Respondent distribution according to risk categories
Source: Field Survey 2021

Determinant of the Arable crop Farmers' to Environmental threat

Table 3 presents the determinant of the respondents' attitude to risk. The log likelihood value of the model is - 174. The chi - square (LR - statistics) value of 84.71. Which was statistically significant at 1% level shows that the model has a good fit. This is an indication that all or some of the slope coefficients are significantly different from zero. It therefore means that the model is capable of showing and explaining the determinants of risk status of the respondents. This indication is also (confirmed by the pseudo R^2 of 0.3851 which is similar to the quantity obtained by Rahji and Fakayode 2009). The result of the estimates of the explanatory variables in the below table show about nine (9) variables are significant and their sign vary across the group. The coefficients of labour employed were significant for both groups relative to risk seeking base outcome but with different sign and level of significance. The labour employed is positively significant (P<0.01) for risk averse, but negatively significant (P<0.05) for risk neutral group relative to the base outcome. According to the result, Sex of the farmers was negatively significant (P<0.10). This indicates that the probability of risk averse is increase by the female arable farmers. This is obvious because female are meticulous and careful in taking precautions against threats that can lessen agricultural output. Age of the arable crop farmers was positively significant (P<0.05). This implies that age increase the probability of being risk neutral. This is because as the farmers grow older, they tend to be conscious of the negative outcome and implications of the environmental threats occurrence. Educational level was positively significant (P<0.05). This implies that the farmers' education decreases the probability of being risk averse. This conforms to the *Apriori* theoretical expectation. Education empowers and enlightens the mind to take informed decision regardless of the risk involved. In addition, education enhances the investment potential of the farmer to practice new technology. This corroborates with work of (Bello, 2013; Etu, Udoc and Okon, 2018) which states that education decrease risk averse. Access to credit is positively significant (P<0.05) for risk neutral group. This signifies that the farmers' Access to credit increase the probability of being risk neutral. Therefore getting credit by the farmers will make them indifferent to solution that is needful for environmental threat. The farm income was positively significant (P<0.05) risk aversion categories. This means that the probability of risk aversion increase the tendency of the farmers to take right precaution and decision to avoid the occurrence of the environmental threats. Off farm income was positively significant (P<0.10) for risk averse group. This shows that the off - farm income increase the probability of risk aversion among the arable crop farmers. The income from other sources can be a rescue to procure solution to oppose any foreign material imposed by environmental threats. The extension agents' contact to the farmers was negatively significant (P<0.01). This connotes that extension agents visitation to the farmers decrease their probability of being risk neutral to environmental threat. The guidance and information offered by the extension personnel during their visitation re - orientate the farmers' mindset to environmental threats therefore, arable crop farmers tends to believe that environmental threats effects on their farming activities are insignificant. The labour employed by the farmers was negatively significant (P<0.05). This shows that labor employed decrease the probability of being risk neutral. This is not expected and not plausible because availability of labour makes the households readily available to fight environmental threat, hence it increases the probability of being risk neutral. However, labour employed by the farmers was positively significant (P<0.01). This implies that labour increase the probability of being risk aversion. This is in line with Aprori and theoretical expectation. When the farmers employ more labour, the prevention strategies of the environmental threats can be simply carried out. Farmers' ability to source formal and informal institution credit was positively significant (P<0.05). This shows that Farmers' ability to source formal and informal institution credit increase the probability of being risk neutral. This is possible when farmers become indeterminate on whether to use the farm credit for farming activities to carry out prevention methods of environmental threats owning to the uncertainty that characterized agricultural farming

Table 3: Coefficient Estimate of the Variables Determining Risk status

Variables	Risk Neutral		Risk Averse		Base Outcome =risk taker
	Coefficient	Standard error	Coefficient	Standard error	Coefficient
Sex	- 0.49 (- 0.40505)	1.20972	0.39460 (- 1.98) *	- 0.19929	0.00171
Age	0.02513 (2.05) **	0.012234	0.02478 (0.61)	0.04062	0.00171
Education level	- 0.09502 (- 0.99)	0.095979	- 0.25716 (2.15) **	- 0.11960	- 0.13763
Marital status	- 0.00879 (- 0.47)	- 0.018702	- 0.51425 (- 0.61)	- 0.843032	- 0.33375
Household size	- 0.00879 (- 0.16)	0.549375	0.03502 (0.60)	0.058366	0.04368
Farm size	0.38500 (0.78)	0.493589	0.550710 (1.10)	0.550710	0.18761
Farming experience	0.17745 (- 0.26)	0.6825	- 0.19000 (- 0.24)	- 0.791666	0.06735
Access to credit	0.59936 (2.16) **	0.25922	0.01452 (0.02)	0.7260	- 0.14815

Farm income	0.51523 (1.07	0.481523	0.08124 (2.05) **	0.039629	- 0.92133
Off - farm income	- 0.00116 (- 0.65)	0.001784	0.52582 (1.99) *	0.264231	0.09190
Number of extension contact	0.22523202 (- 3.02) ***	0.07458	- 0.05 (0.44361)	0.112711	0.00388
Total labour Employed	- 0.00757 (- 2.55) **	0.00296	0.12240 (3.54) ***	0.034576	0.80405
Credit from formal and informal institution	0.01821 (2.07) **	0.00879	0.32081 (1.03)	0.311466	0.04754
Diagnostic statistics		Log likelihood - 174 LRX^2 (100) = 84.71 Pseudo R ^{2} = 0.3851			

Source: Field Survey, 2021 NB: Values in parenthesis are t - value ***significant[at]1%**significant[at]5% *significant[at]10%

4. Conclusion and Recommendations

Findings from this study revealed that the arable crop farmers in the study area were affected by Environmental threats. The results also revealed that majority of the respondents were risk - neutral and adopted prevention, mitigation and coping strategies as their risk management strategies. Based on the findings of the study, the followings recommendations are made:

- Concerted effort should be geared towards training the farmers on the appropriate farming strategies with emphasis on the need of the farmers to use innovation that will enhance improved their farm practices in the study area.
- Farmers' group and relative stakeholders in agricultural enlightment programme should promote the capacity building for farmers this will enhance farmers agricultural output.
- Government should focus on creating and sensitizing the farmers on suitable insurance coverage to mitigate the effect of risks associated with yield and environmental threats.
- Relevant agricultural institution should therefore initiate a forum to sensitize farmers on approach and tactic to scheme and device appropriate management strategies to ameliorate the effect environmental threats.

References

[1] AlukoO. J[1], Bobadoye A. O and Adejumo A. A[3] (2019). perceived effects of damage caused by flood on change in livelihood security along gender line in ido local government area of Oyo state. *Nigeria journal of sustainable environmental management.1*1 (6), 47 - 55,.

[2] Aminu, F. O, Balogun, E. O. S and Oke, O. B. (2019). Farm risks and management strategies among arable crop farmers in odogbolu local government area of ogun state, Nigeria. *Agrosearch, 19 (2), 41 - 53*

[3] Ayinde, O. E, Muchie, M., Omotesho, O. A., Adewumi, M. O. (2010). Multi - Risk model of small - scale agricultural entrepreneurs in central of part of Nigeria. Globelics Conference, November 1 - 3, Kuala, Malaysia.

[4] Babcock, B. A., Chaherli, N. M., Lakshminariayam, P. G. (1995). Programme participation and farm - level. adoption of conservation tillage: estimates from a multinomial Logit Model. Working paper 95 - WP 136, Centre for Agricultural and Rural Development, Iowa State University, Ames, Iowa.

[5] Bello A. U. (2013) Herdsmen and farmers conflicts in north - eastern Nigeria; causes, repercussion, and resolutions. *Academic Journal of Interdisciplinary Studies*2 (5), 81 - 93.

[6] Binici, T., Koc, A. A., Zulauf, C. R. and Bayaner, A. (2003). Risk attitudes of farmers in terms of risk aversion: A case study of lower Seyhan plain farmers in Adana province, Turkey. *Turkey Journal of Agriculture, 27 (1), 305 - 31.*

[7] Etuk, E. A., Udoe, P. O and Okon, I. I. (2018). Determinants of Livelihood Diversification among Farm Households in Akamkpa Local Government Area, Cross River State, Nigeria. *Agrosearch,* 18 (2), 99 - 110

[8] Mohammed, N. T. (2015). Desertification in northern Nigeria: Causes and implications for national food security. *Journal of Social Sciences and Humanities,* 3 (2), 22 - 31

[9] Nwafor, J. C. (2006). Environmental Impact Assessment for Sustainable Development: The Nigerian Perspective. Enugu: EDPCA Publication.

[10] Osuala, E. C. (1982). "Introduction to Research Methodology". New York Exposition Vocational Education, University of Nigeria, Nsukka. Osuala - Publications.

[11] Pennings, J. M. E., Garcia, P. (2001). Measuring producers' risk preferences: A global risk - attitude construct. *American Journal of Agricultural Economics*, 83 (4), 993 - 1009

[12] Rahji, M. A. Y., Fakayode, S. B. (2009). A multinomial Logit Analysis of agricultural credit rationing by commercial banks in Nigeria. *International Research Journal of Finance and Economics*, 2 (4), 90 - 100.

[13] Salami, R. O., Giggins, H., Salami, R., & Meding, V. (2016). *Vulnerability of human settlements*