Journal of Biodiversity, Bioprospecting and Development

Osasogie et al., J Biodivers Biopros Dev 2018, 5:1
DOI: 10.4172/2376-0214.1000169

Review Open Access

Socioeconomic Determinants of Farmers Adaptation Strategies to Climate Change Hazards in Benue state, Nigeria

Daniel Izevbuwa Osasogie* **and Isaac Omorogbe**

Department of Agricultural Economics, Ambrose Alli University, Ekpoma Edo state, Nigeria

***Corresponding author:** Department of Agricultural Economics, Ambrose Alli University, Ekpoma Edo state, Nigeria, Tel: +234 000 000 0000, E-mail: omoisaac2000@yahoo.co.uk

Received Date: January 12, 2018; **Accepted Date:** February 5, 2018; **Published Date:** February 25, 2018

Abstract

This study examined the factors that influenced the quality of adaptation strategies of farmers to climate change hazards in Benue state Nigeria. Multi-stage and Probability Proportional to Size sampling technique were adopted to select 360 farmers across the three agro-ecological zones in the state. Data were collected using interview schedule. Descriptive and inferential statistics were used in data analysis. The results showed that the farmers adopted strategies with the mean vales as Mixed cropping system (4.41), Use of irrigation (1.60), Use of drought tolerant crops (2.60), Diversification (2.59), Use of improved variety (3.41), non-agricultural income (2.80), Increased use of fertilizer (2.61), Land ownership (43.60%), Membership of an association (2.21), livestock ownership (2.20), supply of pesticide (1.79). The result of logistic regression showed that the educational level of the farmers is a significant (X= 0.603; p<0.050) socioeconomic variable influencing the kind of climate change adaptation strategies adopted by the farmer.

Keywords: Adaptation strategies; Farmers; Climate change

Introduction

Research findings indicate that over the past years, mean temperature levels in Africa have experienced significant increase while precipitation levels have revealed a decline [1]. It is believed that Africa is highly vulnerable to climate change and climate variability due to the fact that the majority of the populations in Africa depend on subsistence rain-fed agriculture [2]. Studies undertaken to analyses the impact of climate change on crop cultivation, livestock rearing and mixed farming in Africa indicated that the increasing temperature and decreasing precipitation will significantly reduce income from agriculture [3].

In Africa, agriculture provides a source of employment for more than 60 percent of the population and contributes about 30 percent of Gross Domestic Product [4]. Rain-fed farming dominates agricultural production in sub- Saharan Africa, covering around 97 per cent of total cropland and exposes agricultural production to high seasonal rainfall variability. Since agriculture in Nigeria is mostly rain-fed, it follows therefore that any change in climate is bound to impact its productivity in particular and other socioeconomic activities in the country. As further explained by UNFCCC (write in full), the effect of climate change implies that the local climate variability which people have previously experienced and adapted to is changing and this change is observed in a relatively great speed. The threat that climate change poses to agricultural production does not only affect the area of crop husbandry but also livestock and in fact the total agricultural sector. African farmers depend on livestock for income, food and animal products. Climate can affect livestock both directly and indirectly. Direct effects of climate variables such as air, temperature, humidity, wind speed and other climatic factors influence animal performance such as growth, milk production, wool production and reproduction. Climate can also affect the quantity and quality of feed stuffs such as pasture, forage, and grain and also the severity and distribution of livestock diseases and parasite. Hence the totality of agricultural sector is considered by examining agricultural productivity. Rainfall is by far the most important element of climate change in Nigeria and water resources potential in the country. The northeast region of Nigeria is increasingly becoming an arid environment at a very fast rate on a yearly basis occasioned by fast reduction in the amount of surface water, flora and fauna resources on land [4].

Consistent reduction in rainfall leads to a reduction in the natural re-generation rate of land resources. This makes people to exploit more previously undisturbed lands leading to depletion of the forest cover and increase on sand dunes/Aeolian deposits in the northern axis of Nigeria. Climate change is the most severe problem that world is facing today. It has been suggested that it is a more serious threat than global terrorism. The southern area of Nigeria largely known for high rainfall is currently confronted by irregularity in the rainfall and temperature is gradually increasing in the Guinea savannah zone of the country. In addition, the northern zone faces the threat of desert encroachment.

In addition to the gradual trends of increasing temperature and decreasing precipitation, which negatively affect agriculture, climate related risks (especially droughts and floods) are the other natural calamities impoverishing Nigerian farmers. Dercon et al. [5] indicated that adverse events that are costly to individuals in terms of lost income, reduced consumption, disease outbreak and the sale or destruction of assets inflict poverty. Studies carried out by Osasogie and Alabi [4] to review the economic effect of flooding on the income distribution of farmers in Edo state of Nigeria sequel to heavy flooding in the area revealed that flooding which is an outcome of climate change reduced the income of the farmers In Nigeria, droughts and flooding have been claiming lives at most and impoverishing households through the reduction in income and consumption at least mainly due to the dependence of the sector on rainfall and lack of insurance or social safety nets. In very severe cases of drought in

Nigeria, it's been reported that drought significantly reduced the income distribution of farming households in state. The effect of this flooding becomes even more devastating on the farmers as a result of lack or sub-optimal compensation system in place by the relevant government agencies.

Understanding vulnerability to risk of climate extremes is crucial for Nigeria as it allows policy makers to devise a host of strategies and instruments towards risk management. Vulnerability to climatic risk can be defined from two perspectives: ex ante ('before the event') and ex post ('after the fact') approaches. The ex-ante approach is based on measuring the probability of households consumption or utility falling below a given minimum level in the future due to current or past shocks, whereas the ex post methods measure welfare loss due to shocks [6].

Purpose of the study

The overall aim of the study is to evaluate the factors that predict the adaptation strategies adopted by farmers in the study area in coping against the adverse effects of climate change.

Methodology

The study was carried out in Benue State, Nigeria. Multistage and Probability Proportional to Size sampling technique was used to select three hundred and sixty (360) respondents from the three agricultural zones in the state. Structured interview schedule was used for data collection. Socio-economic characteristic of respondents were collected at nominal and interval level. Respondents were asked to indicate their sex (male or female), age (years), household size (number of persons in their household), monthly income (in naira) and major occupation. The strategies for mitigating the effects of climate change were collected by asking respondents to tick on a five-point Lykert-type scale to indicate their responses. The mean/cut-off point was 3.0. Data was analyzed using descriptive and inferential statistics.

Result and Discussions

Data in Table 1a and Table 1b show that majority (92.5%) of the respondents were male while 7.5% were female. 40% of the respondents were aged between 41 and 50 years. There is a culture of gender role stereotyping in the study area that defines farming as a male occupation consequently putting the women at disadvantaged position in terms of policy and intervention target.

		Benue South		Benue Central		Benue North		Total	
		Freq	%	Freq	%	Freq	%	Freq	%
Age group (years)	<=30.	7	6.93	24	17.39	33	27.27	64	17.78
	31. - 40.	26	25.74	30	21.74	18	14.88	74	20.56
	41. - 50.	44	43.56	57	41.3	43	35.54	144	40
	51. +	24	23.76	27	19.57	27	22.31	78	21.67
	Total	101	100	138	100	121	100	360	100
Sex	Male	89	88.12	130	94.2	114	94.21	333	92.5
	Female	12	11.88	8	5.8	7	5.79	27	7.5
	Total	101	100	138	100	121	100	360	100
Marital status	Single	5	4.95	8	5.8	5	4.13	18	5
	Married	59	58.42	79	57.25	78	64.46	216	60
	Divorced	5	4.95	8	5.8	3	2.48	16	4.44
	Widowed	32	31.68	43	31.16	35	28.93	110	30.56
	Total	101	100	138	100	121	100	360	100
Educational level	No formal	27	26.73	43	31.16	35	28.93	105	29.17
	Primary	24	23.76	12	8.7	15	12.4	51	14.17
	Secondary	29	28.71	64	46.38	51	42.15	144	40
	Tertiary	21	20.79	19	13.77	20	16.53	60	16.67
	Total	101	100	138	100	121	100	360	100

Household size (range)	<=4	42	41.58	63	45.65	46	38.02	151	41.94
	05-Aug	47	46.53	64	46.38	63	52.07	174	48.33
	9+	12	11.88	11	7.97	12	9.92	35	9.72
	Total	101	100	138	100	121	100	360	100
Farming experience (range)	<=10	19	18.81	26	18.84	19	15.7	64	17.78
	Nov-20	34	33.66	45	32.61	37	30.58	116	32.22
	21 - 30	43	42.57	66	47.83	60	49.59	169	46.94
	31 - 40	0	0	0	0	0	0	0	0
	41+	5	4.95	1	0.72	5	4.13	11	3.06
	Total	101	100	138	100	121	100	360	100
Occupation of household	Farming	30	29.7	49	35.51	36	29.75	115	31.94
	Petty trading	30	29.7	34	24.64	34	28.1	98	27.22
	Craftsmanship	25	24.75	28	20.29	28	23.14	81	22.5
	Public service	16	15.84	27	19.57	23	19.01	66	18.33
	Total	101	100	138	100	121	100	360	100
Total Income (N)	<=50000	26	25.74	49	35.51	37	30.58	112	31.11
	150001-200000	0	0	10	7.25	8	6.61	18	5
	200001+	3	2.97	0	0	0	0	3	0.83
	Total	101	100	138	100	121	100	360	100
Farm size ha (range)	<=2	49	51.04	68	51.91	64	55.17	181	52.77
	3-3	45	46.88	62	47.33	52	44.83	159	46.36
	4+	2	2.08	1	0.76	0	0	3	0.87
	Total	96	100	131	100	116	100	343	100
	50001-100000	41	40.59	51	36.96	46	38.02	138	38.33
	100001-150000	31	30.69	28	20.29	30	24.79	89	24.72

Table 1a: Socioeconomic characteristics of respondents.

	Benue South		Benue Central		Benue North		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age years	44.66	9.6	43.1	11.81	41.95	14.18	43.15	12.14
Household size	5.41	2.37	5.17	2.19	5.54	2.26	5.36	2.26
Farming experience (years)	20.62	9.8	19.83	7.95	21.1	9.36	20.48	8.97
Farm income per annum	33504.95	19079.64	33514.49	22155.14	32636.36	17667.77	33216.67	19829.99

Non-farm income	66683.17	151021.32	42739.13	37781.03	46454.55	39848.88	50705.56	86780.53
Total Income (N)	100188.12	152181.19	76253.62	46070.73	79090.91	44690.98	83922.22	89629.88
Total farm size (ha)	2.34	0.78	2.21	0.86	2.12	0.88	2.22	0.85
Flock size of livestock	3.01	1.59	2.37	1.78	2.21	1.83	2.5	1.77
Source: 2017 field survey								

Table 1b: Socio-economic characteristics of Respondents (Mean).

Table 2 shows the mean age was 43years. 40% of the respondents completed secondary education; the mean household size was 5 persons. The mean years of farming experience was 20 years which implies that the average farmer in the study area must have experienced climate change effects. This is in line with IPCC [1] which states that it takes a minimum of one decade to experience climate change effects. (One hundred percent) of the respondents had farming as major occupation implying also that respondents may have experienced some of the adverse effects of climate change since agriculture is their major source of livelihood and agricultural production is reported to be a worst victim of climate change. Table 2 also shows that the mean annual income from farming activities was NGN 33,216.67 while the mean non-farm income was NGN 50,705.56. Majority (87.4%) of the respondents was members of social organizations; the average monthly income was about N27, 955.

	Benue South		Benue Central		Benue North		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Mixed cropping	4.36	0.76	4.35	0.86	4.52	0.75	4.41	0.8
Land ownership	3.34	1.13	3.7	1.19	3.71	1.25	3.6	1.21
Use improved variety	3.68	1.11	3.34	1.4	3.25	1.48	3.41	1.36
Non-agricultural income	2.75	0.82	2.8	0.71	2.85	0.75	2.8	0.75
Increased use of fertilizer	2.59	1.24	2.72	1.41	2.49	1.41	2.61	1.36
Use of drought tolerant crops	2.32	1.03	2.7	0.96	2.74	1.03	2.6	1.02
Diversification	2.26	1.15	2.72	1.35	2.74	1.49	2.59	1.36
Membership of an association	2.23	1.22	2.23	1.11	2.16	1.2	2.21	1.17
Livestock ownership	2.24	0.63	2.27	0.79	2.09	0.79	2.2	0.75
Supply of pesticides	1.82	0.7	1.88	0.79	1.68	0.73	1.79	0.75
Use of irrigation	1.51	0.77	1.73	0.84	1.51	0.75	1.6	0.8
Access to credit	1.51	0.77	1.73	0.84	1.51	0.75	1.6	0.8
Others	2.52	0.86	2.67	0.75	2.57	0.82	2.59	0.81
*Frequent (mean > 3.00) Source: 2017 field survey								

Table 2: Assessment of the climate Change Adaptation strategies.

Table 2 shows that mixed cropping (mean=4.41), land ownership (mean=3.60) and use of improved crop variety (mean=3.41) were the most frequently (mean > 3) adopted strategies against climate change hazards. However, the respondents also adopted use of irrigation (mean=1.60), Use of drought-tolerant crops (mean=2.60), Diversification (mean=2.59), non-agricultural income (mean=2.80), Increased use of fertilizer (2.61), Membership of an association (mean=2.21), livestock ownership (mean=2.20), supply of pesticide (mean=1.79) as climate change adaptation strategies. This finding is in sync with the results of Rajendra et al. [7] which showed that farmers that are faced with the challenges of climate change hazards adopt other traditional farming techniques in mitigating the climate change impacts. The findings also affirm the result of Nwobodo and Agwu [8] and that of Nnaji [9] which reported that all respondents in Benue State were aware of climate change and are putting up adaptation strategies.

Test of hypothesis

The hypothesis analyzed states as follows: Socio-economic characteristics of respondents are not significant determinants of adoption of climate change adaptation strategies. Logistic regression was used to analyze the hypothesis and the result is presented in Table 3. The model statistics is depicted below: The result shows that the dichotomous dependent variable (Poor and Good adaptation strategies) shows that 60.7% and 39.3% of the farmers' adaptation strategies are poor and good respectively. Lykert scale was adopted in

defining a cut-off point for good and bad adaptation strategy. The likelihood ratio test (X2=40.52; P<0.050) indicates that the aggregate influence of the predictors on the farmers' choice of climate change adaptation strategies is significant. The goodness-of-fit test (X2=305.79; df=286; P>0.050) is not significant which implies that the regression model is a good representation of real life or actual data. The Coefficient of determination (0.664) indicates that the predictors in the model provide explanation for 66.4% of the observed variations in the choice of adaptation strategies adopted by the farmers. The result also shows that only the level of education of the farmers had significant influence on the climate change adaptation strategies adopted.

Parameter	Coefficient	Hypothesis Test			Odd ratio
		Chi-Square	df	Prob. level	
constant	-0.037	0.001	1	0.971	0.964
Age	0.009	0.913	1	0.339	10.009
Sex (Male)	0.177	0.127	1	0.722	10.194
Educational level	-0.603*	17.865	1	0	0.547
Household size	0.023	0.154	1	0.695	10.023
Farming experience	0.023	2.704	1	0.1	10.024
Total Income	-0.077	0.3	1	0.584	0.926
Farm size	-0.092	0.133	1	0.716	0.912

Table 3: Determinants of Climate Change Adaptation Strategies.

Age: the result shows that with a unit (a year) increase in the age of the respondent, the respondent is 10 times (odd ratio of 10.009) more likely to have good climate change adaptation strategies. This has direct bearing on the availability of able-bodied manpower for agricultural production and also on the ease of adoption of climate change adaptation strategies. Also, age influences the ability to seek and obtain off-farm jobs and income, which could increase farmer's income and could help cope with adverse change in climate [10].

Sex: the pooled result of the logistic regression analysis shows that male farmer is 10 times (odd ratio of 10.194) more likely to have good adaptation strategies compare to the female farmer. This can be attributed to the fact that male farmers constituted the majority of farmers in the study area. Furthermore, good adaptation strategies imply the use of different farming practices which can be very tedious and high-energy demanding.

Educational level: The coefficient for education is negative (b=-0.603) and significant. The result shows an inverse relationship between the level of education of the farmers and the odd of having good climate change adaptation strategies. The implication of the result is that farmers with low education were half times (odd ratio of 0.547) more likely to have good climate change adaptation strategies compared to those with higher education. A possible explanation for this could be that the more educated farmers are engaged in other better paying non-farm opportunities that can better strengthen their household livelihood. It could also be that farmers with higher education tend to be more critical and obstinate at accepting the fact that strategic use of farming system can improve climate change resilience.

Household size: The coefficient for household size is positive (b=0.023) and in line with apriority expectation. This means that with an additional increase of one household member, the respondent is 10 times (odd ratio of 10.023) more likely to have a good climate change adaptation strategies. Adikwu [11] in a similar study to evaluate the influence of household size on agricultural land use pattern in Benue state observed that households with relatively larger size cultivate larger expanse of land. Ahmed also discovered that rural farmers give birth to several children as a means of labor supply for farming operations. The International Labor Organization's (ILO) survey on Working Child shows an alarming statistic on Nigeria. 43.2% of children (aged 5-17 years) in Nigeria are engaged in Child Labor and 42.1% of these children are engaged in agricultural activities mostly in the rural areas [12]. However, despite the consensus global condemnation of child labor, child labor contribute significantly to the capacity of the farming households to develop viable resilience and adaptation against climate change.

Farming experience: the result shows a positive coefficient (b=0.023) which is in line with apriori expectation. The implication of the result is that for every one year increase in the years of farming experience, the farmer is 10 times (odd ratio of 10.023) more likely to have a good farming adaptation against climate change hazards. This outcome is in resonance with the outcomes of a similar study in Northern Thailand which showed that farming experience significantly influenced (with positive coefficient) the quality and level of farmers' adaptation against climate change impacts [7]. The possible explanation for this stems from the fact that with increase in the years of farming experience, the farmers become more skilled in the different farming practices and adaptation in this context involves the ability to use the different farming practices and system to improve resilience in the event of climate change impacts. Nwobodo and Agwu [8] also revealed similar findings that the farmers' years of farming experience influenced the climate change knowledge and adaptation.

Total income: the pooled results showed a negative coefficient (b=-0.077) which implies that with a naira decrease in households' total income, the farming households is 0.9 times (odd ratio of 0.912) more likely to have a good adaptation. Farming operations require so much capital involvement which limits the level of participation of farmers with relatively low income. However, low income farmers who are engaged in farming activities are more diligent in ensuring optimal farm output with the minimal factor inputs.

Farm size: the coefficient for farm size is negative (b=-0.092). The implication of the result is that farmers with smaller farm size are 0.9 times (with odd ratio of 0.912) more likely to have a good climate change adaptation strategies compared to farmers with larger farm size. The most likely reason for this observation could be that smaller farm size is easier to manage because of cost efficiency. Therefore, the larger the farm size, the less likely the possibility of the farmer being able to adopt the unique farming practices that improves the resilience level against climate change impacts.

Conclusion

The farmers in the study areas responded to climate change hazards using various traditional mitigating strategies in coping with the adverse impacts of climate change on agricultural production. The study also concludes that farmers with relatively lower level of

education as compared to farmers with higher level of education are less likely to adopt good climate change adaptation strategies.

Recommendations

Government in collaboration with development agencies should develop programs that will strengthen the educational institutions in Benue state to improve the level of education of the farmers. The government of Benue state should deepen the level of awareness of farmers on the various means of coping with the adverse impacts of climate change.

References

1. IPCC (2007) Climate Change: A report on the Intergovernmental Panel on Climate Change. Synthesis Report.
2. Boko M, Niang I, Nyong A, Vogel C, Githeko A, et al. (2007) Africa. In Parry ML, Canziani OF, Paluitkof JP, van der Linden PJ, Hanson, CE (eds.) Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press, Cambridge 433-467.
3. Kurukulasuriya P, Mendelsohn R (2008a) A Ricardian analysis of the impact of climate change on African cropland. Afri J Agri Reso Econo 2: 1-23.
4. Osasogie DI, Alabi RA (2015) Economic analysis of effects of climate change on income distribution among farmers in state, Nigeria. Int J Res Agri Forestry 2: 7-13.
5. Dercon S, Krishnan P (2000) Vulnerability, seasonality and poverty in Ethiopia. J Develop Studies 36: 25-53.
6. Hoddinott J, Quisumbing A (2003) Methods for Microeconometric Risk and Vulnerability Assessments.Social Protection Discussion Paper Series No. 0324. Social Protection Unit, Human Development Network, the World Bank, Washington, DC.
7. Rajendra P, Nuanwan C, Sunsanee A (2017) Adaptation to Climate Change by Rural Ethnic Communities of Northern Thailand. Climate 5: 57.
8. Nwobodo C, Agwu A (2015) Knowledge level of youth farmers on climate change in Benue State of Nigeria. Afri J Agri Res 10: 2-3.
9. Nnaji CE (2012) Effects of climate change on household water resources in Benue State, Nigeria: An MSc Dissertation submitted to the Department of Agricultural Extension, University of Nigeria, Nsukka.
10. Antwi-Agyei P, Dougill AJ, Fraser EDG, Stringer LC (2012) Characterizing the nature of household vulnerability to climate variability: empirical evidence from two regions of Ghana. Environment, Development and Sustainability. Environment, Development and Sustainability 15: 903-926.
11. James OA (2014) Household size and agricultural land-use pattern in Obagaji area of the Guinea Savanna region, Nigeria. J Agri Extension Rural Develop. 6: 48-54.
12. ILO (2001) National Modular Child Labour Survey Country Report.