CLIMATE CHANGE AND ITS MITIGATION ON THE RURAL CATTLE FARMERS; LESSONS FROM SAKI AREA OF OYO STATE, NIGERIA.

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Abstract

Climate Change as a natural phenomenon is found out to be accelerated by human activities. This study examines the interrelations of climate change, land and cattle faming in Saki area of Oyo state. Data were collected from 300 Livestock (Cattle) Farmers within 2012/2013 farming season, through the use of structured interview schedule using simple random sampling technique. Data collected were analyzed using descriptive statistics (frequency and percentage) while, inferential statistics (Binary Logistic Regression Model (BLRM) is used to determine the impact of climate change and adaptation. The result of this analyses revealed that; primary farm operations and access to extension services increased the likelihood of farmer's adaptation to climate change. Cattle production and ownership were negatively affected by climate change. It was concluded that in the study area, the Cattle Farmers were already aware of climate change in terms of changes in temperature and rainfall pattern. The result of BLRM revealed having access to extension services and information increased the likelihood of cattle farmers to adaptive measure to climate change. It is therefore recommended that government should consider the cattle farmer's perception on climate change when deciding on programmes for cattle production. It is also suggested that programme that encompass significant factor such as climate change adaptation programme should be planned by Government.

Key words; Climate change, mitigation, cattle farming, Saki, Oyo State

Introduction

Livestock has historically constituted one of the Africa's major economic resources and source of protein to its teeming population. Livestock especially cattle is not only serving as a source of table meat but also a store of asset to many tribes in developing countries. Over 1 billion people depend on livestock (cattle) and 70 percent of the 880 million rural poor living on less than USD 1.00 per day are partially dependent on livestock for their livelihoods (World Bank, 2007 and WISP, 2007). The growing body of literature also asserted that the continuous production of cattle is a pathway out of poverty and source of beef for the teeming rural and urban households. It is also a fact that, the rearing of cattle largely depend on natural grazing, rainfall, natural streams and ponds with little supplement. Meanwhile, all these factors are climate induce factors which can become variable and unreliable due to climate change (Freeman *et al.*, 2007).

According to FAO (2008) climate change is defined as the changes in the global climatic system, as a result of anthropogenic global warming and continuous emissions of Green House Gasses (GHG), and the loss of vegetable cover as well as other carbon sinks. Researches in different parts of the world have confirmed that, the consequences of climate change will lead to increase in temperature and staggered rainfall which will decrease the expected water supplies and then affect Agricultural ecosystem negatively (UNDP, 2008) and will be a major setback in cattle production. Also, realities of climate change had led to Agricultural economic loss in Nigeria (Madzwamuse, 2010, Deressa *et al*., 2009, Apata *et al*., 2009) where a lot of natural disasters in the form of storm and flooding had swept away farm land, rangeland and fishery dams in 2011 leading to colossal loss of agricultural assets up to the tune of (worthy) billion Naira. On the other hand, delay and staggered rainfall is still being experienced in most of the savannah belts of Nigeria where the peasant arable rural farmers depend largely on rain fed Agriculture in the crops and animal production.

Through research findings Cattle production is not only being affected by climate change but also, a contributor to climate change. Assessment report revealed that, cattle and other livestock production activities account for about 18 per cent of global anthropogenic emissions (Gill *et al.*, 2010). Estimated methane emissions were 72 times more potent contributor as a global warming gas than $C0_2$ (FAO, 2010a). Extensive research also revealed that raising animals whether intensively or extensively encourage deforestation and other processes such as; slaughtering, refrigeration and transportation of meat

around the world were authentic sources of GHG (Gill *et al*, 2010, Moran, 2008, Good land and Anhang 2009 and Clark *et al*., 2011)

Despite the fact that, the small holder cattle farmers are known to be the most vulnerable to climate change. Majority of them were aware of climate change but were not aware of their contributions through their actions such as; destroying forests for lodging and charcoal, dumping of wastes from their ruminant. They are still major players in the provision of milk, beef and hide in Nigeria. It was also reported that, livestock products contribute 30 percent of the protein in man diets globally. And the volume is predicted to increase, with world production of milk predicted to increase from 580 tonnes to 1043 tonnes, and meat from 229 million tonnes in 2000/2001 to 405 million tonnes by 2050 (Steinfeld *et al*., 2006)

Thus, it seems that there is a gap between the rate at which climate changes and the response to reduce its effects through mitigation strategies that will ensure sustainable meat security by cattle farmers. This study seeks to bridge the gap and to investigate the factors that influence cattle farmers' decision to adapt to climate change in order to formulate policy that will stimulate sustainable cattle production.

The main objective of the study is to examine the effect of climate change on cattle production among the cattle farmers in Saki Area of Oyo State. While, the specific Objectives are to;

i) describe the Socioeconomic characteristics of the cattle farmers in the study area,

ii) determine the level of climate change awareness among the cattle farmers in the study area,

iii) estimate the factors that affect adaptation strategies by cattle farmers in the study area, and

(iv) examine the effect of climate change on cattle production in the study area

Methodology

Study area and source of data:

This study was conducted in Saki area of Oyo State. Saki area lies on longitude $2^0\ 55^1 - 3^055^1$ and on latitude $9^015^1 - 8^015^1$. It has land area of 12, 310 sq km and bounded by Ogun, Kwara, Osun and Benin republic in West, East, South and North respectively. The area comprises three Local Government Areas (i.e. Saki west, Saki East and Atisbo LGAs) with total population of 278,002 inhabitants (Census 2006). Data were collected on respondent' socio economics, the source of information on climate change and diverse ways by which rural cattle farmers mitigate against climate change in the study area.

Sampling techniques:

A multistage random sampling technique was adopted in data collection from the study area. The first stage involves the selection of all the three Local Government area in the study area. The second stage was the selection of five (5) rural wards from each of the Local Government Areas. Rurality indicator was based on area which has population density below 150 inhabitants per square kilometre and living in a location more than 1 hour journey away from a major city (Chomnitz *et al*., 2004). Twenty (20) respondents (cattle farmers) were purposefully interviewed from each ward making a total of 300 respondents (rural cattle farmers).

Analytical Methods:

In this study, the statistical tools used in the analyses of data include; descriptive statistics (cross-tabs, frequencies and percentages) and Binary Logistics Regression Model (BLRM). While descriptive statistics was used to analyse, describe and summarise respondents' socio economic characteristics and different mitigation strategies available; the Binary Logistic Regression Model was employed to ascertain the effect of climate change shocks on rural cattle farmers in the study area.

The Binary Logistic Regression Model:

The Binary Logistic Regression used in this study as adopted by Oni and Adepoju (2011) describes the relationship between categorical response variable and a set of independent variables. The categorical variable can be binary, ordinal or nominal. The Binary Logistic Regression as the response variable is dichotomous. Thus, the general model is given:

$P(Yi = m) = 1/1+e^{-z}$ …… (1)

$P/1-P= e^z$ ……..... (2)

P is the probability of occurrence of the dependent variable Yi equal to a certain value.

Z is the predictor variable and can be said to be a linear combination of the conversion factors;

e is the base of natural logarithm and

P is the estimated probability of occurrence of one point of the dependent variable.

From equation 1,

$1-P = 1-1/1+e^{-z}$ ……..... (3)

1-P is the probability of failure.

Given that $\Omega=P/1-P$ ……(4)

Then, $\Omega= e^z = \exp(Z)$ ……(5)

Ω=P/1-P, represents the Odd of the evaluative factors occurring for each conversion factor,

Assuming Z is a linear function of a set of predictor variable, then,

$Z= \beta_0 + \beta_1X_1i + \beta_2X_2i +…..\beta kXki$ ……. (6)

If (6), then;

$\Omega= e\ \beta_0 + \beta_1X1i+ \beta_2X2i +…..\beta kX\ ki$ …… (7)

In this study $P(Y_i \geq m)$ is the probability of occurrence of the ith , these are ascribed 1; and 0 otherwise.

The logistic regression model is thus given as :

$\Omega=\exp(\beta_0 + \beta_1\sum X_1\ i + \beta_2\sum X_2\ i +…..\beta k\sum Xk\ i)$ ……(8)

The conversion factors are:

X1i: Individual cattle farmer social economics characteristics

X2i: Access to information on climate change

X3i: Farmers observation on climate change

The conversion factors in this study are given below, and the base variables for the regression are designated as follows:

Gender of CATTLE farmers: dichotomous; Male = 1, Female = 2

Age of cattle farmers: categorical: 15-25 years=1, 26-35 years=2, 46-55years=3, ≥56years=4.

Marital status of cattle farmers: categorical; Single=1, Married =2, Divorced = 3, Widowed = 4, Separated=5.

Educational level of cattle farmers : categorical ; No Formal Education = 1, primary=1, Junior Secondary =2, Senior Secondary =3, Tertiary=4.

Household size: categorical; 1-5 = 1, 6-10 = 2, ≥10 = 3.

Results and Discussion

In this section, discussion was made on the major outcome from the processed data collected on the field.

Table 1 reveals that, out of majority 86.33% of the rural cattle farmers that have no climate change awareness have their ages between 46 –and 55 (33.33%); while 30.67% of the respondents were 36 – 45 years. Table: 2 illustrates the cross tabulation between the rural cattle farmers climate change awareness and the household size: The result revealed 86.33% of cattle farmers that have no climate change awareness to have house hold sizes of between 6 - 10 people (36%) and 1 - 5 households (33.33%). Findings from table 3 shows majority 86.33% of the rural cattle farmers that were not aware of climate change were male, farming as major occupation and have no formal education. The Table 4 above shows that, out of 86% of the respondents that have no climate change awareness 41.67% agree to observe late and staggered rainfall while 36% agreed to experience decrease in rainfall which lead to untimely dryness of streams and well during the production period.

Table 5 reveals the result of the statistical relationship between climate change awareness and pattern of temperature change in the study area. The result indicated that 52.67% out of 86% of the respondents (Cattle farmers) that were not aware of climate change agreed to note temperature increase in the study area. The result of table 6 revealed that, out of 86% of those respondents not aware of climate change; 66.67% of them were oblivion of the flooding disaster that destroyed farms and claimed life Nigeria last year. This shows the level of ignorance of Cattle farmers on happening in their environment. Table 7 revealed 80.67% of the respondents (cattle farmers) have access to land use through communal while 5.33% got permission to occupy from local chief out of 86% Cattle Farmers that were not aware on climate change. Table 8 also shows the summary statistics of the relationship between Climate change awareness and the source of information on climate change among cattle farmers: the result revealed that majority 83.33% of the respondents agreed to not having access to information on climate change effect on cattle production. Table 9 indicated that, out of those cattle farmers (86%) that have no awareness on climate change; 52.67% manage their cattle farms by themselves while 30.66% use family member in the rearing of their animals.

Table 10 shows the summary statistics of the mitigation strategies being adopted by respondents to reduce the effect of climate change on their cattle production the finding revealed that most cattle farmers were not aware of climate change but notice changes in weather condition which affect the cattle production and thus call for strategies being taken by them as discussed below. The result revealed 91.7% of the respondent agreed to provide supplementary feed for cattle in place of natural grasses 86.9% of the rural cattle farmers could not establish rangeland due to lack of adequate land. It was also revealed that 94.4% use dip and drug administration while 97.2% of the respondents sell stock to buy need to cushion effect of climate change. It was further revealed that 97.2% and 88.9% of the respondents dig well or borehole and provide lick salt respectively to solve problems of water scarcity in the area. The results in table 11 revealed that majority 83.3% of the respondents agreed to lack of information on climate change and lack of fund as reasons for not adopting any mitigation strategies on their farm; while 66.7% and 86.1% of the cattle farmers asserted to inadequate land (for planting feed) and distance to input market respectively as reasons for not adopting any mitigation strategies while experiencing negative weather condition.

Table 12 presents the Binary Logistic Regression Model (BLRM) analysis of the relationship between Adaptation to climate change and predictor variables in Cattle Production in the Study Area. The result of BLRM analysis presented predicted variables such as; Access to Extension Service ($p<0.05$), Land Ownership ($p<0.1$), Cattle Production and Ownership ($p<0.001$) and Access to Credit ($p<0.1$) were all significant. The log odd for Access to Extension Service of Cattle Farmers is 0.8830. This implies that having access to Extension services by the Cattle Farmers will significantly increase the log odds of attaining at least average adapting to climate change than not having access to extension services.

Findings revealed the Cattle Farmers that have absolute land ownership right significantly increase the log odds of adapting to climate change by 0.7818. The result indicates that, the cattle farmers that have higher usufructural right to landed property for rearing cattle will have stable planning and improve cattle production on their farm. The result also revealed the log odds of attaining better adaptation strategy f or cattle production and ownership by 0.4640. This indicates that; sole ownership of a cattle farm is synonymous with higher adaptation tendency to climate change rather than when the cattle farm is being managed by any other forms in the study area.

It was further found out that ace to credit by the cattle farmers significantly decrease the log odds of attaining at least average adaptation strategies to climate change. The result for this predictor is significant but negatively affects the adoption of mitigation strategies to climate change.

Summary and Conclusion

The study is set out to examine the effect of climate Change on rural Cattle farmers in the study area. Based on the findings, the study concluded that majority of Cattle Farmers in Saki area of Oyo State were male, married and illiterate. Most of them notice changes in climate, change in rainfall pattern, and increase in temperature but could not link it as factors that affect the cattle rearing and production on their farm. Also unavailability of factors such as; information, fund, land for growing supplement affect the adaptation level of the cattle farmers. Furthermore, the results indicated that Access to extension services (highest weighting coefficient), primary farm operation, land tenure and Cattle farm ownership had a positive effect on adaptation decision while access to credit had a negative effect on adaptation decision. From the results, it was inferred that having access to extension services secured land increased the likelihood of adaptation to climate change.

It is hereby recommended that, the NGOs and government should consider the cattle farmer's perception on climate change when deciding on programmes for cattle production. It is also suggested that trained extension agent should be recruited and programme that encompass significant factor such as climate change adaptation programmes should be planned, aired and sponsored by the Government.

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Table 1: Summary Statistics of the relationship between climate change awareness and age of rural cattle farmers

Age of cattle farmers (Yr)	**Yes**	**No**	**Total**
26 – 35	8 (2.67)	25 (8.33)	33 (11)
36 – 45	0 (0)	92 (30.67)	92 (30.67)
46 – 55	15 (8.33)	100(33.33)	125 (41.66)
>56	8 (2.67)	42 (13.67)	50 (16.67)
Total	41 (13.67)	259 (86.33)	300 (100)

Source: Authors computation from survey data 2013.
Figures in parenthesis represent % count.

Table 2; Summary statistics of the relationship between climate change awareness and household size.

Household size	**Yes**	**No**	**Total**
1 – 5	8 (2.69)	100 (33.33)	108 (36)
6 -10	25(8.33)	108(36)	133 (44.33)
>10	8 (2.67)	51 (17)	59 (19.67)
Total	41 (13.67)	259 (86.33)	300 (100)

Source: Authors' computation from survey data 2013.
Figures in parenthesis represent % count

Table 3: Summary Statistics of the relationship between climate change awareness in relation to gender /educational level and occupation.

Variables	Yes	No	Total
Gender Male	42 (13.67)	258 (86.33)	300 (100)
No formal Edu.	42 (13.67)	258 (86.33)	300 (100)
Farming	42 (13.67)	258 (86.33)	300 (100)

Source: Authors computation from survey data 2013.
Figures in parenthesis represent % count.

Table 4: Summary statistics of the relationship of the climate change awareness and rainfall pattern.

Rainfall pattern	Yes	No	Total
Rainfall increase	0 (0)	25 (8.33)	25 (8.33)
Rainfall Decrease	25(8.33)	108 (36)	133 (44.33)
Late and staggered	17 (5.67)	125(41.67)	142 (47.33)
	42 (14)	258 (86)	300 (100)

Source: Authors computation from survey data 2013.
Figures in parenthesis represent % count.

Table 5: Summary statistics of the relationship between the climate change awareness and temperature pattern.

Temperature pattern	Yes	No	Total
Temperature increase	34 (11.33)	158 (52.67)	192 (64)
Constant Temperature	8 (2.66)	50 (16.67)	58 (19.33)
No observation	0 (0)	50 (16.67)	50 (16.67)
	42 (14)	258(86)	300 (100)

Source: Authors computation from survey data 2013.
Figures in parenthesis represent % count.

Table 6: Summary statistics of the relationship of the climate change awareness and 2012/2013 Nigeria flooding.

2012/2013 flood awareness	Yes	No	Total
Yes	8 (3)	58 (19.33)	67(22.33)
No	33(11)	200 (66.67)	233 (77.67)
	42 (14)	258 (86)	300 (100)

Source: Authors computation from survey data 2013.
Figures in parenthesis represent % count.

Table 7: Summary statistics of the relationship of the climate change awareness and land ownership.

Land ownership	**Yes**	**No**	**Total**
Communal	8 (2.67)	242 (80.67)	250 (83.33)
Permission to occupy	34 (11.33)	16 (5.33)	50 (10.67)
Total	42 (14)	258 (86)	300 (100)

Source: Authors" computation from survey data 2013.
Figures in parenthesis represent % count.

Table 8: Summary statistics of the relationship between climate change awareness and source of climate change information.

Source of information	**Yes**	**No**	**Total**
Media	25 (33)	0 (0)	25 (8.33)
Flyers/postal	0 (0)	8 (267)	08 (2.67)
Friends	17 (5.67)	0	17 (5.67)
Not Available	0 (0)	250 (83.33)	250 (83.33)
	42 (14)	258 (86)	300 (100)

Source: Authors" computation from survey data 2013.
Figures in parenthesis represent % count.

Table 9: Summary statistics of the relationship between climate change awareness and management of farm.

Who manage farm	**Yes**	**No**	**Total**
Self	9 (3)	158 (52.67)	167 (55.67)
Family member	33 (11.0)	92 (30.66)	125 (41.67)
Hired labour	0 (0)	08 (2.67)	08 (2.67)
Total	42 (14)	258 (86)	300 (100)

Source: Authors" computation from survey data 2013
Figures in parenthesis represent % count.

Table 10: Summary statistics of mitigation strategies employed by respondents

	Strategies	**Yes**	**No**	**Total**
A	Provision of supplementary feed	275 (917)	25 (8.3)	300 (100)
B	Range land establishment	33 (11)	267 (86.9)	300 (100)
C	Dip and drug application	283 (94.4)	17 (5.6)	300(100)
D	Sell stock to buy needs	292 (97.2)	8 (2.8)	300 (100)
E	Fence camp	133 (44.4)	167 (55.6)	300(100)
F	Portable water provision	292 (97.2)	8 (2.8)	300 (100)
G	Provision of lick salt	267 (88.9)	33 (11.1)	300 (100)

Source: Authors computation survey data 2013
Figures in parenthesis indicate % count

Table 11: Reasons for not adapting to mitigation Strategies

	Reasons	Yes	No	Total
A	Lack of information	267(83.3)	33 (16.7)	300 (100)
B	Lack of money	267 (83.3)	33 (16.7)	300 (100)
C	Unavailability of local strategy	300 (100)	0 (0)	300 (100)
D	No land for supplementary feed	200 (66.7)	100 (33.3)	300 (100)
E	Distance to weather station	292 (97.2)	8 (2.8)	300 (100)
F	Distance to input market	42 (13.9)	258 (86.1)	300 (100)

Source: Authors" computation from survey data 2013.
Figures in parenthesis represent % count.

Table 12: Estimates of the binary logistic model of climate change and adaptation dependent variable: climate change adaptation, (N=300)

Predictor	Coefficient	Std. error	t-ratio
Constant	-4.61297	1.89835	-2.430**
Household size	0.296318	0.184448	1.607
Age of H/ hold	0.0126315	0.142440	0.08868
Marital Status	0.0479410	0.179888	0.2665
Access to Extension Service	0.883025	0.370471	2.384**
Climate Change Awareness	0.690524	0.454432	1.520
Information Service	-0.006536	0.117574	-0.05560
Climate Change Info. By Extn	-0.393070	0.456352	-0.8613
Climate change Support	-0.109372	0.115809	-0.9444
Land Ownership	0.781764	0.437092	1.789 *
Cattle Production and Ownership	0.464006	0.119710	3.876***
Access to Credit	-0.280648	0.135439	-2.072 *
Source of Finance	0.0250725	0.101166	0.2478
Weather Condition	-0.0149211	0.0604910	-0.2467
Rainfall Pattern	-0.0359591	0.0707972	-0.5079

Source: Authors" computation from survey data 2013.
NB: Significance level is given as ***, ** and * for 1%, 5% and 10% respectively.