FACTORS INFLUENCING FISHERMEN'S PERCEPTION ON CLIMATE CHANGE AND CHOICE OF COPING STRATEGIES IN ONDO STATE, NIGERIA

Ashley-Dejo*,S.S., Adelaja, O. A. B. and Idi-Ogede, A. M.

Department of Aquaculture and Fisheries, Federal University Gashua, Yobe State, Nigeria.
School of Economics, Finance and Banking, College of Business, Universiti Utara Malaysia
Department of Fisheries and Aquaculture, University of Ilorin, Nigeria.
*Corresponding author: ashleydejosamuel@gmail.com

ABSTRACT
The study examined the factors influencing fishermen's perception on climate change and choice of coping strategies in Ondo State, Nigeria. Multi-stage sampling technique was used to select 400 fishermen for this study. Data were obtained through the use of structured questionnaire and were analysed using descriptive statistics and double hurdle model. The result indicated that the mean age of the fishermen was 39 years, which were mainly dominated by males, while 61.0% had secondary education. Result also shows that age was significant at 5% for the first and second hurdles while educational level, extension service, extension visit and membership of association were significant at 1%. These variables influenced the fishermen's perception on climate change and choice of coping strategies in the study area. The study therefore recommends that local and state government should encourage fishermen to acquire more education in order to increase their literacy level resulting to better understanding on climate change and choice of coping strategies. Agricultural extension services should be strengthened through provision of necessary logistics and workshops for extension workers on climate change issues for better information flow to end users. In addition, fishermen need to strengthen their association by providing relevant information on climate change and training of members for better understanding of the subject.
Key Words: Fishermen, climate change, coping strategies, double hurdle model

INTRODUCTION
In Nigeria, agriculture is one of most significant sector in the country economy, contributing up to 21.2% to the Gross Domestic Production (GDP). Despite its huge contribution this sector is affected by climate change (Apata *et al*., 2009). Agriculture places substantial burden on the environment through emission of greenhouse gases from various farming practices in the process of providing humankind with food (Apata *et al*., 2009; Byravan & Chella, 2009; Adeleke *et al*., 2016). According to Intergovernmental Panel on Climate Change (IPCC, 2007), climate change can be defined as vital disparities in climate that occur for a longer period and has the possibility to influence natural environment which leads to threat to human growth. In Africa and world at large, climate change is a main trial which affect virtually all agriculture sectors fish farming inclusive (Adebo & Ayelari, 2011).

IPCC (2007) revealed that climate change have strong influence on countries in the Sub-Sahara Africa, mainly in energy, land use, agriculture, biodiversity, water and health resources. Similarly, due to long shoreline (800km) of Nigeria, the country is susceptible to rise in sea-level and danger of severe storms making her to be greatly vulnerable and anxious of climate change (Apata *et al.,* 2009). Adeleke *et al*. (2018) submitted that knowledge and individual view on climate change varies due to political, ecological, cultural, socioeconomics, geographical location and occupation. Climate change affect fisheries in Africa and also threatens the livelihoods of over 200million people who survive by fisheries and aquaculture (Food and Agriculture Organization (FAO), 2003; Fregene & Ogunika, 2013). Studies by Adeleke *et al*. (2016) opined that as a result of change in climatic pattern, temperature and rainfall as increased over the years. Coastal areas are severely affected by climate change while small-scale fishermen who derive their livelihood from there are most vulnerable. Hence, adaptation approaches are vital for the artisanal fishing communities in order to survive the unpredicted weather condition

and related climatic disparities (Mulyasari *et al*., 2018). However, the approaches are likely to be inefficient without the knowledge of fishermen's views on climate change. Perspective of fishermen on climate change is very essential because it forms the willingness or fishermen's behaviour to construct adaptation plans and marine capture modifications (Mulyasari *et al.,* 2018).

Based on the essential role of fisheries in human health, both state and federal agencies have conveyed their concern as regards the potential effects of climate change on fish productivity. Due to interest in this problem, large body have been inspired to conduct research on climate change and fisheries over the past years (Adebo & Ayelari, 2011; Aphunu & Nwabeze, 2012; Adeleke, 2016; Mulyasari *et al*., 2018). If climate change problem is not addressed, more agricultural losses will be incurred in Nigeria and other West Africa countries. As a result of this, there is need to conduct research on factors influencing fishermen perceptions on climate change and choice of coping strategies in Ondo State, Nigeria.

METHODOLOGY

The study was carried out in Ilaje Local Government Area (ILGA) of Ondo State southwest Nigeria. Ilaje has the longest coastline of about 180km, rich in in various groups of aquatic flora and fauna (Adelaja, 2018). The area consists of above 50 fishing communities along its coast as shown in Figure 1. This part is one of the most significant areas for fishing in the shore as a result of rich biodiversity of fin and shell fish.

Primary data were used for this study. Structured questionnaire were designed towards achieving the objectives of the study. Multi-stage sampling procedure was used for the choice of respondents. Firstly, twenty (20) fishing community were randomly selected from the identified fishing community in the study area. Also, twenty fishermen were selected randomly from the selected fishing community using simple random sampling technique. Finally a total four hundred (400) fishermen from the population of 1,243 fishermen were selected for this study. Reliability test and validity test was conducted to test the effectiveness of the research instrument. This was done through pre-test of the questionnaire using 10% of the sampling size (40 households). Data were analysed to know whether the information collected fit into the model used. This was done before the actual survey was carried out. Descriptive statistics and double hurdle modelling technique was used to achieve the object of the study.

Double hurdle model

The model was used to determine the factors influencing fishermen perception on climate change and choice of coping strategies. This objective consists of two separate hurdles: perception on climate change and coping strategies that needed to be crossed. The double hurdle model is one of the variants of the tobit model. It includes binary choice and continuous choice simultaneously. It is assumed that fishermen must perceive climate change before they could decide on the coping strategy to adopt (Maddison, 2006; Gbetibouo, 2009; Deressa *et al*., 2010). For double hurdle model, likert type item were used to calculate the perception index for each respondent. The index was calculated by assigning figures for each likert (strongly agree = +2, agree = +1, neutral = 0, disagree = -1 and strongly disagree = -2). Thus, fishermen perception index was calculated by summing up his response.

FPI = PR + NR ……..1

Where,

FPI = Fishermen perception index, PR = Positive response and NR = Negative response.

Therefore, for this study the following likert type items were used:

Positive response included

1. Climate change results to increase in fish harvested

2. Climate change results to increase in availability of new fish species
3. Climate change results to increase of water pollution
4. Climate change results to increase in fish availability

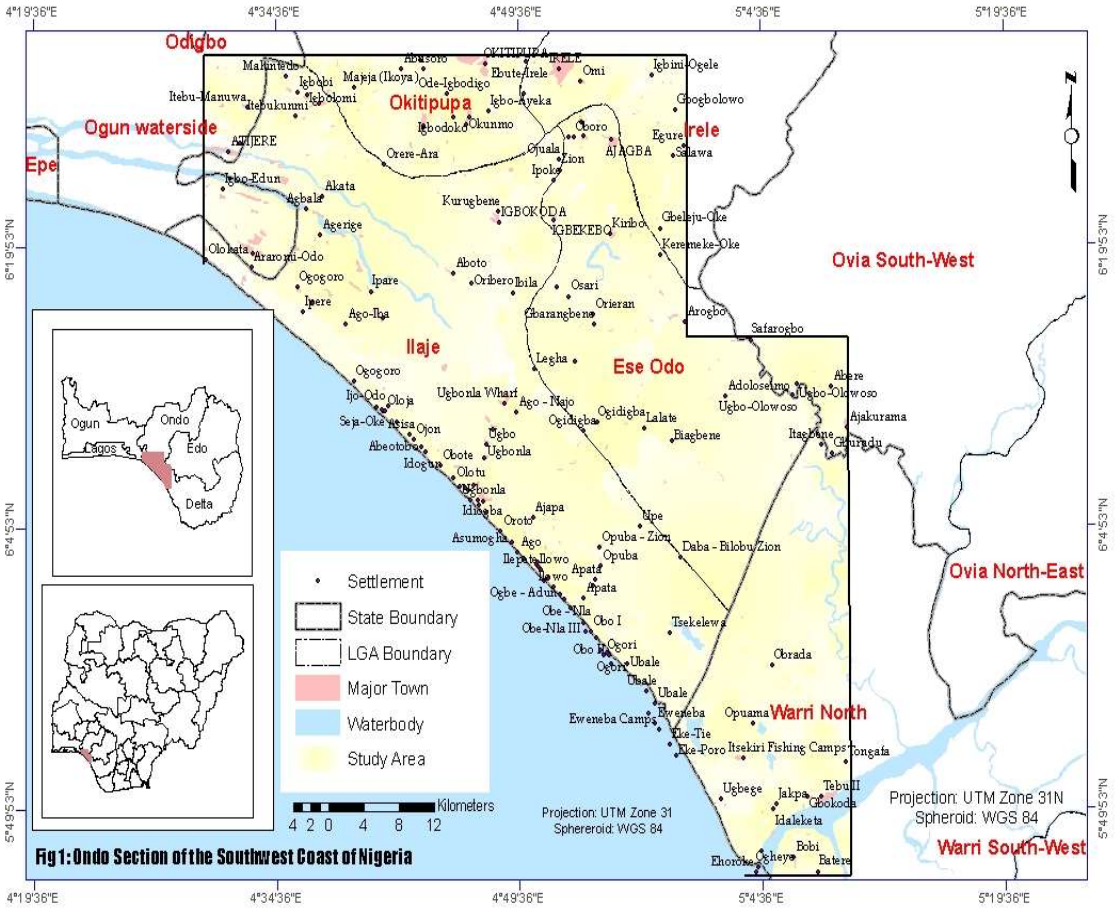

Fig 1: Ondo Section of the Southwest Coast of Nigeria

Figure 1: Map showing the fishing communities along the coastal areas of Ondo State, Nigeria

Source: http://pubs.sciepub.com/ajrd/2/1/1/index.html

Negative response included

1. Climate change results to decrease in fish harvested
2. Climate change results to decrease in productivity of some fish species
3. Climate change results to decrease of water pollution
4. Climate change results to decrease in fish availability

If the sum of the index is positive, the farmer is assumed to have positive perception to climate change and scores a value of 1. The value is 0 otherwise. In this context, Logit Regression Model was used to analyse the first hurdle. The model is expressed as follows:

$Y_{i1} = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8$ ……. (2) (First Hurdle Equation)

Where Y_1 = dependent variable indicating fishermen; perception on climate change.

Where $X_1 – X_9$ are the factors influencing fishermen perception on climate change.

X_1 = Age of household head (in years)
X_2 = household size (number)
X_3 = Level of education (in years)
X_4 = farming experience (in years)
X_5 = Assess to credit (actual number)
X_6 = Extension service (Yes=1, No=0)
X_7 = Number of extension visit (number)
X_8 = Membership of association (Yes=1, No=0)
$\beta_1 – \beta_8$ = Coefficient
α = Constant

The second hurdle was analysed using Tobit model (Tobin 1958). The model describes the relationship between a non-negative dependent variable Y_i and an independent variable X_i. Tobit model used for the study is expressed as follows.

$Y_{i2} = \beta X_i + U_i$ ……. (3) (Second Hurdle Equation)

$Y_{i2} = \beta X_i + U_i$ if $\beta X_i + U_i > 0$

i.e Y_{i2} is observed only if the household choose a coping strategy.

$Y_{i2} = 0$ if $\beta X_i + U_i \leq 0$……. (4)

In this equation, Y_{i2} is not observed (latent variable) because it is possible that the fishermen perceives climate change and refuse to adopt any coping strategy due to his deliberate decision.

Therefore, $Y_{i2} > 0$ or $Y_{i2} \neq 0$

i = 1, 2, 3 ……N

where,

Y_{i2} = dependent variable (Sum of coping strategies adopted)
X_i = vector of independent variable ($X_1 = X_8$)
β = a vector of unknown coefficient
U_i = independently distribution error term assumed to be normal with zero mean and a constant variance
N = number of observations

RESULTS AND DISCUSSION

Socioeconomic characteristics of the fishermen

Table 1: Socioeconomic characteristics of fishermen (n = 400)

Variables	Frequency	Percentage
Age (years)		
20 – 40	261	65.2
41 – 60	139	34.8
Mean ± std	**38.60 ± 5.64**	
Sex		
Male	400	100.0
Educational qualification		
No formal education	13	3.3
Primary education	144	36.0
Secondary education	243	60.7
Fishing experience (Years)		
Less than 10	88	22.0
10 – 15	80	20.0
16 – 20	112	28.0
21 – 25	62	15.5
Above 25	58	14.5
Mean ± std	**17.61 ± 6.82**	

Access to credit facilities		
Yes	255	63.8
No	145	36.3

Source: Field survey, 2017

Table 1 presents the socioeconomic characteristics of fishermen. Result showed that on the average, a fisherman is 38 years old. This implies that fishermen were in their energetic age bracket and still have the strength to undergo fishing tasks. Finding is comparable to the study of Aphunu and Nwaubeze (2012) who stated that the mean age of fishermen was 39.4 years which shows that fishermen are still very much agile and can dynamically adopt efficient measures for mitigating the effect of climate change. All (100%) the fishermen in the study area were males. This is in line with the study of Aphunu and Nwabueze (2012) who observed that male dominate small-scale fishing. This implies that male dominant was due to strenuous nature of fishing activities. From the results majority (60.7%) had secondary education. This denotes that the fishermen are educated and should have understating on climate change and choice of coping strategies. On the average, fishing experience of fishermen was 18 years, implies that fishermen are well experienced in the fishing activities. The finding agrees with the study of Mulyasari *et al.,* (2018) who reported that most (44.4%) of the fishermen had within 12 – 20 years of fishing experience. Majority (63.8%) of the fishermen had access to credit facilities. This signifies that some of fishermen have access to credit facilities to support their fishing operation in the study area.

Estimates of the double hurdle model

The result in Table 2 reveals the estimates of the double hurdle model. The result indicated that the factors influencing fishermen perception on climate change could be different from those factors influencing fishermen choice of coping strategies and where there are no differences, it could be different in magnitude and direction.

It was observed that the age of the fishermen was significant for the first and second hurdle at 5% significant level. Thus the age of fishermen influences his perception and choice of coping strategies to climate change. The variable has a positive coefficient (0.0632) for first hurdle and negative coefficient for second hurdle (-0.0155).

Table 2: Estimates of the double hurdle model

Variables	**First hurdle (perception)**			**Second hurdle (Copping strategies)**		
	Coefficient	**Standard Error**	**P-value**	**Coefficient**	**Standard Error**	**P-value**
Age (X_1)	0.0632	0.0242	0.028**	-0.0155	0.0084	0.038**
Household size (X_2)	0.0342	0.0342	0.324	-0.0091	0.0163	0.610
Years of education (X_3)	0.2162	0.0332	0.000***	-0.0121	0.0211	0.521
Farming experience (X_4)	0.0167	0.0241	0.131	0.0433	0.0153	0.211
Asses to credit (X_5)	-0.0414	1.1003	0.124	-0.3846	0.2720	0.125
Extension service (X_6)	2.7233	0.8535	0.001***	0.7291	0.2165	0.005***
Extension visit (X_7)	0.3439	0.0733	0.000***	0.0512	0.0177	0.000***
Membership of association (X_8)	-2.5451	1.7433	0.000***	-0.0684	0.0103	0.001***
Constant	-7.1735	1.7533	0.000***	2.3116	0.4112	0.000***
Log likelihood	-70.423			-471.816		
Chi-square value	195.32***			67.07***		

Source: Field survey, 2017

*** Significant at 1%, **Significant at 5%, *Significant at 10% levels of probability.

In the first hurdle, this implies that as the age of fishermen increases, it is likely that his perception on climate change would increase. This implies that the probability of adaptation significantly increases

as the age of farmer increases. This is in line with the study of Fatuase and Ajibefun (2014) who reported that the older the farmer, the higher the probability of the farmer perceive change on climatic factors while the second hurdle indicated that the higher the age of the farmer, the less the probability of choosing a coping strategy. This implies that the probability of adaptation significantly decreases as the age of farmer increases. This can be assumed that the farmers could be having less interest or less incentive in taking climate change issues. Moreover the older farmers could be resistant to change, hence, do not see the necessity of adopting improved technologies and would prefer the old system of farming that they are used to other than adapting to new system of farming. This could be because older farmers in the rural areas are traditionally bound therefore, they tend to stick to their old ways of doing things. This finding corresponds to that of Oyekale and Oladele (2012) who observed that as farmers increase in age, the chance of adopting new innovation decreases but contrary to Deressa *et al*. (2008) who observed that age of farmers increases the chances of adapting to climate change.

Years of education of the fishermen in the first hurdle was significant at 1% significant level and has a positive coefficient (0.0167). This indicates that the probability of fishermen in the study area to adapt to climate change appeared to be greater especially for those who are educated compared to the less educated fishermen in the study area. Educated fishermen have access to more knowledge, better ability to comprehend and react to climate change, can also predict future occurrences on climate change, have access to climate change information. This result is similar to the study Mendelsohn, (2009) who assessed the impact of climate change on agriculture in developing countries, He observed that educated farmers tends to have more knowledge and information about climate change and adaptation practices also that the more the years of education of farmers, the higher the possibility of perceiving climate change. This observation is in line with a priori expectation that the more educated an individual his, the more likely such individual will perceive climate change. This is because advanced education is likely to bring about first-hand information. For second hurdle, years of education was not significant and had a negative coefficient (-0.0121). This implies that years of education do not have influence on the choice of coping strategies to climate change. This is in line with the findings of Fatuase and Ajibefun (2014) but was contrary to the findings of Ndambri *et al* (2010) and Mulinya (2017) who observed that the more educated farmer's is the better is understanding and likelihood to adapt to climate change. Choice of coping strategies depends mainly on affordability, thus farmers may be educated but may not be able to afford the cost of using the coping strategies.

The variable extension service was significant at 1% significant level for the two hurdles. The coefficients of both hurdles were positive first (2.7233) and second (0.7291). This implies that the more the extension service provided, the higher the likelihood of perceiving climate change and choosing a coping strategy. This findings is in line with the priori expectation and it corresponds with the findings of Deressa *et al*. (2008) and Idrisa *et al.* (2012) who observed that farmers who have access to extension services are more likely to be aware of climate change conditions and have better understanding of different management strategies that can be adapted to condition of climate change.
Also, coefficient of number of extension visit was found to be positive for both hurdles (0.3439 and 0.0512) first and second hurdles respectively and significant at 1% significant level. This implies that the more the extension visits, the more the farmers are likely to perceive climate change and choose of coping strategies. Also, farmers with access to training are more likely to take different coping strategies because they are informed of different alternatives in their environment to cope with the climate change. This result was in agreement with the *a priori* expectation that the more contact with extension workers the more the understanding and likelihood of adapting to climate change condition. This study established that an increase in number of extension visit is likely to increase fishermen perception on climate change and their choice of coping strategies. This finding was in agreement with the study of Idrisa *et al.* (2012) that extension visits were highly significant in influencing the level of awareness and use of adaptation measures to climate change among farmers.

Membership of an association was found to be significant at 1% significant level in both hurdles. Negative coefficient was observed in both hurdles (first and second) implying that the more the fishermen belong to association, the less is likelihood of perceiving climate change and choosing a coping strategy. This contradicts the priori expectation of this study. This might be because members of the association lack first-hand information about climate change and choice of coping strategies.

CONCLUSION

The study examined factors influencing fishermen perceptions on climate change and choice of coping strategies in Ondo State, Nigeria. Two hurdles were used to assess the study namely fishermen perception and choice of coping strategies to climate change. The findings revealed that age of fishermen, years of education, extension service, extension visit and membership of association influenced fishermen's' perception on climate change and choice of coping strategies to climate change in the study area. The chi-square value was 178.32% for the first hurdle and 67.07% for the second hurdle all was found to be significant at 1% significant level. The following findings was observed; Years of education of fishermen in the study area significantly influenced perception on climate change at 5% significant level. Assess to extension service and extension visit significantly influenced perception on climate change and fishermen choice of coping strategies at 1% significant level. Membership of association also significantly influenced perception on climate change and fishermen choice of coping strategies at 1% significant level but had a negative coefficient for both hurdles.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made

1. The State government through the local government should encourage fishermen in the study area to acquire more education either through formal or informal means in order to increase their literacy levels, this would help them to understand climate change issue better and boost their capacity to use coping strategies effectively.
2. The State government through the local government should endeavour to strengthen the agricultural extension services through provision of necessary logistics and workshops for extension workers on climate change issues for better information flow to end users.
3. Fishermen in the study area need to strengthened their association by sourcing for more information about climate change and organize training for members for better understanding of the subject.

REFERENCES

Adebo, G. M. & Ayelari, T. A. (2011). Climate change and vulnerability of fish farmers in South-western Nigeria. *African Journal of Agricultural Research,* 6(18), 4230-4238.

Adelaja, O. A. (2018). Assessment of Post-Harvest Fish Losses among small-scale Fishermen in Ondo State, Nigeria. Ph.D Thesis University Utara Malaysia, Malaysia.

Adeleke, M. L. & Omoboyeje, V. O. (2016). Effects of climate change on aquaculture production and management in Akure Metropolis, Ondo State, Nigeria. *Nigerian Journal of Fisheries and Aquaculture,* 4(1), 50-58.

Adeleke, M. L., AL-Kenawy, D., Nasr-Allah, A. M., Murphy, S., EL-Naggar, G. O. & Dickson, M. (2018). Fish farmers' perceptions, impacts and adaptation on/of/to climate change in Africa (The case of Egypt and Nigeria). *Springer, Theory and Practice of Climate Adaptation,* pp.269-295.

Apata, T. G., Samuel, K. D. & Adeola, A. O. (2009). Analysis of climate change perception and adaptation among arable food crop farmers in South Western, Nigeria. *Paper presented at the International Association of Agricultural Economists conference,* Beijing, China, 16-22, 209.

Aphunu, A. & Nwabueze, G. O. (2012). Fish farmers' perception of climate change impact on fish production in Delta State, Nigeria. *Journal of Agricultural Extension,* 16(2), 1-13. http://dx.doi.org/10.4314/jae.v16i2.1.

Fatuase, A. & Ajibefun, I. (2014). Perception and adaptation to climate change among farmers in selected communities of Ekiti State, Nigeria. *Journal of Agricultural Faculty of Gaziosmanpasa University,* 31(3), 101-114.

Fregene, B. T. & Ogunika, O. F. (2013). Perception of fish farmers to climate change and adaptation strategies in Oyo State, Nigeria. In: Ndimele, P. E. Ed) proceedings of the 28th Annual Conference of the Fisheries Society of Nigeria (FISON), 25-29 Nov 2013, Abuja, Nigeria, pp. 408-411.

Maddison, D. (2006). The Perception and Adaptation of Climate Change in Africa. CEEP Discussion Paper No. 10, Centre of Environmental Economics and Policy in Africa, University of Pretoria, Pretoria, South Africa.

Idrisa, Y. L., Ogunbameru, B. O., Ibrahim, A. A. & Bawa, D. B. (2012). Analysis of Awareness and Adaptation to Climate Change among Farmers in the Sahel Savannah Agro-ecological zone of Borno State, Nigeria. *British Journal of Environment and Climate Change*, 2(2), 216 - 226.

Gbetibouo, G. A. (2009). Understanding Farmers' Perception and Adaptation to Climate Change and Variability: the case of the Limpopo basin, South Africa. Discussion paper No. 00849 South Africa Environment and Production Technology Division.

Deressa, T. T., Ringler, C. & Hassan, R. M. (2010). Factors Affecting the Choice of Coping Strategies for Climate Extremes: The case of Farmers in the Nile basin of Ethiopia. International Food Policy Research Institute (IFPRI). Discussion paper No. 1032 Washington D.C.

https://www.statista.com/statistis/382311/nigeria-gdp-distribution-across-economic-sectors/. Assessed on May 10 2020.

Mulyasari, G., Waluyati, L. R. & Suryantini, A. (2018). Perceptions and local adaptation strategies to climate change of marine capture fishermen in Bengkulu Province, Indonesia. *International Conference on Climate Change,* doi:10.1088/1755-1315/200/1/01/2037.

Tobin, J. (1958). Estimation of relationship for limited dependent variables. *Econometric* 26: 24 – 36.

Fatuase, A and Ajibefun, I. (2014). Perception and Adaptation to Climate Change among selected Communities of Ekiti State, Nigeria. Jo*urnal of Agricultural faculty of Gaziosmanpasa University*, 31(3), 101 – 114. http://ziraatdergi.gop.edu.tr/.

Oyekale, A. S. & Oladele, O. I. (2012). Determinant of Climate Change Adaptation among Farmers in Southwest Nigeria. *Journal of Science and Technology*, 2, 154 – 168.

Deressa, T. T., Hassan, R. M., Alemu, T., Yesuf, M. & Fingler, C. (2008). Analyzing the Determinants of Farmers' Choice of Adoption methods and Perceptions of Climate Change in the Nile Basin of Ethiopia. IFPRI Discussion paper 00798.

Mendelsohn, R. (2009). The Impact of Climate Change on Agriculture in Developing Countries. *Journal of Natural Resources Policy Research*, 1(1), 5 – 19.

Mulinya, C. (2017). Factors Affecting Small Scale Farmers Coping Strategies to Climate Change in Kakamega County in Kenya. *Journal of Humanities and Social Science,* 22(2), 100-109 *www.iosrjournals.org*.

Ndambri, H. K., Ritho, C. N. and Mbogoh, S. G. (2010). An evaluation of Farmers' Perception of and Adaptation to the effect of Climate Change in Kenya. *Journal of food and Agricultural Economics*, 1(1), 75 – 96.