# Socio-economic Determinants of Rural Women Farmers' Perceived Effects of Climate Change on Agricultural Production in Imo State, Nigeria

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**Abstract**

This study focused on the socio-economic determinants of rural women farmers' perceived effects of climate change on agricultural production in Imo State, Nigeria. The study objectives were to describe the women farmers' socio-economic characteristics, ascertain the women farmers' perceived effects on climate change in agricultural production, and to ascertain the determinants of the women farmers' perceived effects of climate change on agricultural production. The sample size comprised 240 rural women farmers who were interviewed using structured questionnaires. Data collected were analyzed using descriptive statistics and Ordinary Least Square Multiple Regression Technique at 0.05 level of significance. The result showed that climate change had multifarious consequences on agricultural production as perceived by the women farmers, and that the women farmers' perception of climate change is determined by their socio-economic characteristics. The respondent's socio-economic characteristics showed that they had an average age of 48 years, eight persons per household and 13.3 years experience in their farm business. The result also implied that increasing the magnitude of the variables increased the perceived effects of climate change on agricultural production. It was recommended that women should be educated to enhance their analytical prowess at discerning the effects of climate change, thus reducing their vulnerability to climate change and its effects on their farming activities.

**Keywords:** Climate change, agriculture, socio-economic determinants, rural women, perceived effects

## 1.0 Introduction

Climate change refers to any significant change in measures of climate such as temperature, precipitation or wind, lasting for an extended period typically decades or longer. It is the permanent departure of climate pattern from mean values of observed climate indices (Obioh, 2002). Available evidences show that climate is global, likewise it's impacts; but the most adverse effects will be felt mainly by developing countries, especially those in Africa, due to their low level of coping capabilities (Nwafor, 2007). Climate change has adversely affected agricultural production because of the climate-dependent nature of agricultural production systems. This impact is particularly significant in developing countries like Nigeria in the form of poor and unpredictable yields (UNFCCC, 2007). Farmers (who constitute the bulk of the poor in Africa), face prospects of tragic crop failures, reduced agricultural productivity, increased hunger, malnutrition and diseases as a result of climate change (Zoellick, 2009), and women make up large number of poor people in communities that are highly dependent on local natural resources especially farming for their livelihood, and are disproportionately vulnerable to and are affected by climate change (UNDP, 2008). Evidence from literature and past studies show that the recent global warming has influenced agricultural

production leading to declining food production (Kurukulasuriya & Mendelsohn, 2006).Consequently, there had been repeated crop failures and declining yields which have led to malnutrition and impoverishments of local inhabitants of Imo State, Nigeria due to the extended effects of climate change on their livelihood (Mortimore & Adams, 2001). As rainfall pattern shifts and extreme events such as droughts, floods and erosion become more frequent, the farmers are faced with poor and unpredictable yields. The precipitation and humidity regulates the seasons and period available for crop production. Clouds and sunlight duration may also affect the growth of some crop and varieties which require long hours of daylight to reach maturity. Farmers perceive these effects differently. The variants of socio-economic characteristics sometime determine their perception. Their perception of the effects would be a pointer to their adaptation. Adaptation to climate change refers to adjustment on natural or human systems in response to actual or expected climate stimuli and their effects which moderates harm or exploits beneficial opportunities (IPCC, 2001). Many adaptation methods have been used in agriculture but the common ones include crop diversification, adoption of mixed crop and livestock farming systems, use of new crop varieties and livestock species that are better suited to their conditions, irrigation, and changing planting dates (Kurukulasuriya & Mendelsohn,2006: Nhemachena & Hassan 2007; Onyeneke & Madukwe, 2010). Many authors have written on climate change and agricultural adaptation (Nwajiuba etal., 2008; Nwosu et al., 2012; Chidiebere-Mark, 2012) but none of the studies centered on women, their perception of the effects of climate change on agricultural production, and the socio-economic determinants of the perception which this study sets out to achieve. Again, there is little or no empirical data on women farmers' perceived effects of climate change on agricultural production and their socio-economic determinants. This has given rise to gap in knowledge which has been hampering advocacy and intervention. The result of the study will help to bridge the existing gap in knowledge as baseline to formulating policies and designing programmes towards alleviating the issues under consideration. The study is set to achieve the following objectives;

- to describe the women farmers' socio-economic characteristics.
- to ascertain the women farmers' perceived effects of climate change on agricultural production.
- to ascertain the determinants of the women farmers' perceived effects of climate change on agricultural production.

## 2.0 Materials And Method

The study was carried out in Imo State, Nigeria. Imo State is located in the humid tropics of South East Nigeria. It lies within latitudes $40^0$ 45' N and $70^0$ 15' N and longitude $60^0$ 50' E and $70^0$ 25' E (http://www.imostate.gov.ng/ state-overview/index.php). Imo State is bounded on the East by Abia State, on the West by the River Niger and Delta State; on the North by Anambra State, while Rivers State lies to the South. The state covers a land area of 5,067.20 $km^2$ (Ministry of Lands, Survey and Urban Planning, 1992) with a population of 3,934, 899 persons (NBS, 2006).

The undulating nature of the interfluves gives rise to numerous depressions especially in the northeast. Rainfall distribution is bimodal, with peaks in July and September and a two week break in August. The rainy seasons begin in March and lasts till October or early November. From March to May, there are violent storms that destroy crops and houses. Rainfall is often at its maximum at night and during the early morning hours. However, variation occurs in rainfall amount from year to year. Imo state has an average annual rainfall of 1,800-2,500 MM and altitude of about 100 m above sea level (Imo ADP, 1990).

Temperatures are similar all over the state.

The hottest months are January to March, with the mean annual temperature above 20 $^{0}$c. The influence of the harmattan lasts for about nine weeks (i.e from late December to late February). Imo State has an average annual relative humidity of 75 percent which is highest during the rainy season, when it rises to about 90 percent. .

The state has three agricultural zones namely, Orlu, Owerri and Okigwe. It is also delineated into 27 local government areas. The population of Imo State is predominantly rural. The Imo State economy depends primarily on agriculture and commerce, and the major occupation of the people is farming. Their cash crops include oil palm, raffia palm, rice, groundnut, melon, cotton, cocoa, rubber, maize, et cetera. Their food crops include yam, cassava, cocoyam, maize, melon, etc. (http://www.imostate.gov.ng/state-overview/index.php).

A multi-stage sampling technique was used for the selection of respondents. Two Local Government Areas (LGAs) were randomly selected from each of the three agricultural zones in the state. From each of these LGAs, two communities were randomly chosen, thus giving a total of twelve (12) rural communities. The sampling frame comprised the list of all registered women farmers obtained from the Imo State Agricultural Development Programme (ADP). Twenty (20) women farmers from each of these communities were randomly selected from the list to give a total number of two hundred and forty women farmers.

Primary data for this study were collected from the respondents using structured questionnaire. Major variables on which data were collected included socio-economic characteristics of the women farmers', the women famers' perceived effects of climate change on agricultural production, and the determinants of the perceived effects of climate change on their agricultural production. Data collected were analyzed using percentages, mean and ordinary least squared multiple regression technique.

Specifically, the socio-economic characteristics were analyzed using percentages and mean. The perceived effects of climate change was analyzed using mean score on the five-point likert scale of agreement- Strongly agreed = 5, Agreed = 4, Undecided = 3, Disagreed = 2 and Strongly disagreed =1. The discriminating index was set at 3.00, got by dividing the sum of the weights of the scales by the number of scale.

$$= \frac{SA + A + U + D + SD}{A}$$

$$= \frac{15}{5}$$

= 3.00 (Discriminating index)

The determinants were analyzed using ordinary least squared multiple regression technique, expressed as follows:

$Y = f(X_1, X_2, X_3, X_4, \ldots\ldots X_8, .e)$

Where Y = Adaptation strategy (adapted strategy 1, none 0)

$X_1$ = Age (years)

$X_2$ = Educational level (years)

$X_3$ = Farming experience ( Years)

$X_4$ = Household size (number of persons in a household)

$X_5$ =Farm size (Hectares)

$X_6$ =Marital status (Married 1, single 0)

$X_7$ = Major occupation (farming 1, trading 2, civil service 3, fashion and designing 4)

$X_8$ = Farming status (full time, 1, part time 0)

The apriori expectation from the relationship between the variables are:

$X_1, X_4 < 0 \qquad X_2, X_3, X_5, X_6, X_7, X_8, > 0$

The choice of lead equation was based on: the coefficients significance,

F-value and –apriori expectation.

**3.0 Results And Discussion**

**3.1 Socio-economic characteristics of respondents**

Table 1 shows the socio-economic characteristics of the respondents as follows:

Most (41.7 %) of the respondents were aged between 41-50 years with a mean age of 48.1 years. This shows that the women farmers in the study area were mostly middle aged people who are still strong and energetic and are most likely to use various techniques to cope with climate change events. (Agomuo, 2015). A greater proportion (32.50 %) of the respondents had tertiary education, 31.30 % had secondary education, 22.9 % had primary while 13.30 % had no formal education. This shows that majority of the respondents (women farmers') in the study area were literate. The high level of education is capable of boosting their perception, access to accurate information on climate change and hence their adaptive capacity might be high. This is in line with the findings of Agomuo (2015) which states that education of the farmers was positive on all adaptation options to climate change, and that more education is believed to be associated with access to information on improved technologies and higher productivity. Majority (67.80 %) of the women are married and this will positively influence their level of perception of the effects of climate change since marriage inadvertently increases the size of their household. The mean household size was eight (8) persons. This implies that family labour may be cheap and readily available for farm work since relatively large household size is an obvious advantage in terms of farm labour supply.

Table 1 also shows farming as the major occupation (100 %) as all the respondents are female farmers and see farming as their priority. The mean year of farming experience was13.3 years. This means that the female farmers in the area were not new entrants in the occupation. They must have had significant experience in climate change

phenomenon hence a high perception rate of its effects on agricultural production. This agrees with the findings of Mapuno *et al.,* (2008) and Agomuo (2015) which noted that farmers are in a better position to identify challenges and opportunities on climate change based on their indigenous knowledge and experience. The respondents had a full-time farming status (100 %) as all of them were female farming while some had part-time occupation as a way of portfolio diversification and an insurance measure cushioning the effects of total crop or animal failure. The mean farm size of the respondents was 1.3 ha. This shows a preponderance of small scale farming in the study area. Small scale farmers' generally have inadequate capital to adopt technologies that require huge capital. This was likely boosted by their high level of perception to climate change effects. About 62 percent of the respondents belonged to social organizations which most times is a forum for disseminating information on their farm activities including climate change issues.

**Women Farmers' Perceived Effects of Climate Change on Agricultural Production**

Based on the computations of the like variables, 3.0 discriminating index was obtained as a base for the perceived effects of climate change. The result in Table 2 showed that twelve (12) out of fourteen(14) items were accepted as having affected agricultural production. The computed mean for the fourteen(14) variables ranged from 0.55 to 4.04. The items included poor yield of agricultural products which ranked 1st. Ofor (2009) posited that drought will delay land preparation, planting and subsequently reduce yields at harvest, while increased flooding and sedimentation in flood plains will make them less productive. Also Jones (2003) projected that crop yield in Africa may fall by 10-20 per cent by the year 2050 or even up to 50 per cent due to climate change. IPCC (2007) stated that a decrease of up to 30 per cent in world food production due to climate change on agriculture is generally predicted.

Low income from farming ranked 2nd.The poor yield obtained at harvest only fetchers little income to the farmer. Countries is sub-saharan Africa, including Nigeria, are likely to suffer most because of their geographical location, low income, and low institutional capacity, as well as, their greater reliance on climate–sensitive renewable natural resource sector like agriculture. A southern African study forecast a fall in net crop revenues by as much as 90 per cent by 2100. The study found small scale farmers to be most affected by the decrease. (Maddison, 2006).

However, reduction in soil fertility (mean 0.55), higher period of phototropism (mean 2.90) and increased rate of sickness of farmers (mean = 3.04) respectively, were the least perceived effects of climate change by the women farmers. Soil in this part of the region are becoming so degraded that they can no longer support life (UNCCD, 2009). Incessant rainfall had led to run-off which causes erosion and leaching of soil nutrients from the top soil. Brussels (2009) posited that the degradation of agricultural ecosystems could mean desertification resulting in a total loss of the productive capacity of the land in question. FAO (2007) reported that up to 11 per cent of arable land could be highly affected by climate change in the developing world.

Zoellick (2009) stated that small scale farmers, who constitute the bulk of the poor in Africa, face prospects to tragic crop failure, reduced agricultural productivity, increased hunger, malnutrition and diseases as a result of climate change.

The effects of climate change on the people of Imo State is evident in this study as well as, in many others conducted all over the nation and beyond (Apata *et al.,*2009; Devereux & Edward, 2004; FAO, 2007; Hassan and Nhemachena, 2008; IPCC, 2001; & Ifeanyi-Obi *et al.,* 2011). The result of this study shows that the agricultural sector of the economy is being threatened by climate change and call for urgent action by all stakeholders in the sector.

**Table 1:** Distribution of respondents according to their socio-economic characteristics n = 240

| Variable | Frequency | Percentage | Mean |
|---|---|---|---|
| **Age** | | | |
| <20 | 10 | 4.20 | |
| 21-40 | 70 | 29.20 | |
| 41-60 | 100 | 41.70 | 48.1 years |
| 61-80 | 60 | 25.00 | |
| **Level of education** | | | |
| None | 32 | 13.30 | |
| Primary | 55 | 22.90 | |
| Secondary | 75 | 31.30 | |
| Tertiary | 78 | 32.50 | |
| **Marital Status** | | | |
| Single | 28 | 11.70 | |
| Married | 162 | 67.80 | |
| Separated/Divorced | 12 | 4.60 | |
| Widowed | 38 | 15.90 | |
| **Household size** | | | |
| 1-3 | 69 | 28.8 | |
| 4-6 | 104 | 43.3 | |
| 7-10 | 58 | 24.2 | 8 persons |
| 11 and above | 9 | 3.8 | |
| **Major occupation** | | | |
| Farming | 240 | 100.00 | |
| Trading | 77 | 32.05 | |
| Civil Service | 24 | 9.73 | |
| Fashion and Designing | 24 | 10.12 | |
| **Farming Experience** | | | |
| <1-5 | 79 | 32.00 | |
| 6-10 | 81 | 38.00 | |
| 11-15 | 50 | 20.80 | 13.3 years |
| 16-20 | 30 | 12.50 | |
| **Farming status** | | | |
| Full time | 240 | 100.00 | |
| Part-time | 128 | 53.20 | |
| **Farm size** | | | |
| <1 | 101 | 42.10 | |
| 1.1-3 | 90 | 37.50 | 1.3ha |
| 3.1-5 | 43 | 17.90 | |
| 5.1-7 | 6 | 2.50 | |
| **Social Organization Membership** | | | |
| No | 91 | 37.90 | |
| Yes | 149 | 62.10 | |
| **Social Organization membership Status** | | | |
| Non-members | 91 | 37.90 | |
| Ordinary members | 49 | 22.50 | |
| Financial members | 54 | 23.20 | |
| Regular members | 22 | 6.00 | |
| Committee members | 12 | 5.20 | |
| Executive members | 12 | 5.20 | |

**Table 2:** Distribution of Women Farmers' according to Perceived Effects of Climate Change on Agricultural Production in Imo State.

| Perceived Consequences | Mean | Rank |
|---|---|---|
| Delay in take off of farming | 3.76 | 5th |
| Uncertainty in production | 3.96 | 3rd |
| Water logging | 3.55 | 10th |
| Increased incidence of gullies and rills | 3.56 | 9th |
| Prevalence of pests and diseases of crops and animals | 3.69 | 7th |
| Weak/poor adaptation of crops and animals to the environment | 3.81 | 4th |
| Low income from farming | 3.98 | 2nd |
| Poor yields of agricultural products | 4.04 | 1st |
| Increased processing costs | 3.52 | 11th |
| High rate of spoilage of agricultural products | 3.73 | 6th |
| Increased rate of sickness of farmers' | 3.04 | 12th |
| High period of phototropism | 2.90 | 13th |
| All year round availability of short duration crops | 3.58 | 8th |
| Reduction in soil fertility | 0.55 | 14th |

**Source: Field Survey Data, 2014.**

### 3.3 Socio-economic Determinants of Women Farmers' Perceived Effects of Climate Change

The result in Table3 shows that linear model is the best fit with 49.3 % of the variation in women farmers' perception being explained by their socio-economic characteristics. It also had the appropriateness of signs and numbers of significant variables. The result indicates that four of the independent variables (educational level, farm size, farming status, and household size) correlated positively and significantly with level of perception of climate change consequences on agricultural production. The results imply that increasing the magnitudes of the variables increased the perceived effects of climate change on agricultural production. Education furnished facts and improved the farmers' analytical prowess to discern and interpret the effects of climate change on agricultural production. Also large farm size implied large resource base and predisposed increased interest in the farm business, hence the farmers ability to perceive the effects of climate change highly for the design of adaptation strategies. Large farm size entailed many hands in the business of farming and more 'ears' for information and 'brains' for analysis of farm situations. Again, full time farming status entailed the farm being the major source of income and the disposition to protecting the farm with a high degree of consciousness, hence higher perception of the effects of climate change.

**Table 3:** Ordinary Least Square Regression Analysis of Relationship between Socio-Economic Characteristics of Women Farmers' and Perceived Effects of Climate Change (n=240).

| Perceived Consequences | Linear | Semi-log | Double log | Exponential Model |
|---|---|---|---|---|
| Constant | 47.212 | 1.739 | 53.176 | 1.685 |
| | (15.92) | (30.17)* | (6.96)* | (49.94)* |
| Marital Status | 3.135 | 0.344 | 3.638 | 0.316 |
| | (0.97) | (0.92) | (0.81) | (0.29) |
| Age | 0.056 | 0.055 | 7.162 | 0.001 |
| | (-0.31) | (-0.11) | (0.25) | (-0.66) |
| Educational Level | 0.245 | 0.032 | 3.304 | 0.003 |
| | (2.66)* | (2.02)* | (0.81) | (0.30) |
| Farm Occupation | 1.983 | 0.015 | 1.709 | 0.028 |
| | (-0.27) | (-0.41) | (-0.39) | (-0.02) |
| Farming Experience | 1.733 | 0.040 | 4.973 | 0.022 |
| | (1.82) | (2.18)* | (0.47) | (1.99) |
| Farming Status | 4.627 | 0.037 | 4.266 | 0.047 |
| | (2.85)* | (1.64) | (1.79) | (2.22)* |
| Farm Size | 0.407 | 0.076 | 8.493 | 0.004 |
| | (2.28)* | (2.58)* | (2.64)* | (1.68) |
| Household Size | 0.557 | 0.045 | 4.527 | 0.007 |
| | (2.68)* | (0.84) | (0.62) | (2.75)* |
| $R^2$ | 0.493 | 0.497 | 0.346 | 0.527 |
| F-Statistic (F-value) | 25.500 | 18.390 | 12.050 | 12.010 |

Figure in the first row are regression coefficients
t-ratio are in parenthesis
* t-ratio significant at 0.05 probability level
Source: Computed from Field Survey Data, 2014.

## 4.0 Conclusion

Climate change has multifarious consequences on agricultural production. These multiple effects of climate change on agricultural production include; poor yields of crops and animals, low income from farming, uncertainty in production, weak/poor adaptation of crops and animals to the environment, delay in take off of farming, prevalence of pests and diseases of crops and animals, all year round availability of short duration crops, high rate of spoilage of agricultural produce, among others. Women farmers' perception and awareness of climate change and subsequent exposure to reliable sources of information on climate change effects, is imperative to mitigate the effect on their productivity.

The result of the study implied that an increase in the magnitude of the socio-economic variables/characteristics of the women farmers' increases their perceived effects of climate change on agricultural production. As such, there is need to boost the analytical prowess of women farmers to discern and interpret climate change effects. It therefore calls for concerted effort by the government and other related agencies in keeping with the goal on poverty alleviation, to step down the information on research to this group. There is need to build institutional capacity to carry out research and hence forecasts for climate change effects and adaptive measures. Research on how to disseminate information and ensure its applicability both at the farm and household level would be crucial. There is need to ensure good forecasts on climate and production. This will ensure early responses to climate problems; bolster sustainable livelihoods, and promote adaptations.

The Federal and State government through the Extension Services of the Ministry of Agriculture should brace up to the new challenges posed by climate change by retraining its staff, mounting awareness programmes and disseminating proven technologies to boost the analytical prowess of rural women farmers' to discern and interpret climate change effects. The government should provide agricultural loans and subsidies. Also, there should be increased research and innovation in agriculture to find out more sustainable ways of improving the social status of women.

Lastly, ways of reducing the vulnerability of women to climate change and its effects on their farm activities should be encouraged.

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