Effects of climate change on labour use efficiency in Southeast, Nigeria


Department of Agricultural Economics, Federal University of Technology, Owerri, Imo State, Nigeria.

Accepted 24 June, 2013

The cataclysmic consequences of climate change on the existence of man, the flora and fauna on earth have been burning in the hearts of scientist and policy makers all over the world. This study as one of the myriads of efforts being made to understand and provide solutions on the menace is tailored to identifying the trends in climate change and the effects on labour use efficiency in southeast Nigeria. Multistage sampling technique was used to select a total of 312 cassava based food crop farmers found in the study location. Data were collected from both secondary and primary sources with the use of structured and validated questionnaire/interview schedule and by direct observation using cost route approach. Data were analysed with the use of descriptive statistical tools like mean, frequencies, percentages and frequency polygon or line graphs as appropriate. Also ordinary least square (OLS) multiple regression analytical tools and partial labour productivity as index of efficiency were used. Results show that climate element like temperature presents a statistically significant increasing trend with a trend coefficient of 1.192 and a mean of 26.7°C. Rainfall volume also shows an increasing trend but not statistically significant. Number of rain-days shows a statistically significant decreasing trend with a trend coefficient of -6.717 and mean of 141.8 days/annum. Furthermore, the result showed that climate indicators like Sunshine duration (Hss), Excessive heat or temperature (Eh), frequency or incidence of flooding (Fd) and frequency of dry spell (Ds) are statistically significant and inversely related to labour use efficiency. It was concluded that the climate is indeed changing and negatively affecting labour use efficiency which reduces agricultural productivity, and hence slowing the scope for reducing hunger and poverty in Nigeria. The government and all stakeholders should synergise to provide appropriate adaptive and mitigation strategies to ameliorate the present and potential effects of climate change.

Key words: Cataclysmic, climate change, multistage, regression, efficiency, mitigation, adaptation, productivity and labour.

INTRODUCTION

Agriculture has occupied a central position in the growth and development of Nigerian economy particularly during the pre-independent and post-independent era. In Nigeria, agriculture is the main source of food and the main employer of labour, employing about 60 to 70% of the population. Cereals (notably millet and sorghum), groundnuts and beans dominate crop production in the northern part of the country, while the dominant crops in the south are cassava, yam, palm produce, cocoa and rubber. It is a significant sector of the economy and also the source of a lot of raw materials used in the processing industries, as well as a source of foreign exchange earnings for the country. Despite being a major petroleum producing country, agriculture is the most contributor to Gross Domestic Product (GDP) in Nigeria with the GDP from 2001 to 2005 at unit market prices (US$ billion) put at 63.1; 66.0; 78.3; 87.4 and 113.1 respectively (Nwajiuba, 2008). Agriculture contributed 41.25% of GDP in 2005, and almost the same in 2004 (CBN, 2005). According to the Nigerian National Bureau of Statistics, in 2007 agriculture contributed (42.2%) to GDP followed by Oil and Gas (19.35%). Manufacturing was a mere (4.025%) and Solid Minerals (0.29%) (NBS, 2008).

These analogies suggest that agriculture occupies a very prominent position in the growth and development of
Nigerian economy, hence any factor which impedes the efficient utilization of available human and material resources towards agricultural production should be seriously tackled to forestall severe consequences likely to emanate from such occurrence.

Climate change is one of the most crucial factors that seriously impede the effective and efficient agricultural production and the scope for reducing poverty in Nigeria. It encourages unsustainable agricultural production systems and debilitates the health of farm workers and hence adversely affects their efficiency in production which projects an imminent doom for the generations to come. Global climate change will increase average temperatures, as well as shift the distribution of daily peak temperature and relative humidity - so that heat episodes will become more frequent and more extreme (Clark et al., 2006; Kjellström et al., 2007). In order to cope with heat, an instinctive adaptive action by a worker is to reduce work intensity or increase the frequency of short breaks. One direct effect of a higher number of very hot days is therefore likely to be the “slowing down” of work and other daily activities (Kjellstrom, 2000). Whether it occurs through “self-pacing” (which reduces output) or occupational health management interventions (which increases costs), the end result is lower labour productivity (which is defined as the value of output over labour cost). When the body carries out physical work, heat is produced internally; this needs to be transferred to the external environment in order to avoid the body temperature increasing (Kerslake, 1972). If body temperature exceeds 39°C heatstroke may develop and a temperature of 40.6°C is life threatening. Before these serious health effects occur, at lower heat exposures, the effects are diminished “work ability”, (Kerslake, 1972; Dawson, 1993), diminished mental task ability (Ramsey, 1995), and increased accident risk (Ramsey, 1983). These effects all contribute to a reduced “work ability” and lower labour productivity.

Therefore any change in climate is bound to impact on the agricultural sector and on the availability and use of farm labour. Most studies on climate change and agriculture (Rosenzweig et al., 1994; Wolfe and Erickson, 1993) have focused mainly on biological consequences while neglecting likely socio-economic aspects particularly from the perspective of farm workers. In fact, in sub-Saharan Africa, 65% of the power for land preparation is provided by people, with 25% by draft animals and only 10% from engines (Hunter, 2010).

According to Kovats et al. (2008), global climate change will increase outdoor and indoor heat loads, and may impair health and productivity for millions of working people. This statement suggests severe implications of climate change on health and productivity of labour and hence requires to be confirmed true or otherwise.

Labour with respect to agriculture means the available human effort for use in production. Its availability or supply is a function of economically active proportion of the population released into agriculture (FAO, 1986-1995) and its quality is a function of the level of education and training. Farm management studies according to Johnson (1990) have shown that in peasant farming communities, human labour requirements in the production process constitute between 50 and 65% of all farm operations. This implies that large-scale production with tractorized equipments will definitely require an increase in the number of hands required for stumping and weeding unless economical herbicides are available and for harvesting unless this can be mechanized at reasonable cost. High cost of labour and the unwillingness of young grade school leavers to undertake the heavy chores of weeding and stumping with primitive tools, pose serious challenges for farm labour in developing countries. Considering the myriads of prospects from labour as a factor of production and the associated problems with it, this study is therefore made to measure the effects of climate change on labour use efficiency in food crop production in southeast Nigeria as a prelude to determining the mitigation and adaptive measures appropriate to the study area.

MATERIALS AND METHODS

This study was conducted in southeast Nigeria characterised by tropical rainforest nature. The zone lies within latitudes 5 to 6°N of the equator and longitudes 6°W and 8°E of the Greenwich (prime) meridian (M.S corporation, 2009). Southeast Nigeria is made up of five (5) states namely Abia, Anambra, Ebonyi, Enugu and Imo. The zone occupies a total land mass of 10,952,400 hectares with a population of 16,381,729 people (NPC, 2006). The Southeast rainforest zone of Nigeria is a belt of tall trees with dense undergrowth of shorter species dominated by climbing plants (Nwajiuba and Onyeneke, 2010). There are two major seasons experienced in this zone. These are the Dry season and the Rainy season. The dry season occurs between November and March while the rainy season occurs between April and October. Although over the recent decades, it appears very difficult to create a clear cut distinction between the periods we refer to as rainy season and dry season due to climate change. This is epitomized by heavy rains that fall during the supposed dry spells and obvious dry spells suffered during seasons that heavy rains are expected.

The zone experiences an average annual temperature, rainfall, relative humidity, number of rain-days and hours of sunshine per day, of 27°C, 1800 mm, 72%, 4.4 h, and 142 days respectively. Despite the observed erratic nature of both rainfall and dry spells, the location of the zone within the tropical rainforest belt of the country encourages and allows the growth and survival of most tropical food crops like yam, cassava, vegetables, rice, etc, and livestock production. Hence about 60 to 70% of the inhabitants of this zone are observed to engage in
agriculture, mainly crop farming and animal rearing (Okoye et al., 2010).

The multi-stage sampling technique was adopted in the process of sample selection. The topographic distinction of the southeast states enabled the clear division of the states into two distinct categories namely the relatively hilly terrain states (Enugu, Ebonyi and Anambra) and the relatively flat terrain states (Imo and Abia). Consequently, one state was purposively selected from each category based on typical hilly or flat nature of the state. This gave rise to Imo and Ebonyi states as the two states of interest. Secondly, two agricultural zones were chosen from each of these states to get a total of four agricultural zones for the study. Thirdly, three Local Government Areas (L.G.As) were randomly selected from each of these agricultural zones to get twelve (12) L.G.As. In the fourth stage, three communities were purposively selected from each of the 12 L.G.As to get a total of 36 communities. These were purposive due to the fact that the selections were based on the high proportion of food crop contact farmers (cassava farmers) as contained in the register of each L.G.A Extension Department. Finally one village was randomly selected from each community to get a total of 36 villages used for the study.

To ensure that adequate and representative sample was drawn at this stage, a pre-survey sampling frame was determined by compiling a list of the cassava producer households available in the chosen 36 villages. This was done with the assistance of village heads and extension agents. When this frame was determined, (331 from Imo state and 195 from Ebonyi state), the adequate sample size from each state was computed using the formula:

\[
n = \frac{N}{1 + N \left( e^2 \right)} \quad \text{(Yamane, 1967)}
\]

Where:
- \( n \) = sample size
- \( N \) = population (sample frame)
- \( e \) = level of precision in percent.

Following this model, the total sample size used for the study was 312; 181 from Imo state and 131 from Ebonyi state at \( e = 0.05 \). These were randomly selected from the sample frame.

Data for this study were collected from both primary and secondary sources. Secondary data were collected from the records of research institutions, published works by government ministries, agencies and parastatals like National Root Crop Research Institute Umudike (NRCRI), National Bureau of Statistics (NBS), State and Federal ministries of agriculture and natural resources (MANR) and the State Agricultural Development Programmes (ADPs). Secondary data concerning the annual mean climate variables like temperature, rainfall, relative humidity, and sunshine duration for a period of thirty years were collected from the Agro-metrological unit of the NRCRI Umudike. Also data on annual quantities of inputs used and outputs produced with their corresponding cost and returns for cassava for a period of thirty years were collected from (NBS) and state ADPS.

Primary data for this study were collected from the cassava farmers using both direct and indirect approaches. This implies that in some cases cost route approach were used by the researcher to collect some data while others were collected with the use of interview schedule. The type of data collected included those that bother on the socio-economic characteristics of farmers like (age, sex, level of education, household size, annual income, etc). Others were quantities of inputs and outputs used and produced respectively in physical and value terms. Data concerning the man-days or man-hours of work usually agreed upon between labourers and employers and the actual man-hours engaged in the work (that is effectively utilized in the work) were collected. Further enquiry into the factors that determine the types of inputs used were also made. These included effects of (their socio-economic characteristics, farm size, climate variables, cost of labour, cost of fertilizer, etc). Information on the type of labour used (hired, family, communal) was ascertained.

Data were analysed using appropriate descriptive statistical tools and the ordinary least square (OLS) multiple regression analytical tools. The socioeconomic characteristics of farmers were analysed using mean, frequencies and percentages; the trend of change in climate variables were analysed with the use of frequency polygon or line graphs while the effect of climate change on labour use efficiency was analysed by firstly determining labour use efficiency using the partial productivity as an index of efficiency. The partial productivity index i.e. ratio of value of total output to the value of a single input(labour) as used by Ehui and Spencer, (1990) was used to estimate the technical efficiency of labour. According to Olayide and Heady (1982) maximum resource productivity would imply obtaining the maximum possible output from the minimum possible set of inputs. Thus optimal productivity of resources implies efficient utilization of resources in the production process. Hence the use of productivity of labour as a yardstick of measuring labour use efficiency is considered appropriate.

Therefore the model;

\[
PP_L = \frac{\sum_{i=1}^{n} P_i Q_i}{P_X X} \quad \text{Partial Productivity of labour (labour use efficiency)}
\]
Table 1. Distribution of respondents according to their socio-economic characteristics.

<table>
<thead>
<tr>
<th>Socio-economic characteristic</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>51.3</td>
<td>9.65</td>
<td>28-75</td>
</tr>
<tr>
<td>Household size (persons)</td>
<td>8</td>
<td>2.86</td>
<td>2-8</td>
</tr>
<tr>
<td>Annual income (₦)</td>
<td>391,530.64</td>
<td>0.000022</td>
<td>113290-1634271</td>
</tr>
<tr>
<td>Level of education (years)</td>
<td>9.6</td>
<td>5.94</td>
<td>0 – 22</td>
</tr>
<tr>
<td>Farming experience (years)</td>
<td>20.96</td>
<td>9.28</td>
<td>2-60</td>
</tr>
<tr>
<td>Farm size (hectares)</td>
<td>0.84</td>
<td>0.83</td>
<td>0.05- 5.00</td>
</tr>
<tr>
<td>Number of extension contact (No. of visits)</td>
<td>0.73</td>
<td>1.2</td>
<td>0.00- 12.00</td>
</tr>
</tbody>
</table>


\[ V_{T.} = \text{Value of Total Output in Naira/ha} \]
\[ V_{L.} = \text{Value of Labour Input in Naira/ha.} \]
\[ P_i = \text{Price per unit of output in naira} \]
\[ Q = \text{Quantity of Output} \]
\[ i = \text{Type of output (i ranges from 1- n\textsuperscript{th} output type)} \]
\[ P_s = \text{Price per man-day of labour input in naira} \]
\[ X = \text{Quantity of labour used in man-days} \]

(Adopted from Ehui and Spencer, 1990)

This implies that if \( PP_i > 1 \), labour is efficiently utilized and if it is \(< 1\), labour is not efficiently utilized.

Furthermore, the effect of climate change on labour use efficiency was achieved by regressing partial labour productivity with identified climate change indicators. Hence the use of the model;

\[ PP_i = f(\ Hss, \ Ds, \ Eh,Fd, \ Re,Rv, \ e) \]

(3)

Where

\( PP_i = \text{Labour productivity.} \)

\( Ds = \text{Frequency of dry spell, } \)
\( \text{Eh = Excessive heat/temperature, } \)
\( \text{Hss = hours of sunshine, } \)
\( \text{Fd = frequency or incidence of flooding, } \)
\( \text{Re = Erratic nature of rainfall, } \)
\( \text{are indicators of climate change measured using ordinal scale values } \)
\( ((0 = \text{no change, } 1= \text{low, } 2 = \text{moderate, } 3 = \text{high) } ) \)
\( \text{to elicit from the farmers their various perceptions on these indicators (Etiosa and Agbo, 2007; Okon and Egbon, 1999; French et al., 1995; Awosika et al., 1992; Oladipo, 1995) and } e = \text{stochastic error term.} \)

It is expected a priori that the coefficients of Fd, Eh, Hss, and Re < 0 while the coefficients of Rv and Ds > 0.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

Table 1 shows the distribution of respondents according to their socio-economic characteristics.

According Table 1, the mean age of cassava producer farmers in southeast Nigeria is 51.3 years with a standard deviation of 9.65 years. This implies that there is high variability in the ages of farmers, however they are still within the productive age limit during which they can fully and efficiently engage in all forms of productive labour especially farm labour. The mean household size of farmers in the study area is 8 persons per home mean annual household income of ₦391,530.64 and mean farm size of 0.84 ha. These categorise the farmers in the study area as smallholder and resource poor farmers because they farm on land between 0.1 to 5.99 ha (Olayide, 1980; Ogungbile and Olukosi, 1999; Nwaiwu, 2007). This implies that they are mainly subsistence farmers who have very limited capacity to practice commercial farming. Consequently, they are also expected to have very weak capacity to adapt to the fast changing climate which has very adverse effects on agriculture and food production, if some abatement strategies are not strictly adopted.

Furthermore, the farmers are said to be food insecure because according to the world Health Organization (WHO), an individual is said to be food insecure if that person subsists on below $1 dollar per day. Obviously $1 dollar is currently equivalent to about hundred and sixty (₦160.00) Nigerian naira. From Table 1 the per capita income of the farmers per day is about one hundred and thirty-four naira (₦134.00). This implies that they leave below $1 USA dollar per day. The table also shows that the mean frequency of extension visits to the farmers is 0.73 times. This implies that extension education in the study area is very poor as such farmer will be lacking a lot in terms of availability and use of innovations including climate change adaptive and mitigation strategies that would have helped them overcome the dangers of climate change. Finally, the mean level of education of farmers in the study area is approximately ten (10) years. This implies that they would have acquired post-primary education which makes them enlightened enough to be able to adopt available innovations when introduced to them.
Table 2. Analysis of climate Records from 1972-2011.

<table>
<thead>
<tr>
<th>Climate element</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Range</th>
<th>Trend</th>
<th>Correlation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>26.77</td>
<td>0.444</td>
<td>25.95-27.65</td>
<td>1.192*</td>
<td>0.425*</td>
</tr>
<tr>
<td>Rainfall (MM)</td>
<td>1794.05</td>
<td>239.94</td>
<td>1250.95-2290.33</td>
<td>2.074</td>
<td>0.091</td>
</tr>
<tr>
<td>Number of rain-days (days)</td>
<td>141.80</td>
<td>10.99</td>
<td>110.00-167.00</td>
<td>-6.717*</td>
<td>0.497*</td>
</tr>
<tr>
<td>Relative humidity (%)</td>
<td>71.98</td>
<td>1.44</td>
<td>68.50-74.00</td>
<td>-0.900</td>
<td>0.138</td>
</tr>
<tr>
<td>Sunshine duration (h)</td>
<td>4.35</td>
<td>0.35</td>
<td>3.80-5.20</td>
<td>0.008</td>
<td>0.253</td>
</tr>
</tbody>
</table>

*Significant at 1%. Source: Author with data from NRCRI, Umudike.

LNC = -5.769 + 1.192LNT, R = 0.425

![Temperature in °C](image)

Figure 1a. Trend of temperature of Southeast Nigeria between 1972-2011. Source: Author with data from NRCRI, Umudike.

Describing the trend of climate variables

Table 2 shows the analysis of climate records in southeast Nigeria between the periods of 1972 through 2011.

According to the statistical records of temperature in southeast Nigeria as recorded by the Agromet unit of the NRCRI, Umudike from 1972-2011, temperature shows an increasing trend with the highest temperature occurring in 2009 at 27.65°C and the lowest occurring in 1975 at 25.95°C (Table 2 and Figure 1a). Also the mean and standard deviation of the temperature record are 26.77 and 0.441°C respectively (Table 2). This shows that there is a very small variability in temperature from year to year. The trend coefficient is 1.192 and is statistically significant at 1% level (Table 2).

The correlation coefficient is 0.425 and is statistically significant at 1% level implying that temperature has a significant positive relationship with time. This therefore indicates that climate with respect to temperature is really changing and increasing; hence there is indeed global warming.

Statistics of rainfall volume in southeast Nigeria between the periods of 1972-2011 shows an increasing trend with the highest occurring in 1996 and lowest occurring in 1983 with values of 2290.33 and 1250.95 mm respectively (Table 2, Figure 1b). The mean and standard deviation are 1794.05 and 239.94 mm respectively (Table 2). This implies that there is a high variability in rainfall within this period hence the observed positive trend though not statistically significant. The coefficient of correlation is 0.091 (Table 2), which is not statistically significant also. This indicates that there is a weak positive relationship between rainfall and time.

Analysis of number of rain-days as recorded by the Agromet unit of the NRCRI, Umudike shows a decreasing trend in the number of rain-days in southeast Nigeria with a trend coefficient of -6.717 which is statistically significant at 1%. The maximum and minimum number of rain-days occurred in 1976 and 1987 with the values of 167days and 110days respectively (Table 1 and Figure 1c). The mean and standard deviation are 141.8 and
Figure 1b. Trend in volume of rainfall of Southeast Nigeria between 1972-2011. Source: Author with data from NRCRI, Umudike.

Figure 1c. Trend of number of rain-days in Southeast Nigeria between 1972-2011. Source: Author with data from NRCRI, Umudike.

10.99 days. This indicates a high variability in number of rain-days from year to year. The coefficient of correlation between number of rain-days and time is 0.497 and is statistically significant at 1% implying that the number of rain-days is strongly correlated with time and since a negative trend is observed, it means that the region and indeed Nigeria is tending toward a dryer period which portends an imminent doom for the life of the flora and fauna.

Furthermore, the negative correlation between number of rain-days and time vis-a-vis the positive correlation between volume of rainfall and time provides a clearer explanation about the torrential rainfall that are usually observed in recent times.

Relative humidity records from southeast Nigeria between 1991-2011 shows a decreasing trend with a coefficient of -0.900 though not statistically significant. The highest occurred in 1996 and 1997 and the lowest occurred in 2008 with values of 74 and 68.5% respectively (Table 2 and Figure 1d). The mean and standard deviation are 71.98 and 1.44% implying that relative humidity has a very small variability with time. The coefficient of correlation between relative humidity and time is 0.138. This indicates a weak relationship
between relative humidity and time because the coefficient is insignificant.

Table 2 and Figure 1e show that the hours of sunshine indicates an increasing trend with time with a coefficient of 0.008 h. This positive trend in sunshine duration could be linked to the increasing trend in temperature as observed in Table 2 and Figure 1a. It is agreeable that the higher the hours of sunshine the greater is the temperature. The mean and standard deviation are 4.35 and 0.35 h respectively. This implies a narrow variability between sunshine duration and time over the period under review. The maximum and minimum hours of sunshine per day are 5.20 and 3.80 h and were recorded in 1995 and 1978 respectively. The coefficient of correlation (r) is 0.253 and is not statistically significant. This indicates that there is a weak relationship between sunshine duration and time.

**Multiple regression result showing the effect of climate change on labour use efficiency**

Table 3 shows the result of multiple regression analysis showing the effect of climate change on labour use.
efficiency. Here labour use efficiency is measured as technical efficiency of labour which is the ratio of total value product TVP to total labour cost in naira per hectare.

According to Table 3, four plausible functional forms were tried and on the basis of relevant economic a priori, statistical and econometric criteria, the exponential function was chosen as the lead equation. It would be observed from this table that the exponential function has the highest value of $R^2$ (0.459), implying that about 46% of the variation in the criterion variable was explained by the predictor variables. Also the F-value is highest with 43.2, standard error lowest with the value of 0.39, adjusted $R^2$ highest with 0.45 and the unexplained variation value (Total sum of squares, TSS) of 85.49 which is the same with the double-log function.

The exponential function shows that the frequency of dry spell (Ds), hours of sunshine (Hss), excessive heat /temperature (Eh), Incidence of flooding or erosion (Fd), are statistically significant at 5%. This implies that changes in these predictors, strongly affects the labour use efficiency. It also showed that the combined effects of these explanatory variables on labour use efficiency represented by the F-value are also statistically significant at 5%. These implies that the model strongly fits the data, hence the relationship between the endogenous variable and the exogenous variables. The table also shows that there exist inverse proportional relationships between the criterion variable and Hss, Eh, Fd, and Re. Besides, Hss, Eh, Fd, and Ds are statistically significant at 5% level with t-calculated values of -10.87, -4.69, -2.20, and -4.24 and t-tabulated value of 1.96. These are in-line with the a priori theoretical expectation that the higher the Hss, Fd, Eh, and Re, the lower the labour use efficiency. This fact is true because longer hours of sunshine, excessive heat and rainfall erraticity, reduces labour time allocation and hence lower labour productivity. Also flooding leads to loss of farm crops hence lower total value product which a major determinant of labour productivity.

It was observed in the table also that the volume or amount of rainfall is directly proportional to labour use efficiency. This is also in-line with a priori expectation because rainfall encourages crop growth and performance. Therefore the higher the amount of rainfall, the higher the total value product, hence higher labour use efficiency. It was hypothesised that frequency of dry spell should be positively related to labour use efficiency, but the result is against this a priori. This could be attributed to the fact that frequency of dry spell leads to loss of crops to scorching sun, heat, and drought. Although dry season favours longer hours of work for labour, it is also concomitant with excessive heat, longer hours of sunshine, and hence lower labour productivity. A closer look at the coefficients of the significant predictors, shows that excessive heat (Eh) with coefficient (-0.2) is the greatest factor that negatively affects labour use efficiency followed by frequency of dry spell(Ds) with coefficient (-0.13). These imply that climate change which brings about increased temperature, excessive heat and prolonged drought greatly reduces the efficiency of labour in food crop production.

### CONCLUSION

Following the foregoing, it would be right to conclude that the climate system is obviously changing. This is
indicated by the increasing trend in temperature and volume of rainfall as the most relevant and significant climate parameters that seriously affect agricultural production. The recently observed torrential rainfall and concomitant flooding in most parts of the world and Nigeria in particular could be linked to the increasing trend in rainfall volume as against the decreasing trend in number of rain-days. This implies that the amount of raindrop per unit time has increased, bringing about the cases of sea level rise and inundation. It is worthy to note also that the changes in these climate elements significantly and negatively affect labour use efficiency, food security and hence the scope of the nation to reduce poverty. Therefore, it is vehemently recommended that government at both micro and macro levels of the world and Nigeria in particular should through its agencies like United Nations Organization (UNO) and National Environmental Management Agency (NEMA) in Nigeria, institute policies and regulations that could improve the mitigation and adaptive strategies already being adopted by farmers against the menace of climate change.

REFERENCES


University, Oxford, UK. Internet paper accessed 24/10/11.

Agriculture” In Olucosi et al (eds) Appropriate Agricultural Technologies for Resources Poor Farmers . Natural Farm Systems Network, pp. 21-34.


Olayide, S.O (1980). “Characteristics and Significance of Small farmers in Nigeria; Problems and Prospects” In integrated Rural Development CARD, University of Ibadan, Ibadan Nigeria


