Impact of Global Warming and Climate Change on the Pattern and Distribution of Rainfall in Afikpo North Local Government Area of Ebonyi State, Nigeria

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Abstract

The purpose of this work, was to observe and generate data on the trend and distribution of rainfall in Afikpo North Local Government Area (LGA) of Ebonyi State in the year, 2013. Simple Random and purposive Sampling Technique were adopted in the work. The data generated were analyzed using Frequency tables and graphs. The result will help to suggest to farmers how to probably plan their farming activities. Some of the results showed that high frequency of rainfall commenced in the month of May and the highest peak recorded in the month of August, contrary to popular opinion and dropped sharply afterwards. Recommendations, among others, were that farmers should delay cultivation of their crops to about 3-4 weeks after the first set of rains and plant edible cover crops as "must crops" during cropping periods.

Keywords: *Global warming, Climate change, Rainfall pattern, Distribution and Agriculture.*

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Background to the Study

The mainstay of Nigerian Economy since independence according to Bureau of public Enterprise (BPE) (2004), is agriculture, as it accounts for 38% of the non-oil foreign exchange earnings and employs about 70% of the active labour force of the population. Agriculture offers Nigeria the most cost-effective path to growth and development. With its ever extending value chains, agriculture provides jobs to over 60% of the working population, and if well-harnessed could be a sustainable springboard for the much awaited industrialization (Moghalu, 2012). This is because the produce from agriculture when exported to foreign countries earns the country foreign exchange with which acquisition of the necessary items or materials for the industrialization of the nation is made.

In effort to achieve the desired level and targets in agriculture, in terms of adequate food production and provision of substantial support for the local industries, the practice of agriculture requires adequate availability of land and supply of vital inputs such as 'improved seeds, fertilizer, agro-chemicals, among others. The farmers, according to Akinbile, Akinwale and Ashimolowo (2006) should be assisted by Extension Organizations' to have current knowledge of improved sources of information and have access to all inputs needed for effective production. There is equally the need, among others, to provide relevant infrastructure such as storage facilities and other assistance to include provision of credit facilities, education, training and extension services, research and appropriate technology. There is also the need for a favourable climate as an all important ingredient or input in agriculture. The effect of climate, a major requirement in agricultural production need not be over emphasized. This is in consideration of the crucial roles of its various elements, especially rainfall, in relation to agricultural production.

Rainfall, a very essential element of climate has numerous implications for agricultural production of a place (Oga, 2014). This is because its nature (time of commencement in a given period, amount, duration, intensity and distribution) to a very large extent determines the type of and level of agricultural practices and production of a place. According to Emedo, Maduka and Oranekwulu (1995), much of the water for Agricultural production comes from rainfall. Where rainfall is well distributed and in adequate amount, growth and productivity of crops like yam, cocoyam, cassava, plantain, corn, rice and tree crops like rubber, kola-nut, oil palm, citrus, among others, is guaranteed.

According to Nwite, Nnabo and Nnoke (2007, Oga, 2014) the most important element of climate is rainfall, the amount that falls, how it falls e.g steadily over several days or suddenly in torrential downpours, hence its effectiveness i.e how much of it is available for use by plants. Currently, it has been observed, and even available records have shown that the nature (time of commencement, amount, duration, intensity, etc) of rainfall has not been encouraging. There has been a deviation from the natural pattern of rainfall (Nigerian Meteorological Agency (NIMET), 2016). An encouraging nature of rainfall in terms of commencement at the right time, moderate or adequate in amount, duration and intensity, no doubt, is desired and generally accepted as the "best nature" of rainfall for any desired level of agricultural production. Consequent upon this best nature of rainfall, it is the utmost desire of places substantially involved in agricultural production, of which Afikpo North Local Government Area (LGA) of Ebonyi State is among, to have and appreciate this

nature of rainfall. The current unfavourable nature of rainfall widely experience is due to global warming and subsequently climate change: This situation does not augur well for agriculture and agricultural productions, and this, no doubt, has multiplier effects. Often, it has been observed and recorded that the rains do not come when expected and when it is eventually experienced, may be fair, moderate or torrential and in the process may not be adequate for agricultural production or may even be very destructive to physical structures as well as agricultural products (Radio Nigeria (RN), 2011). As a result of global warming and subsequently climate change, there is rise in sea level and increased flooding (Midori, 2007). This position was corroborated by (Parry, 2001). There is equally, reduction in the area of cultivable land and decreased food supply. According to (Kluger, 2006) records have shown reduction, relocation or even extinction of some plants and animal species e.g butterflies, polar bear, walrus, caribou, mistletoe, etc. Sequel to the above discouraging scenario of rainfall as a result of global warming and climate change, there is need to chart a path to assist in mitigating their negative effects and this informed the study.

Statement of the Problem

Hitherto, farmers embarked on farming activities adequately equipped with the knowledge of average weather conditions, especially, (the pattern and distribution of rainfall) of their immediate environment without much farm loses. But today, the realities of Global warming and climate change have made the exercise of this knowledge more of a mirage. Consequently, farmers no longer understand the pattern of rainfall and subsequently incur huge losses on their farms. As a result of these, farmers need to be assisted with some current basic information/data to enable them cope with the present vagaries of weather in relation to their farming activities, especially as it concerns rainfall pattern and distribution in Afikpo North Local Government Area (LGA) of Ebonyi State.

Objectives of the Study

The main objective of this work was to observe and generate data on the present trend and distribution of rainfall in the L.G.A. in the year, 2014.

Specific Objectives

These were to:

i.   Observe and record the dates/days of commencement of rainfall in each month of the year, 2013 in Afikpo North Local Government Area (LGA) of Ebonyi State.

ii.   Observe and record the time of commencement of rainfall in each day of rainfall in each month of the year, 2013 in the LGA

iii.   Observe and record the duration (in minutes/hrs) of rainfall in the days of rainfall in each month of the year, 2013 in the LGA

iv.   Discuss the trend of rainfall and its distribution in each month of the year, 2013.

v.   Based on the results recorded in nos. (i-iii) above make recommendations on the strategies to help ameliorate the effect of global warming and climate change as they affect rainfall and subsequently agricultural production in the LGA.

Methodology

The Study Area

The work was conducted in Afikpo North Local Government Area (LGA) of Ebonyi State of Nigeria, in 2013. Afikpo North Local Government Area of Ebonyi State is an Agrarian LGA with a good number of the populace engaged in one form of agricultural production or the other mainly at subsistence level. The crops cultivated in the LGA include: maize, rice, yam, cassava, cocoyam, potatoes, vegetables, among others. Besides cultivation of crops, animals are reared especially the small ruminants (sheep and goat) and fishing is also practiced by the people. The keeping of poultry is also practiced. The pattern of agricultural production is mainly affected or defined by the influence of the annual weather condition of the LGA based on two distinct seasons: the dry and wet seasons. The dry season starts about the month of November and terminates around the month of March, while the wet season starts in the month of April and ends in the month of October with the average annual rainfall of about 134mm (Ebonyi State Agricultural Development Programme (EBADEP), 2001).

Instrument for Data Collection

The instrument for data collection was a self designed recording instrument. The instrument showed the days/dates of each month of the year, 2013. The instrument was face validated by two Agricultural experts in the Department of Agricultural Technology, Akanu Ibiam Federal Polytechnic, Unwana, Ebonyi State. The Experts suggestions were considered in the final design of the instrument. The instrument was considered suitable since it solicited information purposively from Research Assistants (RAs) in the Autonomous Communities who observed and recorded trends of rainfall in the LGA. Timing instruments such as Table clock and Wrist Watches were also used. Information were equally sought from friends, relations and well wishers in relation to this work verbally and making phone calls with Global system of Mobile Communication (GSM).

Method of Data Collection

Afikpo North Local Government Area (LGA) is made up of twelve (12) Autonomous Communities. Ten (10) Autonomous Communities were randomly selected for the field work and Research Assistants (RAs) were needed to assist in the work. Two RAs were purposively selected from each of the 10 Autonomous Communities to give a total number of 20 RAs who assisted in observing and recording the parameters considered relevant to the field work.

Results and Discussions

Information available in Table 1 shows that all the months of the year, 2013 had rainfall with the months of May, January and February recording the highest and lowest rainfall respectively. This scenario is evident in Fig 1.

In terms of frequency and duration of rainfall, See Fig 2, the months of January and December had low frequency of rainfall with the months of January and February having the lowest frequency. The month of May, 2013 had the highest frequency of rainfall followed by the months of June, July and September. The month of May and June recorded the highest number of days of heavy rainfall. In the month of August, there were ten (10) days of rainfall and more than half of these days recorded very heavy rainfall. In the month of August, there

were two (2) days of very heavy rainfall spanning average of ten (10) hours with rain falling intermittently in these two days. The month had few days of rainfall but which spanned many hours compared to what obtained in the months of May, June and July which had 17, 15 and 14 frequency of rainfall respectively and also heavy rainfall frequency of 11, 11 and 10 respectively. The findings revealed that there was the usual August break in the month of August for about two weeks from the 8th day to 20th day of the month.

In terms of duration of rainfall, Table 1 shows that the month of August had the highest duration of rainfall (sum of hours) of 42 hours and the lowest in the month of February of 35 minutes. As can be observed from Table 1 and Fig 1 and 2, the months of May and August had the highest number of moderate rainfalls. Lowest moderation of rainfall was experienced and recorded in the months of February and March, 2013. In terms of heavy downpours, the months of May and June ranked first and the lowest downpour was recorded in the month of February. In relation to windy days, the months of March, April and May had some windy days prior to commencement of rainfall, the months of March, April and May having the highest.

As it relates to sunny days, majority of the months of the year had fairly sun shines with the month of October having the highest sunny days. The months of May and June had the highest number of gloomy days consequent upon the high frequency of rainfalls. The months of July and October had moody days. In the months of December and January, fair and short duration of harmattan winds were experienced. The months were moderately dry with intermittent show of harmattan winds and weather (hazy days).

Implications for Agricultural Production
This pattern of rainfall and distribution may not be favourable for both crop and livestock production in the LGA. Where rainfall is well distributed in amount, growth and productivity of crops are guaranteed (Emedo et al, 1995). In a situation where rainfall is expected to be well distributed and probably last for six (6) months and only about four (4) months of rainfall which is not well distributed in the months of the year may be available for agricultural production, is not in favour of agriculture. Consequently, crops may not be cultivated at the appropriate time and even when cultivated, the rains may come down heavily washing and carrying away plants and animal materials and other resources. This will lead to reduction in food production and high cost of production.

In most parts of the country, and even in the LGA, some farmers allow some un-harvested crops in the farm between the months of October and November to dry up in order to use them as future farm inputs and even for consumption. In this regard, these farmers have suffered losses of such crops as a result of rainfall being experienced around this time of the year, contrary to popular opinion. This implies that farmers may no longer allow this practice and this may affect availability of crops both as inputs or for consumption. This trend of rainfall equally implies that those crops that require much water e.g rice may not do well and crops like late maize may not be cultivated as a result of inadequate rainfall. According to the field work carried out by Oga and Oga in (2011 and 2012) on rainfall pattern and distribution in the LGA, the trends of rainfall in the LGA for quite sometime now are not in-keeping with

available records, information from Focus Group and personal experiences and these have not been favourable to Agricultural production in the LGA.

Conclusion
The practice of agriculture is affected by various factors especially climate. The effect of climate is felt through one of its potential elements, rainfall. The rainfall of a place, to a large extent determines the scenario of agricultural production of the place. Currently, the nature of rainfall in relation to agricultural production in the LGA is not encouraging due to the influence of global warming and climate change. In order that agriculture continues to play its role as the backbone of a nation's economy, global warming and subsequently climate change, need to be mitigated. Strategies to be employed in this regard include among others, creating adequate awareness to the public and especially to farmers on the realities of global warming and climate change, farmers to delay cultivation of crops to about 4-5 weeks after the first set of rains which now occur early in the year and farmers to avoid setting fire on cut down vegetation on the whole farm but to pack them at strategic places probably on the farm to rot away over time.

Recommendations
1. Adequate awareness should be created on the realities of global warming and climate change both for the farmers and public consumption.
2. Farmers should be advised not to plant with the coming of the first rains but to delay planting and probably commence planting after about 4-5 weeks after the first set of rains.
3. Farmers should be advised as a matter of necessity to cultivate cover crops during each cropping season as must crops.
4. Deforestation should be discouraged and Farmers and youths advised to plant trees through youths' and farmers' organizations.
5. Government as a matter of urgency revitalize relevant Agencies such as NIMET and equip them with appropriate technologies in order for them to improve on their activities and personnel trained in this regard.
6. Local Government Councils should establish appropriate Centres in their localities for keeping records on weather conditions and equipped with modern facilities and well trained staff for this purpose.
7. Government should support in minimizing the impact of global warming and climate change by constructing dams and boreholes and wells where necessary and as the need warrants.
8. Philanthropists, legislators among others should encourage siting of boreholes/wells in their localities and constituencies respectively in order to provide water for agricultural productions and for domestic needs.
9. Farmers should be discouraged from setting fires to cut down vegetation on the whole farm but to pack them at strategic spots to rot and decay for further use on the farm.
10. Zero tillage should be practiced by farmers especially in areas where the soil is fragile and vulnerable to erosion.
11. Results from the study may assist policy makers in formulation of policies relevant to agriculture.

Table 1: Monthly Summary of Rainfall in Terms of Frequency, Duration, Among Others, in the year, 2013

	Months of the year 2013	Rainfall		No of times of rainfall in each month	Duration of rainfall in hrs/mins in each month		No of times of moderate rainfall in each month	Frequency of Heavy rainfall in each month	Frequency of windy days in each month	No of days of sunny days		No of moody days	
		Yes	No		Hrs	Mins				Very sunny day	Not very sunny	Very moody	moody
1.	Jan	✓		2	3	-	2	2			27		
2.	Feb	✓		2	-	35	1	1					
3.	Mar	✓		5	6	-	1	4	2				
4.	Apr	✓		10	8	47	4	6	3				
5.	May	✓		17	25	30	6	11	5	5			11
6.	Jun	✓		15	29	10	4	11					11
7.	Jul	✓		14	22	4	4	10					9
8.	Aug	✓		10	42	40	6	4			16		
9.	Sep	✓		13	15	50	5	4			11		
10.	Oct	✓		12	6	40	7	5			18		2
11.	Nov	✓		5	11	25	1	4		10	15		
12.	Dec	✓		4	4	-	1	3		8	20		

Source: Field Work, 2013.

A Graph showing Mean monthly Duration of Distribution of rainfall in hours in the year, 2013 in Afikpo North Local Government Area of Ebonyi State.
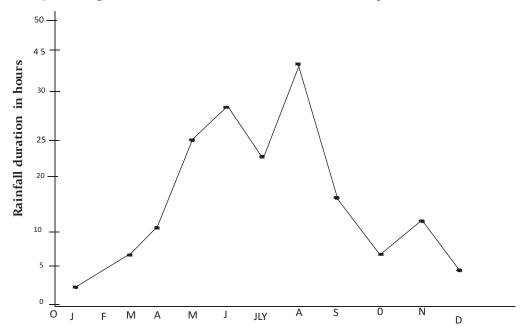

Fig. 1: Months of the year, 2013 showing mean monthly duration of rainfall in hours.
Source: Field Work, 2013.

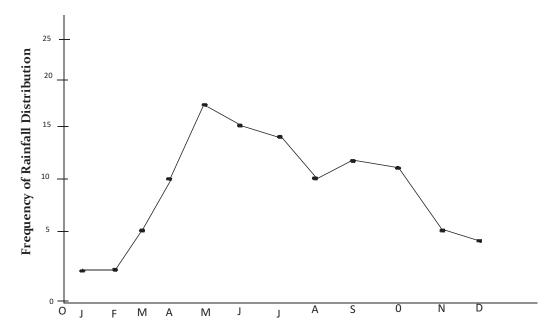**Graph showing frequency of rainfall in the months of the year, 2013**

Fig. 2 Frequency distribution of rainfall in the months of the year, 2013
Source: Field work, 2013.

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