

RESEARCH ARTICLE

Effects of Climate Change Variability on Physical, Natural, and Financial Livelihood Assets of Rural Farmers in Imo State, Nigeria

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ABSTRACT

The study investigated the effect of climate change variability on the livelihood assets of the rural farmers in Imo State, Nigeria. The specific objectives were to ascertain farmers' awareness of climate change signs; sources of information on climate change; identify the livelihood activities of respondents; and describe the effect of climate change on the livelihood assets of the farmers. A purposive sampling technique was used in selecting a sample size of 120 respondents. Data were collected by use of a structured questionnaire and interview schedule. Descriptive statistics were used to analyze the data. The result revealed that the major signs of climate change included increased temperature, unpredictable rainfall patterns, drought, flooding, increased precipitation, crop damage, and others. The major livelihood activities of the respondents in the study area include crop farming, poultry farming, fishing and fish farming, trading, and livestock rearing. Climate change affects the livelihood of rural people and can be seen in the effects it has on their physical, natural, and financial capital. We recommend that rural people should be well educated on the issue of climate change and made aware of its various effects so that they can get a good understanding of the concept before devising ways to battle it.

Key words: Capital, climate change, farmers, livelihood, rural

INTRODUCTION^[1-5]

Rural households obtain livelihoods through agriculture, rural labor market, and self-employment in rural non-farm economies and others through migrating to towns, cities, and other countries (Campbell *et al.*, 2003).^[5] Agriculture, therefore, is the major source of livelihood in many African countries, Nigeria inclusive. Large numbers of the rural population are dependent on agriculture for their livelihoods. In Sub-Saharan Africa, more than 60% of the economically active population and their dependents rely on agriculture for their livelihoods.

Although the share of agriculture in gross domestic product is decreasing, the share of agriculture in employment is still high (Mahendra-Dev, 2011).^[10] In many rural and urban areas, the livelihoods of people are limited to a fairly narrow range of activities, but these activities may be combined in complex ways and are sometimes short-lived (Aniah, 2016).^[2]

Climate change and extreme weather events present severe threats and erode essential needs, capabilities, and rights, especially for the poor and marginalized thereby redesigning their livelihoods (UNDP, 2010; Adger, 2010;^[1] IPCC, 2014).^[8] A number of livelihoods are directly climate-sensitive, such as rain-fed agriculture, seasonal employment in agriculture (for example fishing and pastoralism), and tourism (IPCC, 2014).^[8] Campbell *et al.* 2003^[5]

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indicated that rainfall is the primary driver of change, altering crop production from year to year and causing massive longer-term fluctuations in production. Households are unable to raise sufficient grain for their subsistence needs in 1 out of 3 years (Campbell *et al.*, 2003).^[5]

Climate change is an emerging stressor that is experienced over longer time frames through changes in climatic norms and over shorter periods through changes in the frequency and severity of extreme weather events. Climate change is commonly recognized to have major implications for food security and livelihoods (Thompson and Scoones, 2009). In sub-Saharan Africa, extreme droughts already impede people's ability to grow food and rear livestock, and pastoralists and agro-pastoralists will need to adapt to changes in water regimes to maintain their food security and well-being (Karamba *et al.*, 2011).^[9]

The rural farmers as part of the African society at large have their major livelihood source from agricultural activities from the various sectors such as cropping, animal or livestock production, forest and forest resources, fisheries as well as aquatic-related activities, and all these activities are largely dependent on the climate for their effective performance and productivity. This is because most agriculture and food production activities in Africa are sensitive to climatic changes. Climate change has affected the aforementioned livelihood strategies and continuous change in climatic conditions will lead to an even greater extent of damage and deterioration in the survival capacity of rural farmers. Climate change has directly and indirectly caused a decline in the living condition or standard of the African society at large and this has direct and dire consequences on health and income security.

The foregoing argument shows that climate change can no longer be sidelined as a development issue. The effect that climate change has on the poor communities in sub-Saharan Africa is increasingly prominent. According to Bunce *et al.* (2010),^[4] the African continent risks becoming a major global food crisis epicenter if climate change issues remain unaddressed at local levels. The vulnerability of African communities to climate change is exacerbated by high poverty levels already high temperatures and low precipitation.

This study sought to understand the impact of climate change on the livelihood assets of local communities, focusing on the rural areas of Imo State, Nigeria. Thus, a livelihood can be defined as the activities, the assets, and the access that jointly determine the living gained by an individual or household (Ellis, 1998; 2000).^[6,7] When it comes to an individual, a livelihood is the ability of that individual to obtain the basic necessities in life, which are food, water, shelter, and clothing. Studies abound on climate change, but there is none on how it affects the livelihood assets of respondents.

The main objective of this study was to assess the effect of climate change variability on the livelihood assets of rural farmers. Specifically, the study sought to

1. Ascertain farmers' awareness of climate change signs
2. Identify sources of information on climate change
3. Identify the livelihood activities of respondents
4. Describe the perceived effects of climate change on the selected livelihood assets of rural farmers.

METHODOLOGY^[6,7]

The study was conducted in Imo state. Imo state is in Southeast of Nigeria. The state is made up of three agricultural zones, namely, Orlu, Owerri, and Okigwe agricultural zones, and 27 local government areas. Imo state lies within latitude 4°45'N and 7°15'N and longitude 6°50'E and 7°25'E with an area of around 5100 sqkm. It is bordered by Abia State to the East and Delta State to the west and Anambra State to the north. The estimated population of Imo state in 2019 is 4.8 million and the population density varies from 230 to 1400 people/square kilometer. The state has a tropical climate characterized by two distinct seasons, rainy and dry (harmattan) seasons. The rainy season commences in April and lasts until October with an annual rainfall varying from 1500 mm to 2200 mm (60–80). An average annual temperature above 20°C creates an annual relative humidity of 75%, with humidity reaching 90% in the rainy season. The dry season is usually from November to March, with the hottest months between January and March. The population under study consisted of all farmers in the study

area. In selecting the sample, a purposive sampling technique was used to select 40 farmers from each agricultural zone, making a total of 120 respondents. The two main sources of data collection used in this study included primary and secondary data. The primary data were collected from the field survey/ investigation by administering the questionnaire to farmers while the secondary data were utilized to provide background information that was necessary to achieve some objectives of the study. Mean, frequency, and percentage were used to achieve objectives 1, 2, 3, and 4. A four (4)-point Likert-type scale of strongly agreed, agreed, disagreed, and strongly disagreed, assigned values of 4 to 1, respectively, was used to achieve objective 4 which is mathematically represented as

$$\frac{4+3+2+1}{4} = \frac{10}{4} = 2.50$$

Therefore, a mean of 2.50 was adjudged okay and acceptable while any value below 2.50 was not accepted.

RESULTS AND DISCUSSION^[8-10]

Farmers' Awareness of Climate Change Signs

Table 1 shows that the respondents are aware of climate change by agreeing to the following statements; weather pattern becomes unpredictable from year to year ($\bar{X} = 3.89$); the environmental temperature has increased ($\bar{X} = 3.87$); the rainfall pattern has become very unpredictable ($\bar{X} = 3.76$); there is increased heat on human body ($\bar{X} = 3.76$); there is increased drought ($\bar{X} = 3.76$); reduction in crop yield ($\bar{X} = 3.74$); increased flooding ($\bar{X} = 3.71$); increased precipitation ($\bar{X} = 3.68$); crop damage ($\bar{X} = 3.65$); and seed germination delay ($\bar{X} = 3.65$). The above is true as the mean of the responses did not deviate from the standard deviation of between zero and one (0–1). Therefore, the changes in climate conditions that they have observed in recent years include low rainfall, excess rainfall, late onset of rainfall, early cessation of rainfall, flooding, and extremely high temperatures. When the farmers were asked how low rainfall has affected them, their responses ranged from reduced crop yield to reduced water for livestock.

Table 1: Awareness of climate change signs

Climate change signs	Mean (\bar{X})	SD
Weather pattern becomes unpredictable from year to year	3.89	0.31
The environmental temperature has increased	3.87	0.33
The rainfall pattern has become very unpredictable	3.76	0.56
There is increased heat on the human body	3.76	0.56
There is increased drought	3.76	0.56
Reduction in crop yield	3.74	0.57
Increased flooding	3.71	0.51
Increased precipitation	3.68	0.59
Crop damage	3.65	0.60
Seed germination delay	3.63	0.48

Cutoff mark: 2.5. SD: Standard deviation

Sources of Information on Climate Change

Table 2 shows that a greater percentage (53.3%) of the respondents got to know about climate change from personal observation, 39.17% got to know from extension agents, 33.3% got the information from the radio, 26.7% got the information from the newspapers, 13.3% have their source from the television, 12.5% got to know through their various cooperative societies, 7.5% got the information from local town criers, and other sources which include family, friends, and the market place, whereas only 2.5% got to know about climate change from the church. One can confidently say that the major sources of information through which the rural farmers received information on climate change include personal observation, friends, radio, television, and extension.

Livelihood Activities of Respondents

Table 3 shows that the livelihood activity engaged by the respondents in the zone is mainly crop farming (63.3%), 46.7% are engaged in poultry farming, 37.5% engage in fishing, 27.5% are traders, 26.7% are engaged in fish farming, 19.2% are livestock rearers, 15% are engaged in sewing, another 15% are engaged in pottery, 8.3% are wood carvers, 5.8% bake, 5% weave basket whereas 1.7% are engaged in other activities such as civil service and artisan. This is in line with the findings of Aniah (2016).^[2] He opined that the major livelihood activities of rural people include crop farming, animal rearing, petty trading, fishing, basket weaving, sewing, pottery, wood carving, baking, and civil service.

Table 2: Sources of information on climate change

Source of information	Frequency, n (%)*
TV	16 (13.3)
Radio	40 (33.3)
Personal observations	64 (53.3)
Newspapers	32 (26.7)
Cooperatives	15 (12.5)
Churches	3 (2.5)
Extension agent	47 (39.17)
Local town crier/others	9 (7.5)

*Multiple response

Table 3: Livelihood activities of respondents

Livelihood activity	Frequency, n (%)*
Crop farming	76 (63.3)
Poultry farming	56 (46.7)
Livestock rearing	23 (19.2)
Fish farming	32 (26.7)
Fishing	45 (37.5)
Wood carving	10 (8.3)
Basket weaving	6 (5)
Trading	33 (27.5)
Sewing	18 (15)
Baking	7 (5.8)
Pottery	18 (15)
Others	2 (1.7)

*Multiple response

Effect of Climate Change on Livelihood Assets

Physical capital

These include transport, buildings, water management, energy, and communications and productive capital (tools, machines, etc.) which enable people to pursue the livelihoods. Table 4 shows that the respondents agree that the effects of climate change on their physical capital include collapse of buildings and structures (= 3.92); damage and disruption of road networks (= 3.86); destruction of property and household (= 3.79); disruption of communication channels (phones, television, and radio waves) (= 3.77); prevention of marketing activities (= 3.73); encourages procurement of irrigation facilities (= 3.67); and encourages set up of soil conservation structures (= 3.60).

These are in line with the findings of Aniah (2016)^[2] that the destruction to physical property, collapse of buildings and structures, damage and disruption of roads, and communication networks as a result of and rainfall and floods were indicated as a critical menace of climate change on their

Table 4: Effects of climate change on physical capital

Climate change effects	Mean	SD
Destruction of property and household	3.79	0.43
Collapse of buildings and structures	3.92	0.27
Damage and disruption of road networks	3.86	0.35
Disruption of communication channels (phones, television, and radio waves)	3.77	0.42
Prevention of marketing activities	3.73	0.45
Encourages procurement of irrigation facilities	3.67	0.47
Encourages set up of soil conservation structures	3.60	0.49

Cutoff mark: 2.5. SD: Standard deviation

livelihoods. Furthermore, petty trading is disrupted or affected by climate change in the form of high and unstable food prices and supply among others. The above is true as the mean did not deviate from the standard deviation of between zero and one (0–1).

Natural capital

The actual resources here include soil, air, water and all living organisms. Table 5 shows that the respondents agree that the effects of climate change on their natural capital include soil erosion ($\bar{X} = 3.70$); decrease in crop yield ($\bar{X} = 3.60$); destruction or loss of certain economic trees (deforestation) ($\bar{X} = 3.60$); drying up of water bodies (rivers, lakes, ponds, etc.) ($\bar{X} = 3.49$); decreased biodiversity ($\bar{X} = 3.47$); reduction in livestock numbers ($\bar{X} = 3.46$); decline in on-farm conservation practices ($\bar{X} = 3.46$); wilting and withering of crops and trees ($\bar{X} = 3.45$); drought ($\bar{X} = 3.41$); increased harvesting of wild food ($\bar{X} = 3.41$); loss of pasture/graze land ($\bar{X} = 3.35$); pest infestation and high disease incidence on crops and trees ($\bar{X} = 3.35$); and leaching occurrence ($\bar{X} = 3.30$).

This is in line with a study by Antwi-Agyei (2012)^[3] that crop farming through perennial droughts, erratic and delayed rainfall patterns is severely disrupted by climate change and this has led to declining crop production or yield. Again, livestock farming was most disrupted by climate change which supports the current study. Livestock production is particularly hampered by the unavailability of pasture/grass for animals to graze, inadequate water for animals to drink, and more importantly, diseases that have been killing animals in recent times. Furthermore, a study by Aniah (2016)^[2] reported droughts which result in the withering of crops as a major negative effect of climate change on their livelihoods. As indicated by

Table 5: Effect of climate change on natural capital

Climate change effects	Mean	SD
Soil erosion	3.70	0.46
Decrease in crop yield	3.60	0.49
Destruction or loss of certain economic trees (deforestation)	3.60	0.49
Drying up of water bodies (rivers, lakes, ponds, etc.)	3.49	0.50
Drought	3.41	0.56
Leaching occurrence	3.30	0.64
Loss of pasture/grazing land	3.35	0.54
Pest infestation and high disease incidence on crops and trees.	3.35	0.60
Wilting and withering of crops and trees	3.45	0.50
Reduction in livestock numbers	3.46	0.50
Decline in on-farm conservation practices	3.46	0.50
Increased harvesting of wild food	3.41	0.49
Decreased biodiversity	3.47	0.50

Cutoff mark: 2.5. SD: Standard deviation

Van *et al.*, (2004) and supported by Aniah (2016),^[2] droughts affect household livelihood more than other circumstances (floods) since wet years are normally good years, and hence, there are fewer extreme cases in which excess rainfall results in yield declines. Aniah also noted that “soil erosion caused by loss of vegetative cover due to overgrazing and over-cultivation in the midst of droughts increase the vulnerability of households.” Another effect of climate change is wilting of crops by excessive rainfall and he also noted that “streams, ponds, lakes, rivers, dams, and even groundwater are drying up due to droughts (poor rainfall).”

Financial capital^[11]

The financial resources available to people include savings, supplies of credit, regular remittances and pensions, social security payments, or insurance which provide them with different livelihood options. These include finances (including credit).

Table 6 shows that the respondents agree that the effects of climate change on their financial capital include; high input cost of production ($M = 3.76$); decrease in total available cash ($M = 3.69$); poor market value of liquid assets (livestock, poultry, fish, etc.) ($M = 3.68$); poor savings ($M = 3.56$); increased expenditure ($M = 3.55$); reduction in wages ($M = 3.53$); borrowing from informal sectors (relatives, friends, rural cooperatives, money lenders, etc.) ($M = 3.49$); and reduction in income from farm and off-farm sources ($= 3.49$). The above showed that climate change and extreme weather conditions

Table 6: Effect of climate change on financial capital

Climate change effects	Mean	SD
High input cost of production	3.76	0.43
Poor market value of liquid assets (livestock, poultry, fish, etc.)	3.68	0.53
Decrease in total available cash	3.69	0.64
Poor savings	3.56	0.80
Reduction in wages	3.53	0.72
Increased expenditure	3.55	0.50
Borrowing from informal sectors (relatives, friends, rural cooperatives, money lenders, etc.)	3.49	0.50
Reduction in income from farm and off-farm sources	3.49	0.50

Cutoff mark: 2.5. SD: Standard deviation

are eroding households/farmers' livelihoods through decreases in crop yield periodically complicated by the proliferation of insect infection, pathogens, parasitic weeds, diseases, reduced availability of and access to medicinal plants, and biodiversity loss, these effects lead to high input cost of production, decrease in total available cash, poor savings, reduction in wages, increased expenditure, poor market value of liquid assets (livestock, poultry, fish, etc.), hence supporting the study. The above is true as the mean did not deviate from the standard deviation of between zero and one (0–1).

CONCLUSION

The study revealed that rural farmers are aware of the climate change menace as evidenced by increased temperature, unpredictable rainfall patterns, drought, flooding, increased precipitation, crop damage, and others. The major livelihood activities of the respondents in the study area included crop farming, poultry farming, fishery and fish farming, trading, and among others. Climate change makes the livelihood of rural people difficult in terms of damage and low productivity of their various crops, animals, and other natural activities rivers and others. Rural people should be well educated on the issue of climate change and be made aware of its various effects so that they can get a good understanding of the concept before devising ways to battle it. Rural people should also be enlightened on the causes of climate change and their contribution to climate change to make them understand the need to manage their surroundings or environment properly to minimize their contribution to climate change. The government, NGOs, and other agencies

should provide the rural areas with amenities and infrastructures that will enable them to carry out adaptation strategies against climate change effects.

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