

**Rurality and climate change vulnerability in Nigeria: Assessment towards evidence based even rural development policy**

By

Ignatius, A. Madu

Department of Geography

University of Nigeria, Nsukka

E-mail: ignatius.madu@unn.edu.ng

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## ABSTRACT

Climate change affects certain groups of people more than others, depending on where they live and their ability to cope with different climate hazards. People residing in rural areas are particularly, vulnerable to climate change because of remoteness, their dependence to a large extent on natural resources for income and livelihoods and limited capacity to adapt to climate change. Despite the growing knowledge base on climate change and its impacts, much remains to be understood about the linkages between climate change and rural development. Also, current climate change vulnerability assessment especially at the international level tend to focus more on the identification of the most vulnerable countries and fail to capture the differences within countries which are very useful in defining the risks posed by climate change and in providing a starting point for identifying measures to adapt to climate change impacts . This paper closes the research gap by ascertaining the influence of rurality and climate change vulnerability using states in Nigeria. The purpose is to provide empirical evidence for robust ('no-regrets') decision-making policies for climate change adaptation and even rural development in Nigeria. To achieve this, rural attributes (based on ecological, occupational and socio-cultural characteristics) were obtained and rurality index computed by aggregating the weighted scores of selected rural characteristics. Also socio-economic and biophysical indicators of vulnerability were obtained and weighted using Principal Component Analysis and analyzed using integrated vulnerability assessment approach. Finally, Pearson's Product Correlation analysis was used to ascertain the influence of rural characteristics on climate change vulnerability. The results show a spatial variation of vulnerability with northern states being more vulnerable because of both higher degrees of rurality and lower adaptive capacity. Consequently, the policy implications for adaptive capacity of the rural households and the achievement of even rural development in the country were highlighted.

**Keywords:** Climate Change Adaptation, Vulnerability, even rural development, Nigeria, Rurality.

## **Introduction**

Climate change is among the most pressing challenges that the world faces today. In fact, given the current atmospheric concentrations of greenhouse gases (GHGs), it is evident that the world is already committed to significant warming (World Bank, 2011). There is growing scientific evidence that global warming due to greenhouse gas emission is causing climate change at an alarming rate thereby posing serious challenge to social, economic and ecological system across the globe (Karl et al. 2009). In a publication by IPCC (2012), it was shown that many groups, sectors, ecosystems and places are highly vulnerable to climate and that climate change is likely to exacerbate such vulnerabilities.

The impact of climate change is however spatially heterogeneous across a diverse range of geographical scales. According to World Bank (2013) the impacts are both distributed and felt disproportionately toward the tropics and among the poor. On its part, UNFPA (2012), indicates that climate change does not affect all countries and all geographic regions in the same way. The organization argues that the risk is generally more acute in developing countries because they rely heavily on climate-sensitive sectors, such as agriculture and fisheries, and because they have a low GDP, high levels of poverty, low levels of education and limited human, institutional, economic, technical and financial capacity (IPCC, 2007.) In view of the spatial impact of climate change, there is a general consensus that the poor disproportionately bear the brunt of changing weather and climate and have limited adaptive capacity to cope with climate change (World Bank, 2012).

The implication is that the vulnerability of countries, localities and societies to the effects of climate change depends not only on the magnitude of climatic stress, but also on the sensitivity and capacity of affected people to adapt to or cope with such stress (Care, 2011; European Environment Agency, 2012; Madu, 2012). Consequently, developing countries and in particular least developed countries are among the most severely impacted by climate change because of their greater social and economic vulnerability to climate (World Bank, 2010). Rural dwellers in developing areas are especially affected by local conditions which amplify their vulnerability to climate change. A number of these conditions according to Ranger and Garbett-Shiels (2012) are geographical in nature and include remote location and paucity of socioeconomic infrastructure

that place considerable limitations on the pursuit of socioeconomic activities in rural communities.

Specifically, the conditions of rural areas in developing countries that make them vulnerable to climate change were summarized as follows:

- Rural areas in developing countries are characterized by a dependence on agriculture and natural resources; high prevalence of poverty, isolation, and marginality; neglect by policymakers; and lower human development.
- The distinctive characteristics of rural areas make them uniquely vulnerable to the impacts of climate change because:
  - Greater dependence on agriculture and natural resources makes them highly sensitive to climate variability, extreme climate events, and climate change.
  - Existing vulnerabilities caused by poverty, lower levels of education, isolation, and neglect by policymakers can all aggravate climate change impacts in many ways (Dasgupta, Morton, Dodman, Karapinar, Meza, Rivera-Ferre, Toure Sarr, and Vincent, 2014)

In view of the pattern of impact of climate, there is a pressing need to address issues related to climate change adaptation, vulnerability and coping, in particular in developing nations as these regions have the largest deficiencies in adaptive capacity (Rishi, Omprakash and Mudaliar, 2010). In this regard, a major challenge of the research community is to provide relevant information to policymakers on vulnerability, impacts and adaptation (VIA) in the context of a changing climate and to do so in a coherent and coordinated way (United Nations Environment Programme, 2013). More importantly, it has been argued that despite the growing knowledge base on climate change and its impacts, much remains to be understood about the linkages between climate change and rural development (Unique Forestry and Land Use, 2013).

Consequently, an assessment of the influence of rural characteristics on vulnerability to climate change is not only important for defining the risks posed by climate change in rural areas but will also provides information for identifying measures to adapt to climate change impacts. Furthermore, it will enable rural development practitioners and decision-makers to identify the most vulnerable rural areas which will in turn enable them tackle climate change problems with precision. This because it is by understanding, planning for and adapting to a changing climate that individuals and societies can take advantage of opportunities and reduce risks (USAID, 2007).

Against this background, an analysis focusing of climate change impacts on rural areas and the influence of rural characteristics on the pattern of the impacts becomes imperative. This is because rural areas still account for almost half the world's population, and about 70% of the developing world's poor people. Furthermore, rural areas, viewed as a dynamic, spatial category, remain important for assessing the impacts of climate change and the prospects for adaptation (Dasgupta et al 2014). This is particularly important for Nigeria because it is the most populous country in Africa and 7<sup>th</sup> in the world with a total population of 160.2 million people out of which 50% resides in rural areas (Madu, 2012; Population Reference Bureau, 2013)

### **The concept of Rurality**

Most people have a fairly clear idea about what is meant by 'rural'. Probably the first thing that springs to mind is the contrast with urban areas and the image of open spaces, either in a relatively natural state or cultivated or grazed by livestock. However, the definition of rural is not as clear-cut as one might think as there is no precise distinction between rural and urban. The consequence of the unspecific view of Rurality is that there is no unified definition of rural areas and that the data on rural areas and their socio-economic characteristics are not comparable or compatible (Duenckmann, 2010). In fact two major tasks that always confront a discussion on any aspect of rural studies is the definition of the term 'rural' and a distinction between rural and urban areas. The tasks arise from the fact that there is no universally acceptable definition of rural and that the distinction between urban and rural areas vary across countries (Madu, 2002).

In general term however, 'rural' is used to refer to areas of small population size or areas of agricultural production. In these senses, 'rural' as argued by Gilbert (1982) is simply a fuzzy descriptive designation or a convenient shorthand label. According to IFAD, (2010) "Rural" refers generally to areas of open country and small settlements, but the definition of "rural areas" in both policy-oriented and scholarly literature are terms often taken for granted or left undefined. Therefore, beyond the simple description, the distinction between rural and urban is highly problematic and illusive.

Three main reasons account for the difficulties in defining and differentiating between rural and urban settlements. First is the existence of settlement continuum. Human settlements exist along

a continuum from “rural” to “urban,” with “large villages,” “small towns,” and “small urban centers” not clearly fitting into one or the other (Dasgupta, et al 2014). This implies that there is no point where urbanity disappears and rurality begins. As a result, it is difficult to determine whether a given borderline characteristics should be classified as rural or urban. Second is the changing character of settlements which includes urban expansion and development of sprawls and rural transformation. Third is the use of different criteria by different countries such as population (with different cut-off points also varying between countries) or percentage population employed in primary, secondary or tertiary activities (Bernstein, 1992, Madu, 2002). Each country has its own official definition based on statistical criteria or administrative decisions. Even when using administrative definitions, they are applied on different territorial units or frequently change without clear criteria (Bogdanov , Nikolić , Dimitrievski., Kotevska 2015).

It must also be noted here that the concept of rurality has been a subject of long-standing debate and controversy. Coupled with the difficulties in defining rural, building an objective or unequivocal definition of rurality appears an impossible task in reality (Study Programme on European Spatial Planning, 1999). This is because there exists not a single methodology and a single definition of what constitutes rural. The problem basically is that that the patterns of spatial occupation are culturally and historically determined and vary among regions of the world (Anriquez and Stamoulis, 2007). Consequently, the treatises of alternative views on the rural concept are numerous and varied. One outstanding debate is whether “rural” is a geographical concept, a location with boundaries on a map or whether it is a social representation, a community of interest, a culture and a way of life (Plessis et al, 2001). This explains why the questions as to what is meant by rural, the identification of its diagnostic features and attempts at understanding the nature and scope of rurality are continuing themes in the literature.

In spite of these difficulties, there is incontestable evidence of the existence of rural areas. As Lewis (1983) stated, the inescapable and simple truth is that there remains a fundamental distinction between a rural area and an urban sphere. It is therefore important that researchers interested in the activities and living conditions in rural areas notwithstanding the difficulties,

acquire clearer understanding of what constitutes rurality and subsequently the likely challenges they might encounter when undertaking rural research programs.

Apart from utilizing practical rural knowledge in the design of rural research strategies and approaches, an exposure to real world conditions in rural areas and the extent to which they could impact on planned activities would ensure that researchers enrich their views and perceptions of what constitutes 'rural' and its diverse environments (Madu, 2015). Also, researchers should not give up talking about the rural, since the idea of rurality, even though chaotic and unspecific, still is an important concept in the ordinary way of perceiving the world (Duenckmann, 2010).

Furthermore, rural is widely used as an expression for non-urban or peripheral regions without necessarily defining the concept or its spatial implications. Again, rural areas have peculiar characteristics that have led to a number of perceptions and viewpoints being formulated about them even though there is no general agreement on what the definition should be

Despite the debate and the difficulties in defining rural many authors agree that most understanding of rural involves the use of either ecological, or occupational or socio-cultural dimension or a combination of the dimensions (Madu, 2002). There is also an agreement on the primary marks of rural areas especially in the developing countries. They are characterized by population regularly supported by extensive land uses within a sparsely populated open country (Wolfe and Fischer, 2003). Thus, one of the key variables used in distinguishing rurality is its often cited relatively small population size (Ghana Statistical Service, 2013).

Another important feature of rurality is the dominance of agricultural activities although its preeminence is on the decline due to declining fortunes from farming and rural economic diversification. However, OECD (2016) was quick to add that rural is not synonymous with agriculture and is not synonymous with economic stagnation although low socio-economic status of rural dwellers is also a well-documented situation in rural studies. For instance, Arku and Arku (2010) emphasized that rural areas have limited physical infrastructure and this has slowed down improvements in socio-economic development programs.

Categorically, Ocheni and Nwankwo(2012) state that rural areas are easily identified by other various criteria, apart from population such as;

a) Level of infrastructural development i.e. road networks, educational institutions, water supply, electricity, health facilities, communication, etc. The rural area lacks most if not all of these infrastructures and where they are available the quality as well as quantity is usually below desirable standard;

b) Occupational differentiation: Most rural dwellers earn their living by engaging in subsistent agriculture production;

c) Housing: Housing in rural areas is generally below the standard an average person will be proud of;

d) Extent of community planning: Community development activities in the rural areas are often carried out with little or no planning at all, such that future development activities cannot be undertaken without interfering with the existing structures;

e) Arising from the combination of the above factors is a characteristic abject poverty when related to the economic buoyancy of urban centers.

Similarly, Ugwoke (2014) has shown that rural communities are characterized by bad roads and difficulties in transporting agricultural produce to the urban areas in Nigeria. Distant location is another primary characteristic of rural areas especially in developing countries and this implies remoteness, accessibility difficulties and continuous separation from each other as well as major urban centres. These result in the need to traverse long distances in order to access vital support services or participate in various activities ((Johnson et al. 2011; Sseguya et al, 2013).

In addition to these primary marks, one would expect, under the general concept, a rural population to display certain distinctive patterns of knowledge, belief, experience, skills, value orientations and customs connected to country living. The distinctive cultural patterns according to Wolfe and Fischer, (2003) are treated as ancillary evidence in support of classifications made with the primary concepts.

In summary evidence abounds in literature that rural areas are settlements with the following features;

- Specific open landscape;



- A relatively, low population density;
- Greater part of the population being associated with agriculture and forestry;
- Traditional (close to nature) life styles and habits;
- Extensive (first and foremost agricultural and forest-related) use of land;
- A scarcity of built-up areas and settlement that is dispersed; and
- A preponderance of inhabitants considering themselves country-dwellers (Madu, 2010)

It is in line with the traditional approach supported by socio-cultural characteristics that Madu (2010) defined rural as areas of low population density, utilizing land extensively and exhibiting distinctive socio-cultural characteristics associated with the rural setting, while, Fredericks, (2012) sees rural as a spatial categorization relative to “agricultural” denoting a sectoral activity. This is also in line with the current view among sociologists that rural refers to areas with low population density, small size, relatively isolation, where the major economic activity is found in agricultural occupations and where the people are relatively homogenous in their values, attitudes and behaviour (Sam, 2014).

The extent of rural conditions needed to be assessed and factored into climate change adaptation measures. This is why it is necessary to first obtain a broader understanding of what constitutes rurality before establishing a link between rurality and climate change vulnerability.

## **Methodology**

The study made use of secondary data on rural household obtained from Federal Republic of Nigeria (2007), UNFPA Nigeria, (2010) and National Bureau of Statistics (2012): The analyses were done in stages. First, the data generated were normalized by converting them to natural Logarithms in order to be able to combine the variables since they are denominated in different units. Next, the variables were aggregated at state levels and an indicator method used whereby different socio-economic and biophysical attributes were integrated and classified into adaptive capacity, sensitivity, and exposure which were used to calculate vulnerability . The following variables adapted from Unique Forestry and Land Use (2013:12) was used.

**Exposure**- range of temperature, rainfall variability, coast, desert encroachment;

**Sensitivity**- employment in agriculture and percentage of land used for agriculture; and

**Adaptive capacity**- education, assets, information and income

Principal Component Analysis was performed to obtain the component scores, which were used to weight the variables. The purpose of using weights obtained from the PCA is to avoid the uncertainty of equal weighting, given the diversity of indicators used. Vulnerability was then calculated as follows:

$$V = W_a X + W_s Y - W_e Z \quad (1)$$

Where  $V$  is vulnerability, while  $X$ ,  $Y$  and  $Z$  are adaptive capacity, exposure and sensitivity variables respectively and  $W$  is the weight from the component score (Madu, 2012).

In calculating the direction of relationship in vulnerability indicators (i.e., their sign), negative value was assigned to both exposure and sensitivity. The justification is that areas that are highly exposed to damaging climate are more sensitive to damages, assuming constant adaptive capacity. The implication is that a higher net value indicates lesser vulnerability and vice versa ((Deressa, Hassan and Ringler, 2008; Madu, 2012). A cluster analysis was then performed to group and map the states and the Federal Capital Territory (FCT) according to their degrees of vulnerability.

Second, rurality index was computed by aggregating the weighted scores of the following prominent rural characteristics in the country:

Percentage of rural population;

Total agricultural land area;

Size of farm holdings per household;

Percentage of dependent population;

Percentage of population employed in agriculture;

Percentage of population dependent on stream/rivers as a major source of water supply;

Number of traditional housing units (hunts);

Use of fuel wood; and

Area of natural forest

The variables were again first normalized by transforming them into natural logarithms while the weighting was done by PCA. The assumption is that the more of these features in an area, the

more rural the area becomes. Furthermore correlation analysis was conducted to ascertain the relationship of rural characteristics on climate change vulnerability.

## **Results**

The results of the vulnerability analysis show a spatial variation of vulnerability to climate change with states in the north experiencing higher degrees of vulnerability than those in the south. Table 1 and Fig 1 show that the first 13 states which experience high vulnerability are all located in the northern geo-political zones. The pattern authenticates the report by Maplecroft (2014) which shows the northern Nigeria as areas of extreme risk in terms of climate change.

A closer look at the pattern of vulnerability according to geo-political zones in Nigeria shows that the North West zone with an average index of 2.91 is the most vulnerable followed by northeast (3.71) and north central (7.55). On the other hand, the Southwest geo-political zone with an index of 11.89 is the least vulnerable followed by Southeast (10.08) and South- south (8.17) (Fig.2)

**Table 1: Vulnerability to climate change by States in Nigeria**

S/no	State	Geo-political zone	Vulnerability index
	Sokoto	North west	2.11
	Kebbi	North west	2.27
	Bauchi	North east	2.87
	Kaduna	North west	3.06
	Gombe	North east	3.08
	Kano	North west	3.08
	Jigawa	North west	3.12
	Yobe	North east	3.14
	Katsina	North west	3.20
	Borno	North east	3.25
	Zamfara	North west	3.54
	Plateau	North central	3.87
	Niger	North central	4.03
	Taraba	North east	4.70
	Adamawa	North east	5.22
	Ebonyi	South east	5.33
	Nassarawa	North central	5.50
	Cross river	South-south	5.54
	Kwara	North central	6.76
	Akwa Ibom	South south	7.16
	Kogi	North central	7.34
	Ekiti	South west	7.70
	Bayelsa	south-south	7.79
	Delta	South- south	8.21
	Edo	South south	8.65
	Benue	North central	8.86
	Osun	South west	9.17
	Ogun	South west	9.68
	Ondo	South west	9.71
	Abia	South east	9.79
	Oyo	South west	10.29
	Imo	South east	11.26
	Anambra	South east	11.33
	Rivers	South south	11.64
	Enugu	South east	12.68
	FCT	North central	16.51
	Lagos	South west	24.78

**NB: Lower value indicates more vulnerability**

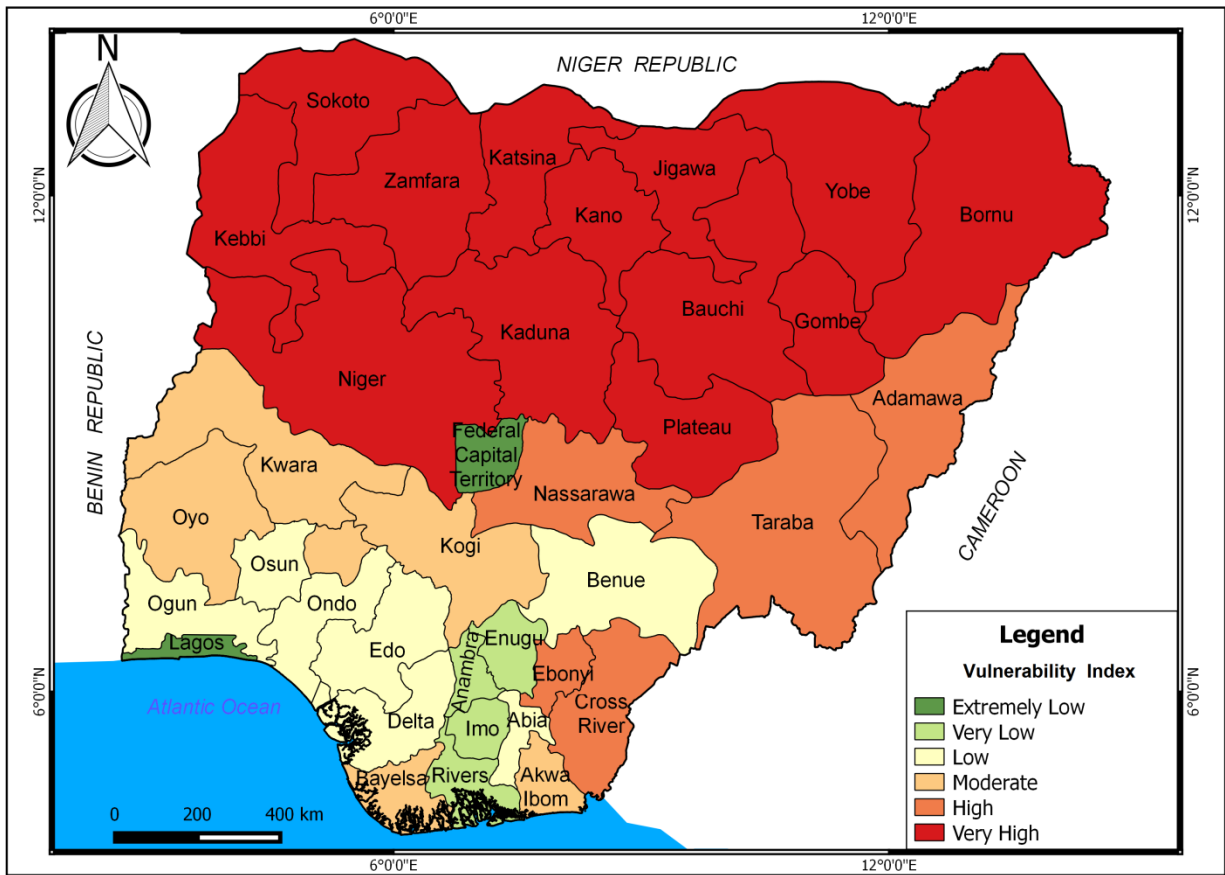
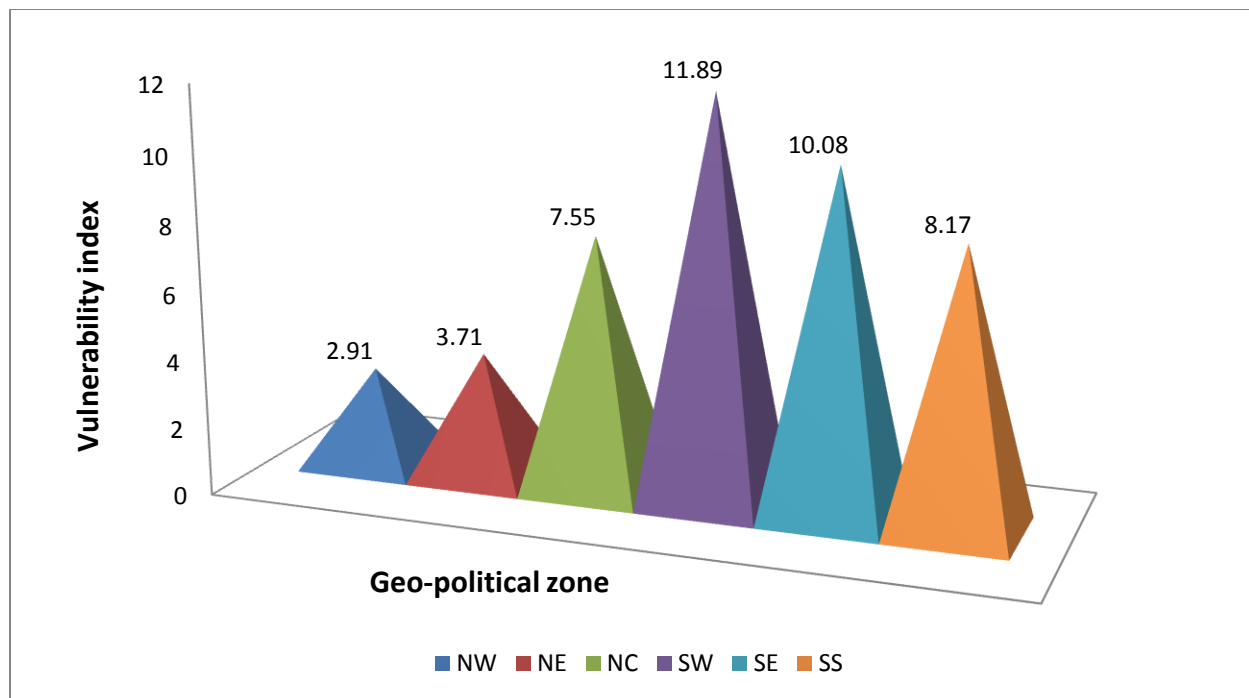


Fig.1 Patterns of climate change vulnerability in Nigeria



**Figure 2: Climate change vulnerability by Geo-political Zones in Nigeria.**

Note again that the lower the value, the less the adaptive capacity and hence the more vulnerability.

The pattern of vulnerability results mainly from the dominant of agricultural activities, poor infrastructural development and other socio-economic conditions in rural areas of the country. Accordingly, the results of the Pearson correlation analysis show that the number of rural population(  $-.687$ ), number of dependent population(  $-.603$ ), number of farming population(  $-.675$ ), size of farm holdings, household size(  $-.599$ ), use of fuel wood for cooking(  $-.766$ ), total land area under agriculture(  $-.627$ ), illiteracy(  $-.637$ ) are significantly negatively correlated with vulnerability to climate change. These variables are clear characteristics of rural areas in Nigeria and the implication is that the more an area is associated by these variables, the higher the vulnerability to climate change. These features are still more prominent in northern geo-political zones than in the south and this explains the high vulnerability in the north.

The pattern of rurality follows the same trend with states in the north having higher degrees of rurality than the southern counterparts (Table, 2). The table again shows that of the first 13 states with high degrees of rurality, only Akwa Ibom which ranks eight is located in the south, while

the rest is in the north. The high degree of rurality of Akwa Ibom can be explained by the fact that a high percentage of the rural household depend on agriculture and forest products for their livelihood. The table shows that Lagos state has the lowest degree of rurality followed by Oyo and Osun in the South west and Anambra in the Southeast. The states with the highest degrees of rurality are Taraba, Benue, Gombe and Adamawa.

On Geo-political zones, the North east with an average Rurality index of 5.21 has the highest degree of rurality followed closely by North west with an average of 4.69 and North central with an average of 4.61 .The South west is the least rural, followed by South east and South south with average indices of 2.50, 3.82 and 4.09 respectively (Fig.3).

Over all, the correlation between vulnerability to climate change and rurality gives a coefficient of -0.979, meaning a near perfect negative relationship. The implication is that the higher the rurality, the more vulnerable a place becomes.

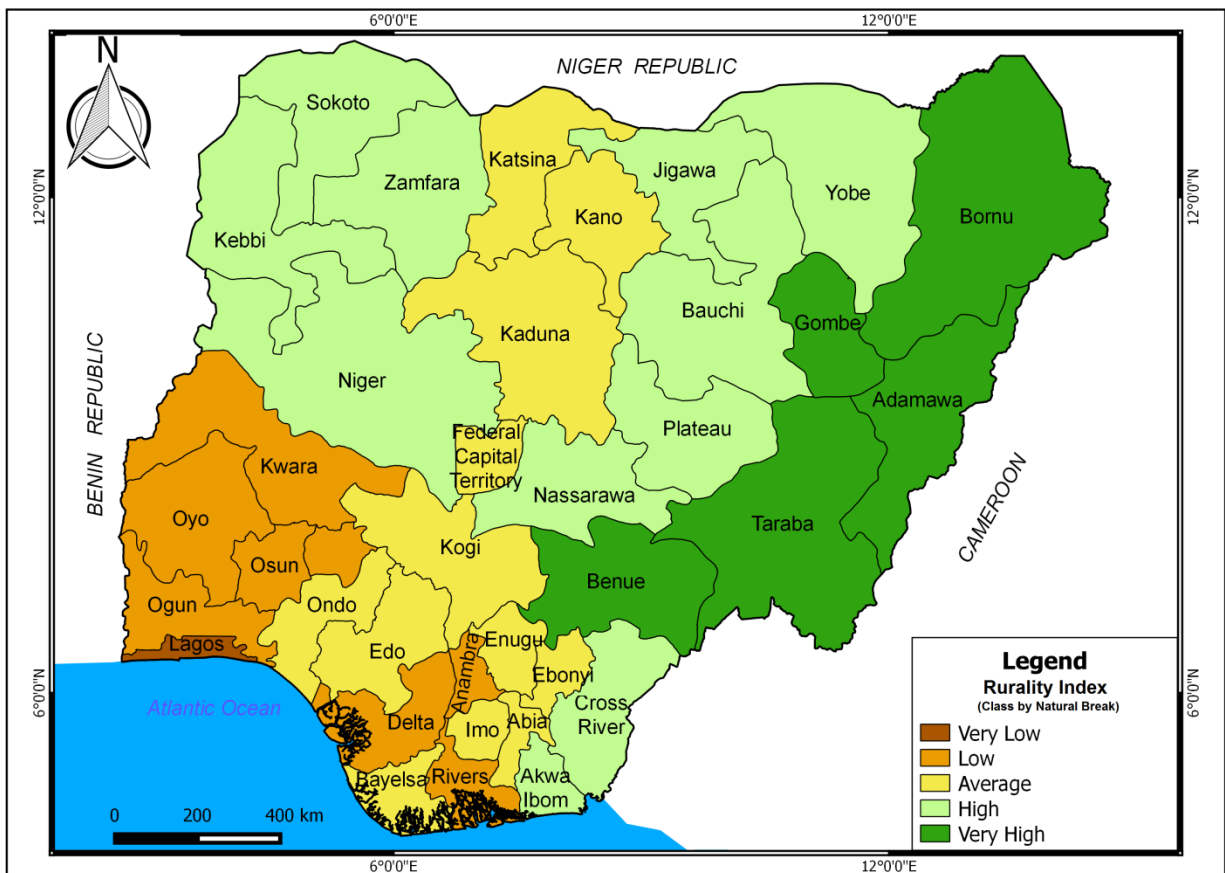


Fig 3: Patterns of Rurality by States in Nigeria

## **Policy implications**

The patterns and linkages between rurality and climate change vulnerability create the need for policy measures to improve the adaptive capacity of the rural households as well as to bring about equitable rural development in the country. The measures should aim at rural infrastructure development, education and training particularly adult education and skill acquisition, poverty alleviation and urban-rural linkages. However, these measures should not be treated as standalone measures but should be integrated into agriculture and rural development and poverty reduction strategies. In doing this, other factors that make people less vulnerable to climate change like gender empowerment, livelihood diversification efforts and literacy promotion should be encouraged with greater attention to the northern states that are more disadvantaged.

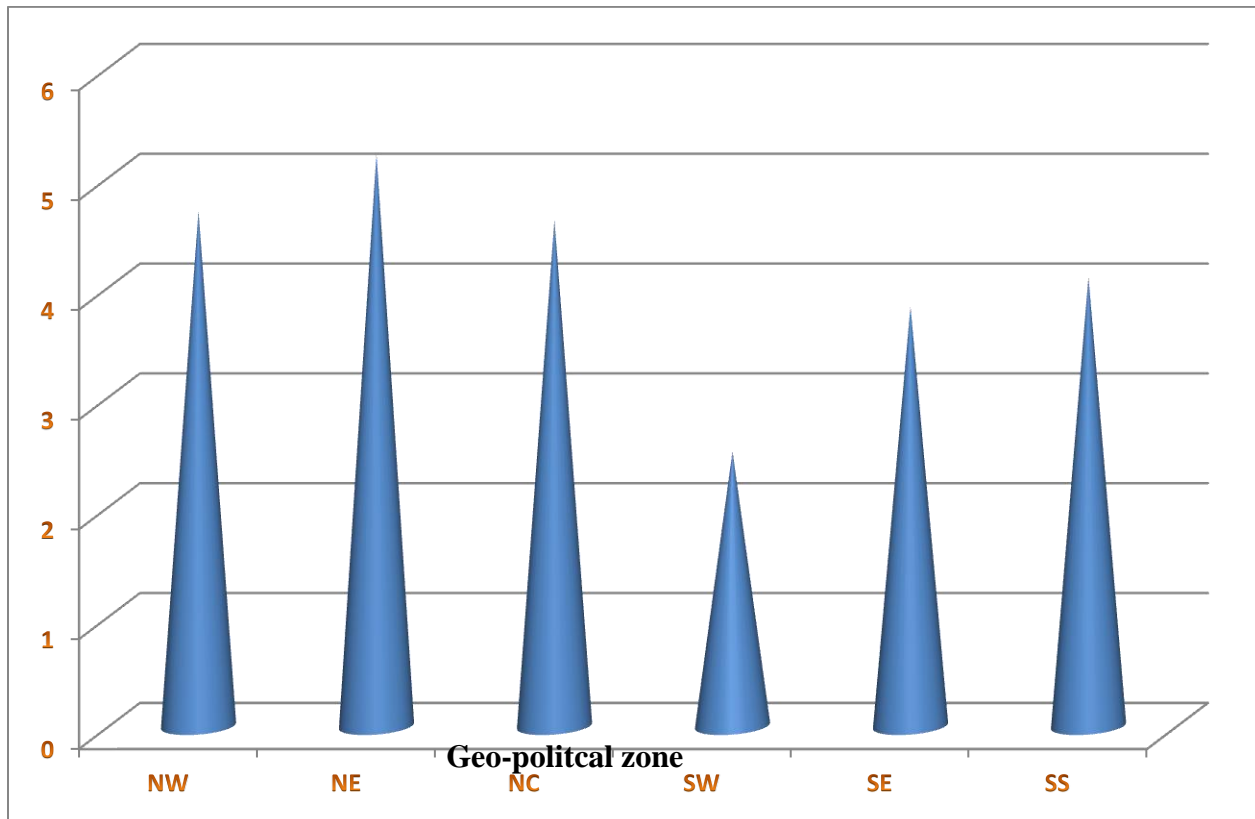
## **Conclusion**

There exists a strong negative relationship between rurality and vulnerability to climate change in Nigeria. This results from the climate sensitive nature of agriculture which is the dominant economic activity as well the other primary marks of rurality which include low socio-economic development status of rural dwellers, remoteness and accessibility difficulties. Consequently, the northern regions of the country which have higher degrees of rurality are more vulnerable to climate change. This requires consented effort to mainstream climate change adaptation into rural development process in the country with emphasis in the northern regions.



**Table 2: Degree of Rurality by States in Nigeria**

S/no	State	Geo-political zone	Rurality
1	Taraba	North east	6.15
2	Benue	North central	5.73
3	Gombe	North east	5.55
4	Adamawa	North east	5.46
5	Jigawa	North west	5.21
6	Nassarawa	North central	5.13
7	Zamfara	North west	5.11
8	Akwa Ibom	South south	5.11
9	Kebbi	North west	5.09
10	Plateau	North central	4.94
11	Sokoto	North west	4.92
12	Bauchi	North east	4.87
13	Yobe	North east	4.76
14	Cross river	South-south	4.74
15	Niger	North central	4.62
16	Katsina	North west	4.49
17	Borno	North east	5.48
18	Kogi	North central	4.40
19	Ebonyi	South east	4.32
20	Abia	South east	4.23
21	Kano	North west	4.09
22	FCT	North central	4.09
23	Bayelsa	south-south	4.08
24	Imo	South east	4.05
25	Kaduna	North west	3.92
26	Ondo	South west	3.80
27	Enugu	South east	3.78
28	Edo	South south	3.77
29	Delta	South- south	3.46
30	Rivers	South south	3.37
31	Kwara	North central	3.36
32	Ekiti	South west	3.24
33	Ogun	South west	2.71
34	Anambra	South east	2.70
35	Osun	South west	2.68
36	Oyo	South west	2.17
37	Lagos	South west	0.38



**Fig.3: Degree of Rurality by Geo-political Zones in the country**

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