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Rural Livelihood Adaptation Practices to Climate Variability in Different Ecological Zones of Nigeria

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

This paper examined the adaptation strategies to climate variability impact of livelihood security of the aged in selected rural settlements of the different ecological zones of Nigeria. Descriptive statistics, Correlation and Principal Component Analysis were used for quantitative data analysis while Content Analysis Method was used for qualitative data analysis. From the study, it was discovered that 54.9% of the respondents were crop farmers with the highest proportions of the respondents in Sudan savannah (85.2%) and Montane zone (85.2%) and about, 70.8% of the respondents were into fishing in the coastal zone of the country. The study also revealed that majority of the respondents (61.8%) earned below N20,000 (US$56) annually. In Guinea Savannah zone 60.1% and Montane zone 88.5% of the respondents adapt by selling their livestock while 60.8% in the Coastal zone and 85.2% in the Sudan savanna zone divert into alternate sources of income. It was also discovered in the study that in all the zones, the common determinant of their responses was their level of education. This implies that there is need for trainings for the aged populations and also diversification of income sources should be encouraged and government should design socio-economic policies to support the rural aged in response to climate change/variability impact as many of them are poor.

Keywords: Indigenous knowledge; adaptation; climate variability; livelihood.

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1. INTRODUCTION

Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events [1]. It is a term used for timescales longer than those associated with synoptic weather events like - months to millennia and longer [2]. Climate variability is reflected in changes in the frequency, intensity, spatial extent, duration and timing of extreme weather and climate events [3]. This might be attributed to natural internal processes within the climate system (internal variability) or variations in natural or anthropogenic external forcing (external variability) [1].

Climate variability has enormous impacts which might be significantly detrimental. For instance, IPCC [3] projected increasing frequencies of heat stress, drought and flooding events for the rest of the century and their adverse effects due to changes in their mean variables. [4] noted that the impact of climate change on social, cultural and natural resources will have enormous impact on our society and the impact will be felt more on the poor, the young , the old, the weak and those located in areas prone to its impact.

Climate change impacts are already having their toll in the developing countries, especially on the poor due to their lack of social, technological and financial resources for adaptation [5]. For instance, Climate change is having great impact in the rural areas and poses great challenges to the livelihoods of the people as it affects their sources of income and means of production. This is not farfetched from the fact that livelihoods of many people especially in rural areas of Africa are dependent on the changing climate [6] and also many people have poor capacity to adapt to the changing climate. In the rural areas, the impact of climate change are enormous on the aged populations. This is because the aged in the rural areas face serious problems as life in the rural areas is hard and sometimes inhuman especially with the impact of climate change on their livelihood. This however makes them highly vulnerable to its impact. It is therefore very important to reduce the ageds' vulnerability to climate change impact by enhancing their adaptive capacity. Adaptation and coping strategies will greatly reduce vulnerability to climate change by making communities better able to adjust to the changes and variability in climate, moderating potential damages, and helping them cope with adverse consequences [7].

Several studies have been conducted on adaptation to climate change/variability in the developed and developing world [8,9,10,11,12,13,14], however little empirical evidence exists on the different adaptation to climate change and livelihood security effects on the rural aged population in sub-Saharan Africa. For instance, [8] examined the impact of climate change on rural farming communities and their indigenous response in the Jaman North District of Ghana. From the study, it was discovered that erratic rainfall and increasing temperatures (as a result of changing weather patterns) were major challenges the farming communities were facing. Also [9] examined rice farmers' vulnerability to extreme climate events for potential adaptation finance allocation in the derived savannah and forest agro-ecological zones of Ekiti State, Nigeria. From the study, it was discovered that rice farmers in the agro-ecology zone were more vulnerable to climate variability and extreme weather events than in the derived savannah. The reason for this is associated with poor and inadequate adaptive capacity. From these studies, it can be inferred that issues on climate change impact on livelihood security and adaptation of the rural aged populations have not been properly articulated and well documented in literature. Also studies that examined the choice of adaptation did not explicitly explain how climate change/variability is adapted by the aged population especially in the rural areas of the different ecological zones of Nigeria, hence this study.

Also there is dearth in studies on determinants of choice of adaptation measures to climate variability and livelihood while studies that examined the determinants to choice of adaptation did not consider it in relation to the rural aged. For instance, [15] analysed the determinants of smallholder farmers' response to climate variability induced hazards. The study discovered that productive assets are a major determinant of response to Climate variability induced hazards. Also, [16] examined the determinants of farmers' choices of livelihoods and perceptions of the effects of climate variability on choices of livelihoods in Anambra State, Nigeria. Results showed that household income, gender, marital status, household size, education level of household head and farm size were the major determinants of farmers' choices

of livelihoods. Gender education level and household income had a positive significant influence while marital status, farm size, and household size had a negative significant influence on the choices of livelihoods. These studies on the determinants of response to climate variability were not in relation to the aged. Hence, this study.

Based on the above, there is therefore need for research that would examine rural ageds' adaptation measures to the impact of climate variability on their livelihood activities. This study will therefore examine the rural ageds' livelihood adaptation practices to climate variability in different ecological zones of Nigeria.

This study therefore attempted to provide answers to the following questions: 1. what are the socio-economic characteristics of the aged population in the selected rural areas? 2. how do they respond to the effect of climate variability on their livelihood security? 3. what are the main determinants of their response?

2. METHODOLOGY

The study area is the different ecological zones of Nigeria. The first stage involved the identification of the ecological zones in the country. (They are: Mangrove zone, Rain forest, Montane region, Guinea savannah, Sudan savannah and Sahel Savanah). Four Ecological Zones were purposively selected for this study. They are: Guinea savannah zone, Coastal zone, Montane zone and the Sudan savannah zone. One State was then selected from each of the selected ecological zones. The states are – Oyo State in the Guinea savannah zone, Ondo State in Coastal zone, Plateau State in Montane zone and Kebbi in the Sudan savannah zone. In the second stage, two local government areas were selected from each of the State based on their level of rurality and peculiarity of the areas. The third stage involved the selection of three rural settlements from each of the local government areas which was done by the simple random selection process by assigning each settlement in the respective local government area a number, written in a piece of paper and placed in a container. After they have been thoroughly mixed together, each number or settlement will then be drawn from the container without replacement. This was to ensure that every settlement has the same probability of being chosen from each of the Local government Areas. The fourth stage is the identification of the houses where the rural aged resides. This will be done using the snowball approach. Where there was no combination of the two (aged men and aged women), either of the two was also sufficient. The research made use of primary data (qualitative and quantitative data). The primary data were obtained through interview and structured questionnaire administered in the selected rural communities in the different ecological zones of Nigeria using a multistage sampling technique. The quantitative data were obtained through structured questionnaire which were administered to an aged male, and aged female available in the houses (the aged are people 60 years and over in age) in the selected rural communities of the selected eco-climatic zones of Nigeria. A total of 683 questionnaires were administered and 659 questionnaires were retrieved for analysis. The qualitative data were obtained through interview method. The respondents to the interview were four aged men and four aged women selected purposively in each of the selected villages.

2.1 Data Collection and Analysis Procedures

Data was collected on the socio-economic characteristics of the rural aged, their response to climate variability impact related to livelihood activities, factors influencing their responses in the selected rural communities of the selected eco-climatic zones of Nigeria through interview and questionnaire administration. Data obtained was analyzed using a number of analytic methods from SPSS package like; descriptive statistics (means, frequencies, percentages) to examine the socio-economic characteristics. Also Pearson and Spearman Correlation Coefficients were used to determine the factors influencing responses to climate variability impact related to the ageds' livelihood activities. Pearson correlation was used for continuous variables and Spearman correlation coefficients were used for ordinal variables. The qualitative method was analysed using Content Analysis Method.

3. RESULTS AND DISCUSSION

This chapter presents the results and discussion of findings obtained through questionnaire administration, observations, in-depth interviews, and key informant interviews during the field survey of indigenous adaptive measures to climate variability impact of livelihood security of the rural aged populations in selected rural settlements of different ecological zones of Nigeria. This section presents: the socio-

economic status of the rural aged population in the selected ecological zones of Nigeria; their responses to the perceived climate variability impact related to their livelihood activities and determinants of their responses. The tables and figures were sourced from the author's 2017 field survey.

3.1 Socio-Economic Status of the Rural Aged Population in Selected Ecological Zones of Nigeria

According to [17], socio-economic status of the people has to do with the attributes of their quality of life, opportunities and privileges afforded to them within the society. It is important to examine the socio-economic status of the people because the effect of climate change is not just environmental but also economic and social, and this has impacts on people's lives [18]. In this study, the socio-economic status of the rural aged in selected ecological zones of Nigeria were examined. The socio-economic attributes examined include: Age, Marital status, Educational level, Occupation, and Income.

Table 1 shows the socio-economic status of the rural aged in selected ecological zones of Nigeria. The study revealed that majority of the respondents (85.6%) are married and many of them (64.9%) are in the age range of 60-64years. It was observed that many of the respondents in this age range were still very active and they really didn't see themselves as old. Many still had their means of livelihood. For instance, 54.9% of the respondents were crop farmers with the highest proportions of these respondents in Guinea savannah (70.6%); Sudan savannah (85.2%) and Montane zone (85.2%). Also, 23.1% of the total respondents are into fishing with 70.8% of these respondents in the coastal zone of the country. Only about and 2.6% of the respondents are into cattle rearing of which 4.6% are in guinea savannah zone; 5.8% in Sudan savannah and 1.7% in Montane zone. This is in line with [19] who explained that old age in many developing countries starts at the point when active contribution is no longer possible. Therefore, age groupings of the elderly are very important. This helps in understanding the experiences of life of the elderly at different stages of life so that experience of life of 60-65years is not equated with the experience of life of over 80 years.

The study also revealed that many of the respondents (55.1%) had no formal education and about 27% had only primary education. Hermalin and Yang [20] noted that education influences the values people hold, the types of living arrangements they prefer when they get older, and the extent and nature of their interpersonal relationships. In other words, since many of the respondents had no formal education, their choice of occupation is influenced and this ultimately determines their income. For instance, the study showed that majority of the respondents (61.8%) earned below N20,000 (US$56) annually. Federal Office of Statistics (FOS) states that any Nigerian earning less than N7 500 per month (US$47) is poor. This implies that the aged in the different ecological zones are very poor and they might find it difficult to adapt to the impact of climate change and variability appropriately.

3.2 Response to Climate Variability Impact on livelihood Security of the Rural Aged in Selected Ecological Zones of Nigeria

This section presents response to climate variability impact on livelihood security of the rural aged in selected Ecological zones of Nigeria. This section identified adaptive strategies in the different ecological zones of Nigeria. The analysis of the responses were done zone by zone. This is because each zone has its own peculiarities especially in response to climate variability impact.

Table 2 revealed the different ways the aged adapt to the perceived climate variability impact of livelihood in the different ecological Zones of Nigeria. From the table, it was discovered that in Guinea Savannah, many of the respondents (60.1%) respond by selling their livestock, this is followed by 43.1% of the respondents who diverted into alternate sources of income while 20.9% had to adapt to the situation by reducing their daily frequency of food. This information was supported by some of the interviews organized for the aged in the region. From the interview, some of the aged explained that they cope with the situation by reducing their expenses and spend only on things based on necessity. Some other participants explained they use their vocational skill to generate additional income for themselves as stated below:

> *Well, some of us are vocationally skilled. Like myself for example, I am vocationally skilled but I have not really worked with it, but God's grace abound. As our sales*

reduces, so also is our needs. We also try to reduce our expenses, and spend more on things based on necessity. That is how I have been balancing the whole situation for myself. However, some people use their vocational skill to generate additional income for themselves, just like this man seated is a teacher and also a farmer. In addition, some people in this situation make things like chin chin to sell in order to generate income.(Participant G1)

Also in the Coastal zone, many of the respondents (60.8%) respond by diverting into alternate sources of income, 53.2% of the respondents adapt to the situation through water harvesting; 22.2% removed children from School, 19.8% of the respondents had to reduce their daily frequency of food while 19.3% of the respondents migrated away from the region. Interviews conducted revealed that the major climate change challenge is the rise in water level above the sea level. For instance in the coastal communities, when the water rises above the sea level, many of the aged migrate to nearby communities with dry land while others stay back and have their houses raised up with logs as shown below:

We have other alternatives like breeding fishes from fish pond and drinking the rain water harvested during the rainy season.
When the water rises above the sea level some houses are raised up in this process with woods and logs and we wait till the flood water subsides, but mostly the general solution is relocating to any available dry land (Participant C2)

Table 1. Socio-economic status of the rural aged in selected ecological zones of Nigeria (%)

Socio-economic status	Value labels	Ecological Zones				Average
		Guinea Savannah	Coastal Zone	Sudan Savannah	Montane Zone	
Age	60-64	44.1	57.8	85.2	71.9	64.9
	65-69	32.3	23.2	5.8	12.9	18.5
	70-74	14.2	9.5	5.8	7.9	9.2
	75-79	4.7	5.7	0.6	3.6	3.8
	80 and above	4.7	3.8	2.6	3.6	3.6
Marital status	Married	88.9	87.3	93.5	70.5	85.6
	Single	0.7	1.9	0.0	2.2	1.2
	Widowed	8.5	10.4	6.5	26.6	12.4
	Divorced	2.0	0.5	0.0	0.7	0.8
Educational status	No formal education	68.6	38.2	56.1	64.7	55.1
	Primary	27.5	36.3	16.1	24.5	27.0
	Secondary	3.9	23.1	5.2	7.2	11.1
	NCE/OND	0.0	2.4	3.9	2.2	2.1
	HND/BSC	0.0	0.0	0.6	0.7	0.3
	Postgraduate	0.0	0.0	0.0	0.7	0.2
	Others	0.0	0.0	18.1	0.0	4.2
Occupation	Crop production	70.6	0.0	85.2	87.8	54.9
	Cattle rearing	4.6	0.0	5.8	0.7	2.6
	Fishing	0.0	70.8	0.6	0.7	23.1
	Trading	20.3	17.0	1.3	5.8	11.7
	Transportation	0.7	5.7	0.0	0.0	2.0
	Civil servant	0.0	0.5	1.9	3.6	1.4
	Others	3.9	6.1	5.2	1.4	4.4
Annual income	Less than 20,000	85.6	40.6	67.1	61.9	61.8
	21,000-40,000	9.8	27.8	13.5	26.6	20.0
	41,000-60,000	3.9	11.3	9.7	9.4	8.8
	61000-80,000	0.0	3.8	5.8	0.0	2.6
	81,000+	0.7	16.5	3.9	2.2	6.8

Source: Author's Field Survey 2017

In the Sudan savannah zone, 85.2% of the respondents respond by diverting into alternate sources of income, 80.6 respond by destocking; 78.1% of the respondents adapt to the situation through water harvesting; 74.2% change their grazing itineary and 72.35 migrate by travelling further in search of water and forage for their animals; 71.6% practice new farming system while 63.9% of the respondents reduce their daily frequency of food. In the Sudan Savannah, it was discovered from the interviews that one of the major climate change challenge is the scarcity of water. For example from the interview, it was discovered that the respondents have challenges with getting water for their plants and livestock. Many of their flowing rivers are dry and therefore the very few available ones during the dry periods are expanded at the surface. Sometimes the women will fetch water from wells in bowls for the cows to drink from as stated and shown below:

> *The women/wives usually get water from the well with buckets and pure it into bigger bowls for the cows to drink from. Because the flowing rivers in this village that the cows have access to are no longer there. They are all dry now.(PS 4)*
> *We do not practice irrigation here because in terms of size, farms are not the same. Some farms are about 15 acres and above. An alternative watering system will not work for such big farm (PS2)*
> *There used to be one behind us and during periods like this, we usually try to expand the surface of the source of water in order for there to be enough for the cows (PS3)*

Fig. 1 also revealed that in Montane Zone, 88.5% of the respondents adapt by selling their livestock, 31.7% practice Irrigation farming; 28.8% diverted into alternate source of income; 38.7% of the respondents had to reduce their daily frequency of food while 33.1 removed their children from school. In the Montane Zone, the interview organized for the aged revealed as stated below:

> *We usually go to the bush to look for a certain plant and perform some traditional magic on it in order to bring rain, but presently with the recent problem of bush burning, the plant in question has become very scarce to see. (PM1)*
> *if it rains around June now, we will plant early, unlike before when we usually wait for rain to fall twice before we plant. Secondly, we plant crops that can be harvested in a short period. Instead of planting green corn, we will prefer to plant maize(PM2).*
> *if there are no water as such, we usually dig the ground till we get. The youth are usually involved in the digging and the women fetch the sand and water out. (PM2)*
> *if you look over there (respondent points to an affected area), there used to be plenty of water there due to erosion, but with a lot of community service volunteers, we see people with shovel and other tools working tirelessly to clear a pathway for the water to make the place better again. The communities usually help with advice on how to create a pathway for the water or drainage. But they do not yield to this advice and it led to flood.(PM3)*
> *For the flood, there is nothing we can do about it. What we do in most cases is to gather the redeemable crops and plant again after flood.(PM3)*
> *We have nothing to do. Since rain comes from God and there is nothing anyone can do about it. We can only leave it to do whatever it wants to do. And we will have less crops because the rain is excessive.*

Comparing the adaptation practices of the rural aged to climate variability impact of livelihood security across the selected ecological zones of Nigeria, it was discovered that sales of livestock was practiced most in the Montane zone while change of grazing itinery, destocking, migration, new farm practices, alternative income opportunities, water harvesting, irrigation and reduction in daily food were practiced most in the Sudan savannah zone compared to the other zones(Guinea savannah, montane, and coastal zones).

3.3 Determinants of Response to Climate Variability Impact of Livelihood Security of the Rural Aged in Selected Ecological Zones of Nigeria

This section presents factors influencing response to perceived climate variability impact on livelihood security of the rural aged in selected ecological zones of Nigeria. Analysis of factors influencing responses to perceived climate variability impact of livelihood was done by correlating Response Index (which is the Dependent Variable) and Socio-economic Variables (which are the Independent Variables) in each Zone as presented in Table 3 to Table 6. Aged's response was first converted to Composite Response Index using Principal

Component Analysis. Response Index was created through Principal Component Extraction estimated from standardized indicator values. This standardization was performed automatically by SPSS before running PCA. The response index created was also in standardized form. Pearson and Spearman Correlation Coefficients were used to examine the relationship between Aged's socio-economic characteristics and their Response. Pearson correlation was used for continuous variables and Spearman correlation coefficients for ordinal variables.

Results in Table 3 revealed weak and negative association between ageds' response to climate variability impact and gender which was statistically significant at (r= - 0.175*, p = 0.031) and also association between ageds' response to climate variability impact and occupation which was also statistically significant at (r= - 0.182*, p = 0.024). This implies that the ageds' response to climate variability impact is influenced by being a man or a woman. In other words, a man's response to climate variability impact might be different from a woman's response in the region. Therefore there it is important to identify gender-sensitive strategies to respond to the environmental and humanitarian crises caused by climate change (Commission on the Status of Women, 2008). Also the lesser the occupation, the better the response. This implies that those in lower level occupations like small scale farming respond better than those in higher status occupations. The result also revealed a weak but positive relationship with their educational status and is statistically significant at (r=0.248**, p= 0.002). This means the higher their educational status, the better their response. The result also revealed weak negative relationship with age at (r= -0.040, p=0.656) and marital status at (r = -0.034, p=0.672) with no statistical significance. This means the more advance they are in old age, the poorer their response to climate variability impact. This is because ageing brings able physical and mental weakness. The table also revealed weak but positive association with Religion at (r=0.150, p=0.064) and Ethnicity at (r= 0.015, p= 0.858). This shows that the major religion practiced in the region play a major role in their response to climate variability impact in the zone. However, from the above analysis it is obvious that all the socioeconomic characteristics have weak association with response to climate variability impact in the region. Therefore they are not taken as major determinants of aged's response to climate variability impact in the region.

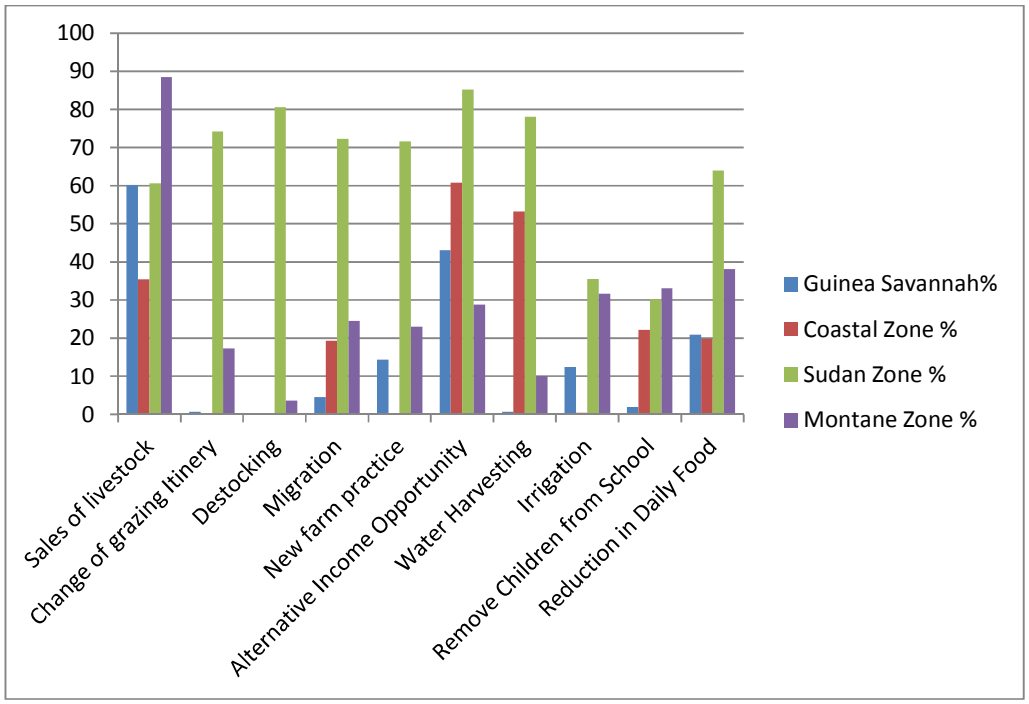

Fig. 1. Response to climate variability impact of livelihood security of aged men and women in selected ecological zones of Nigeria

Table 2. Response to climate variability impact of livelihood security of aged men and women in selected ecological zones of Nigeria

Response to climate variability impact on livelihood	Guinea Savannah %	Coastal Zone %	Sudan Zone %	Montane Zone %
Sales of livestock	60.1	35.4	60.6	88.5
Change of grazing Itinery	0.7	0.0	74.2	17.3
Destocking	0.0	0.0	80.6	3.6
Migration	4.6	19.3	72.3	24.5
New farm practice	14.4	0.0	71.6	23.0
Alternative income opportunity	43.1	60.8	85.2	28.8
Water harvesting	0.7	53.2	78.1	10.1
Irrigation	12.4	0.5	35.5	31.7
Remove children from school	2.0	22.2	30.3	33.1
Reduction in daily food	20.9	19.8	63.9	38.1

Table 3. Correlation between socio-economic characteristics and ageds' response to climate variability impact of livelihood security in Guinea Savannah Zone of Nigeria

Variable 1	Variable 2	Correlation coefficient	Coefficient	P-value
Gender	Aged's Response	Spearman	- 0.175*	0.031
Age	Aged's Response	Pearson	- 0.040	0.656
Marital Status	Aged's Response	Spearman	- 0.034	0.672
Religion	Aged's Response	Spearman	0.150	0.064
Etnicity	Aged's Response	Spearman	0.015	0.858
Educational Status	Aged's Response	Spearman	0.248**	0.002
Occupation	Aged's Response	Spearman	- 0.182*	0.024
Annual Income	Aged's Response	Pearson	- 0.061	0.454

***. Correlation is significant at the 0.05 level (2-tailed)*

Table 4. Correlation between socio-economic characteristics and ageds' response to climate variability impact of livelihood security in Coastal Zone of Nigeria

Variable 1	Variable 2	Correlation coefficient	Coefficient	P-Value
Gender	Aged's Response	Spearman	0.120*	0.001
Age	Aged's Response	Pearson	0.154*	0.021
Marital Status	Aged's Response	Spearman	0.093	0.177
Religion	Aged's Response	Spearman	0.107	0.121
Etnicity	Aged's Response	Spearman	0.012	0.858
Educational Status	Aged's Response	Spearman	-0.273*	0.000
Occupation	Aged's Response	Spearman	0.202**	0.003
Annual Income	Aged's Response	Pearson	0.548**	0.000

***. Correlation is significant at the 0.05 level (2-tailed)*

Table 5. Correlation between socio-economic characteristics and ageds' response to climate variability impact of livelihood security in Sudan Savannah Zone of Nigeria

Variable 1	Variable 2	Correlation coefficient	Coefficient	P-Value
Gender	Aged's Response	Spearman	0.138	0.087
Age	Aged's Response	Pearson	0.066	0.263
Marital Status	Aged's Response	Spearman	0.021	0.794
Educational Status	Aged's Response	Spearman	0.281**	0.000
Occupation	Aged's Response	Spearman	0.223**	0.005
Annual Income	Aged's Response	Pearson	0.132	0.100

***. Correlation is significant at the 0.05 level (2-tailed)*

Table 6. Correlation between socio-economic characteristics and Ageds' response to climate variability impact of livelihood security in Montane Zone of Nigeria

Variable 1	Variable 2	Correlation coefficient	Coefficient	P-value
Gender	Aged's Response	Spearman	0.078	0.359
Age	Aged's Response	Pearson	-0.040	0.656
Marital Status	Aged's Response	Spearman	0.037	0.665
Etnicity	Aged's Response	Spearman	0.032	0.795
Educational Status	Aged's Response	Spearman	0.258**	0.002
Annual Income	Aged's Response	Pearson	0.121	0.154

***. Correlation is significant at the 0.05 level (2-tailed)*

Table 4 revealed the Correlation between socio-economic characteristics and ageds' response to climate variability impact of livelihood security in Coastal zone of Nigeria**.** From the table, gender and occupation showed weak and positive associations with ageds' response to climate variability impact and they are statistically significant at (r= 0.120, p = 0.001) and (r= 0.202**, p=0.001). This implies that the ageds' response to climate variability impact varies on either being a man or a woman. Also the lower the occupation, the poorer their response in the coaster region. The result also revealed a weak positive relationship with Income which is statistically significant at (r = 0.548, p=0.000). This means, the lower the income, the higher their response. However, marital status, Religion and Ethnicity did not present a meaningful relationship. Therefore they are taken not to be major determinant of response to climate variability impact of livelihood of the aged in Coastal Zone of Nigeria.

Results in Table 5 showed the Correlation between socio-economic characteristics and ageds' response to climate variability impact of livelihood security in Sudan Savannah Zone of Nigeria**.** From the table, only Education and Occupation showed a positive but weak association with response to climate variability impact which were statistically significant at (r= 0.281**, p = 0.000) and (r=0.223**, p=0.005). This implies that the lower their Education and Occupation in the zone, the higher their response. However, gender, age marital status, and income did not present a meaningful relationship. Therefore they are not taken to be major determinant of response to climate variability impact by the aged in Sudan Savannah Zone of Nigeria.

Results in Table 6 revealed the correlation between socio-economic characteristics and ageds' response to climate variability impact of livelihood security in Montane zone of Nigeria. The result showed that only educational level was statistically significant and had a weak but positive association with ageds' response to climate variability impact at (r= 0.347, p = 0.000). This means, the lower their education, the poorer the quality of their response. However, gender, marital status, age, ethnicity, and annual income did not present a meaningful relationship. Therefore they are taken not to be major determinant of perception of climate variability by the aged in Plateau State, Nigeria.

4. CONCLUSIONS AND RECOMMENDATION

It was discovered in the study that the rural aged in the different ecological zones responded to the climate variability impact by using their different adaptive strategies. The different adaptive strategies were peculiar to each zone like: rain harvesting, Irrigation farming, crop diversification, sale of livestock, reduction in frequency of daily food, migration, changing routing itinery, herding for wages, diversifying of income sources. It was discovered in guinea savannah that the major determinants of their adaptive responses were: their gender, educational status and their occupation. In the Coastal zone, the determinants were: age, education, occupation and their annual income. In the Sudan savannah, the determinants of their responses were their education and occupation while in the Montane zone, their response was only determined by their level of education. There is therefore an urgent need for trainings for the aged populations and also the mainstreaming of local knowledge into climate change adaptation programmes. Also diversification of income sources should be encouraged and government should design socio-economic policies to support the rural aged in response to climate change/variability impact as many of them have poor social economic status.

CONSENT

As per international standard or university standard written participant consent has been collected and preserved by the authors.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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