

Original Research Article

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

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, Culture, Adaptation, Climate Variability, Livelihood

1.0 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 (Intergovernmental Panel on Climate Change, 2013). It is a term used for timescales longer than those associated with synoptic weather events like - months to millennia and longer (American Meteorological Society, 2015). Climate variability is reflected in changes in the frequency, intensity, spatial extent, duration and timing of extreme weather and climate events (IPCC, 2012). This might be attributed to natural internal processes within the climate system (internal variability) or variations in natural or anthropogenic external forcing (external variability) (IPCC, 2013).

Climate variability has enormous impacts which might be significantly detrimental. For instance, IPCC (2012) 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. Environmental Protection Agency (Updated 2016) 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

40 adaptation (UNDP, 2008). For instance, the impact of climate change are felt more on rural
41 populations in developing countries because of their reliance on climate induced agriculture
42 which serves as their major means of livelihood thus making them vulnerable to climate change
43 impact. (Department: Science and Technology, 2007). In the rural areas, the impact of climate
44 change will be enormous on the aged populations. This is because the aged in the rural areas face
45 serious problems as life in the rural areas is hard and sometimes inhuman especially with the
46 impact of climate change on their livelihood. This however makes them highly vulnerable to its
47 impact. It is therefore very important to reduce the ageds' vulnerability to climate change impact
48 by enhancing their adaptive capacity. Adaptation strategies that minimize ageds' vulnerability to
49 climate change and variability are very critical and needed. Adaptation and coping strategies will
50 greatly reduce vulnerability to climate change by making communities better able to adjust to the
51 changes and variability in climate, moderating potential damages, and helping them cope with
52 adverse consequences (IPCC, 2001).

53 Over long periods of time, communities have acquired knowledge about their experiences
54 with nature, through their daily interaction and perceptions of their immediate environment
55 (Fabiya and Oloukoi, 2013). Every environment has its own peculiarities and therefore requires
56 its own adaptation strategies. Intergovernmental Panel on Climate Change [IPCC] (2007)
57 defined adaptability as the ability of a system to adjust to climate change (including climate
58 variability and extremes) to moderate potential damages, to take advantage of opportunities, or to
59 cope with the consequences. It is also defined as the process of adjustment to actual or expected
60 climate and its effects (IPCC 2014). Adaptive strategies to climate variability must take into
61 consideration the Indigenous approaches that the communities are familiar with and which they
62 can readily apply themselves (Fabiya and Oloukoi, 2013). This is because indigenous people,
63 who have survived over long periods to many kinds of environmental changes, including climate
64 change, may have valuable lessons to offer about successful and unsuccessful adaptations which
65 could be vital in the context of climate change (Macchi, 2008). The rural ageds are mostly the
66 indigenous people and the custodians of indigenous knowledge. They have witnessed the
67 evolution of this indigenous knowledge from one generation to another. The aged in the rural
68 areas are therefore very significant and their indigenous knowledge is very significant and
69 needed to enhance adaptation to climate change/variability.

70 Climate change have enormous impact in the rural areas and poses great challenges to the
71 livelihoods of the rural populace especially the rural aged population as it affects their sources of
72 income and means of production. This might be because the livelihoods of many people
73 especially in rural areas of Africa are dependent on the changing climate (Burton, 2006) and
74 many people have poor capacity to adapt to the changing climate. Several studies have been
75 conducted on adaptation to climate change/variability in the developed and developing world
76 (Cobina and Anane (2016); Awolala and Ajibefun (2015); Oginni and Adebamowo (2013);
77 Campos, Herrador, Manuel, McCall (2013); Ogalleh et al (2012); Gomoro et al (2012);
78 McNeeley, 2012; Ford, 2007), little empirical evidence exists on the different adaptation to
79 climate change and livelihood security effects on the rural aged population in sub-Saharan
80 Africa. For instance, Cobina and Anane (2016) examined the impact of climate change on rural
81 farming communities and their indigenous response in the Jaman North District of Ghana. From
82 the study, it was discovered that erratic rainfall and increasing temperatures (as a result of
83 changing weather patterns) were major challenges the farming communities were facing. Also
84 Awolala and Ajibefun (2015) examined rice farmers' vulnerability to extreme climate events for
85 potential adaptation finance allocation in the derived savannah and forest agro-ecological zones

86 of Ekiti State, Nigeria. From the study, it was discovered that rice farmers in the agro-ecology
87 zone were more vulnerable to climate variability and extreme weather events than in the derived
88 savannah. The reason for this is associated with poor and inadequate adaptive capacity. From
89 these studies, it can be inferred that issues on climate change impact and adaptation of the rural
90 aged populations have not been properly articulated and well documented in literature. Also
91 studies that examined the choice of adaptation did not explicitly explain how climate change/variability is
92 adapted by the aged population especially in the rural areas of the different ecological zones of Nigeria,
93 hence this study.

94 Also there is dearth in studies on determinants of choice of adaptation measures to
95 climate variability and livelihood while studies that examined the determinants to choice of
96 adaptation did not consider it in relation to the rural aged. For instance, Mudombi (2012)
97 analysed the determinants of smallholder farmers' response to climate variability induced
98 hazards. The study discovered that productive assets are a major determinant of response to
99 Climate variability induced hazards. Also, Okonkwo et al. (2015) examined the determinants of
100 farmers' choices of livelihoods and perceptions of the effects of climate variability on choices of
101 livelihoods in Anambra State, Nigeria. Results showed that household income, gender, marital
102 status, household size, education level of household head and farm size were the major
103 determinants of farmers' choices of livelihoods. Gender education level and household income
104 had a positive significant influence while marital status, farm size, and household size had a
105 negative significant influence on the choices of livelihoods. These studies on the determinants of
106 response to climate variability were not in relation to the aged. This study will however examine
107 the determinants of the rural ageds' choice of adaptation to climate variability impact of
108 livelihood security.

109 Based on the above, there is therefore need for research that would examine rural ageds'
110 responses /adaptation measures to the impact of climate variability on their livelihood activities
111 in the different ecological zones of Nigeria. This study therefore attempted to provide answers to
112 the following questions: 1. what are the socio-economic characteristics of the aged population in
113 the selected areas? 2. how do they respond to the effect of climate variability on their livelihood
114 security? 3. what are the main determinants of their response?
115

116 3.0 Methodology

117 The study area is the different ecological zones of Nigeria. The first stage involved the
118 identification of the ecological zones in the country. (They are: Mangrove zone, Rain forest,
119 Montane region, Guinea savannah, Sudan savannah and Sahel Savannah). Four Ecological Zones
120 were purposively selected for this study. They are: Guinea savannah zone, Coastal zone,
121 Montane zone and the Sudan savannah zone. One State was then selected from each of the
122 selected ecological zones. The states are – Oyo State in the Guinea savannah zone, Ondo State in
123 Coastal zone, Plateau State in Montane zone and Kebbi in the Sudan savannah zone. In the
124 second stage, two local government areas were selected from each of the State based on their
125 level of rurality and peculiarity of the areas. The third stage involved the selection of three rural
126 settlements from each of the local government areas which was done by the simple random
127 selection process by assigning each settlement in the respective local government area a number,
128 written in a piece of paper and placed in a container. After they have been thoroughly mixed
129 together, each number or settlement will then be drawn from the container without replacement.

130 This was to ensure that every settlement has the same probability of being chosen from each of
131 the Local government Areas. The fourth stage is the identification of the houses where the rural
132 aged resides. This will be done using the snowball approach. Where there was no combination of
133 the two (aged men and aged women), either of the two was also sufficient. The respondents were
134 four aged men and four aged women selected purposively in each of the selected villages. The
135 research made use of primary data (qualitative and quantitative data). The primary data were
136 obtained through interview and structured questionnaire administered in the selected rural communities in
137 the different ecological zones of Nigeria using a multistage sampling technique. The quantitative data
138 were obtained through structured questionnaire which were administered to an aged male, and
139 aged female available in the houses (the aged are people 60 years and over in age) in the selected
140 rural communities of the selected eco-climatic zones of Nigeria.

141

142 **Data Collection and Analysis Procedures**

143 Data was collected on the socio-economic characteristics of the rural aged, their response
144 to climate variability impact related to livelihood activities, factors influencing their responses in
145 the selected rural communities of the selected eco-climatic zones of Nigeria through interview
146 and questionnaire administration. Data obtained will be analyzed using a number of analytic
147 methods from SPSS package like; descriptive statistics (means, frequencies, percentages) to
148 examine the socio-economic characteristics. Also the perceived climate variability impact related
149 to the aged's livelihood activities was done using the descriptive and inferential statistics
150 (frequencies, percentages and likert scale) and Inferential statistics such as analysis of variance
151 (ANOVA) and chi square test would be used to determine their significant difference will be
152 used to determine the factors influencing responses to climate variability impact related to the
153 aged's livelihood activities. The qualitative method was analysed using Content Analysis
154 Method.

155

156 **4.0 Results and Discussions**

157 This chapter presents the results and discussion of findings obtained through
158 questionnaire administration, observations, in-depth interviews, and key informant interviews
159 during the field survey of indigenous adaptive measures to climate variability impact of
160 livelihood security of the rural aged populations in selected rural settlements of different
161 ecological zones of Nigeria. This section presents: the socio-economic status of the rural aged
162 population in the selected ecological zones of Nigeria; their responses to the perceived climate
163 variability impact related to their livelihood activities and determinants of their responses. The
164 tables and figures were sourced from the author's 2017 field survey.

165

166

167

168 **4.1 Socio-Economic Status of the Rural Aged Population in Selected Ecological Zones of** 169 **Nigeria**

170 According to American Psychological Association (2017), socio-economic status of the
171 people has to do with the attributes of their quality of life, opportunities and privileges afforded
172 to them within the society. It is important to examine the socio-economic status of the people

173 because the effect of climate change is not just environmental but also economic and social, and
 174 this has impacts on people's lives (Byrd and DeMates, 2014). In this study, the socio-economic
 175 status of the rural aged in selected ecological zones of Nigeria were examined. The socio-
 176 economic attributes examined include: Age, Marital status, Educational level, Occupation, and
 177 Income.

178 Table 1 shows the socio-economic status of the rural aged in selected ecological zones of
 179 Nigeria. The study revealed that majority of the respondents (85.6%) are married and many of
 180 them (64.9%) are in the age range of 60- 64years. It was observed that many of the respondents
 181 in this age range were still very active and they really didn't see themselves as old. Many still
 182 had their means of livelihood. For instance, 54.9% of the respondents were crop farmers with the
 183 highest proportions of these respondents in Guinea savannah (70.6%); Sudan savannah (85.2%)
 184 and Montane zone (85.2%). Also, 23.1% of the total respondents are into fishing with 70.8% of
 185 these respondents in the coastal zone of the country. Only about and 2.6% of the respondents are
 186 into cattle rearing of which 4.6% are in guinea savannah zone; 5.8% in Sudan savannah and
 187 1.7% in Montane zone. This is in line with Gorman (2000) who explained that old age in many
 188 developing countries starts at the point when active contribution is no longer possible. Therefore,
 189 age groupings of the elderly are very important. This helps in understanding the experiences of
 190 life of the elderly at different stages of life so that experience of life of 60-65years is not equated
 191 with the experience of life of over 80 years.

192 The study also revealed that many of the respondents (55.1%) had no formal education
 193 and about 27% had only primary education. Hermalin and Yang (2004) noted that education
 194 influences the values people hold, the types of living arrangements they prefer when they get
 195 older, and the extent and nature of their interpersonal relationships. In other words, since many
 196 of the respondents had no formal education, their choice of occupation is influenced and this
 197 ultimately determines their income. For instance, the study showed that majority of the
 198 respondents (61.8%) earned below N20,000 (US\$56) annually. Federal Office of Statistics (FOS)
 199 states that any Nigerian earning less than N7 500 per month (US\$47) is poor. This implies that
 200 the aged in the different ecological zones are very poor and they might find it difficult to
 201 responding to climate change and variability impact appropriately.

Comment [i1]: ????

202 Table 1: Socio-Economic Status of the Rural Aged in Selected Ecological Zones of Nigeria (%)

Socio-Economic Status	Value labels	Ecological Zones				Total
		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	No formal	68.6	38.2	56.1	64.7	55.1

Comment [i2]: Total or avarege

status	education					
	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

4.2 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 was done zone by zone. This is because each zone has its own peculiarities especially in response to climate variability impact.

Figure I 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 that diverted into alternate source of income while 20.9% of the respondents had to reduce their daily frequency of food. This information was supported by the interview 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 base on necessity. Some noted 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 base 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.

232 Also in the Coastal zone, many of the respondents (60.8%) respond by diverting into
233 alternate sources of income, 53.2% of the respondents adapt to the situation through water
234 harvesting; 22.2% removed children from School, 19.8% of the respondents had to reduce their
235 daily frequency of food while 19.3% of the respondents migrated away from the region.
236 However interviews were further organized for some respondents to provide information on
237 indigenous adaptive measures practiced in the area as shown below:

238

239 *We have other alternatives like breeding fishes from fish pond*
240 *and drinking the rain water harvested during the rainy season.*

241 *When the water rises above the sea level some houses are raised up in*
242 *this process with woods and logs and we wait till the flood water*
243 *subsides, but mostly the general solution is relocating to any available*
244 *dry land*

245

246 In the Sudan savannah zone, 85.2% of the respondents respond by diverting into alternate
247 sources of income, 80.6 respond by destocking; 78.1% of the respondents adapt to the situation
248 through water harvesting; 74.2% change their grazing itinerary and 72.35 migrate by travelling
249 further in search of water and forage for their animals; 71.6% practice new farming system while
250 63.9% of the respondents reduce their daily frequency of food. Interviews were also conducted
251 for the aged in the zone to support the above findings as stated below:

252

253 *The women/wives usually get water from the well with buckets and pure it into*
254 *bigger bowls for the cows to drink from. Because the flowing rivers in this village*
255 *that the cows have access to are no longer there. They are all dry now.*

256 *We do not practice irrigation here because in terms of size, farms are not the*
257 *same. Some farms are about 15 acres and above. An alternative watering system*
258 *will not work for such big farm*

259 *There used to be one behind us and during periods like this, we usually try to*
260 *expand the surface of the source of water in order for there to be enough for the*
261 *cows*

262

263 Figure 1 also revealed that in Montane Zone, 88.5% of the respondents adapt by selling
264 their livestock, 31.7% practice Irrigation farming; 28.8% diverted into alternate source of
265 income; 38.7% of the respondents had to reduce their daily frequency of food while 33.1
266 removed their children from school. To buttress this information, interview was organized for the
267 aged in the region and stated as below:

268

269 *We usually go to the bush to look for a certain plant and perform some traditional*
270 *magic on it in order to bring rain, but presently with the recent problem of bush*
271 *burning, the plant in question has become very scarce to see.*

272 *if it rains around June now, we will plant early, unlike before when we usually wait*
273 *for rain to fall twice before we plant. Secondly, we plant crops that can be harvested*
274 *in a short period. Instead of planting green corn, we will prefer to plant maize.*

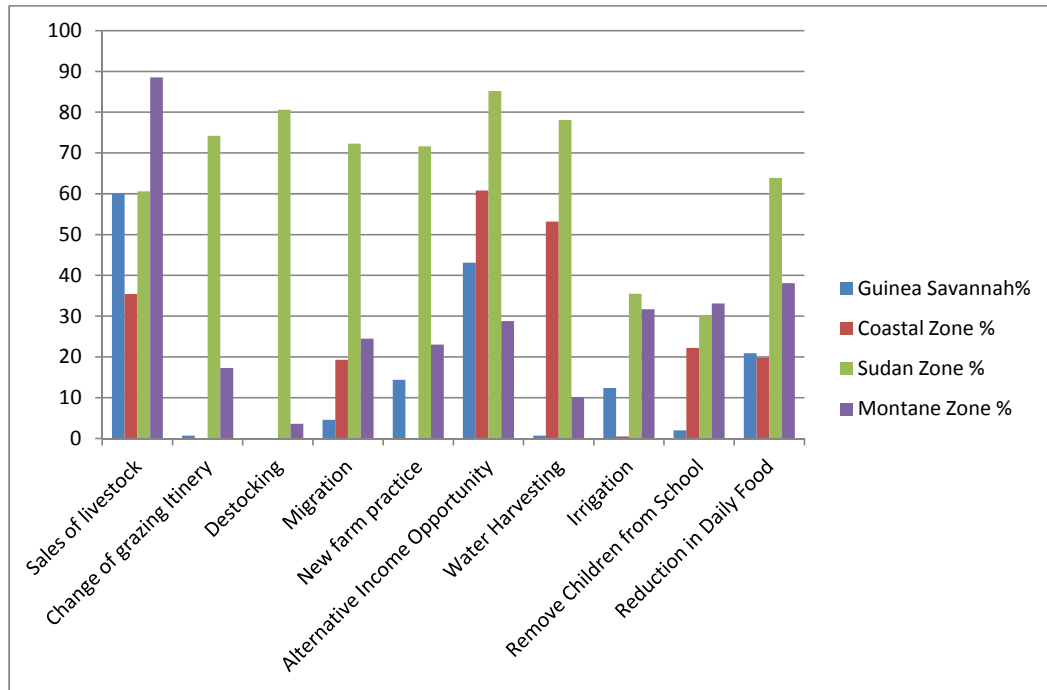
275 *if there are no water as such, we usually dig the ground till we get. The youth are*
276 *usually involved in the digging and the women fetch the sand and water out.*

277 *if you look over there (respondent points to an affected area), there used to be plenty*
278 *of water there due to erosion, but with a lot of community service volunteers, we see*
279 *people with shovel and other tools working tirelessly to clear a pathway for the*
280 *water to make the place better again. The communities usually help with advice on*
281 *how to create a pathway for the water or drainage. But they do not yield to this*
282 *advice and it led to flood.*

283 *For the flood, there is nothing we can do about it. What we do in most cases is to*
284 *gather the redeemable crops and plant again after flood.*

285 *We have nothing to do. Since rain comes from God and there is nothing anyone can*
286 *do about it. We can only leave it to do whatever it wants to do. And we will have less*
287 *crops because the rain is excessive.*

UNDER PEER REVIEW



289

290

291 **Figure 1: Response to Climate Variability Impact of Livelihood Security of Aged Men and Women in Selected Ecological Zones of Nigeria**

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293

294

295 **4.3. Determinants of Response to Climate Variability Impact of Livelihood Security of the**
 296 **Rural Aged in Selected Ecological Zones of Nigeria**

297 This section presents factors influencing response to perceived climate variability impact
 298 on livelihood security of the rural aged in selected ecological zones of Nigeria. Analysis of
 299 factors influencing responses to perceived climate variability impact of livelihood was done by
 300 correlating Response Index (which is the Dependent Variable) and Socio-economic Variables
 301 (which are the Independent Variables) in each Zone as presented in Table 3 to Table 6. Aged's
 302 response was first converted to Composite Response Index using Principal Component Analysis.
 303 Response Index was created through Principal Component Extraction estimated from
 304 standardized indicator values. This standardization was performed automatically by SPSS before
 305 running PCA. The response index created was also in standardized form. Pearson and Spearman
 306 Correlation Coefficients were used to examine the relationship between Aged's socio-economic
 307 characteristics and their Response. Pearson correlation was used for continuous variables and
 308 Spearman correlation coefficients for ordinal variables.

309 Results in Table 3 revealed weak and negative association between aged's response to
 310 climate variability impact and gender which was statistically significant at ($r = -0.175^*$, $p =$
 311 0.031) and also association between aged's response to climate variability impact and occupation
 312 which was also statistically significant at ($r = -0.182^*$, $p = 0.024$). This implies that the aged's
 313 response to climate variability impact is influenced by being a man or a woman. In other words,
 314 a man's response to climate variability impact might be different from a woman's response in the
 315 region. Therefore there it is important to identify gender-sensitive strategies to respond to the
 316 environmental and humanitarian crises caused by climate change (Commission on the Status of
 317 Women, 2008). Also the lesser the occupation, the better the response. This implies that those in
 318 lower level occupations like small scale farming respond better than those in higher status
 319 occupations. The result also revealed a weak but positive relationship with their educational
 320 status and is statistically significant at ($r=0.248^{**}$, $p= 0.002$). This means the higher their
 321 educational status, the better their response. The result also revealed weak negative relationship
 322 with age at ($r = -0.040$, $p=0.656$) and marital status at ($r = -0.034$, $p=0.672$) with no statistical
 323 significance. This means the more advance they are in old age, the poorer their response to climate
 324 variability impact. This is because ageing brings able physical and mental weakness (Anele, 2012). The
 325 table also revealed weak but positive association with Religion at ($r=0.150$, $p=0.064$) and Ethnicity at ($r=$
 326 0.015 , $p= 0.858$). This shows that the major religion practiced in the region play a major role in their
 327 response to climate variability impact in the zone. However, from the above analysis it is obvious that all
 328 the socioeconomic characteristics have weak association with response to climate variability impact in the
 329 region. Therefore they are not taken as major determinants of aged's response to climate variability
 330 impact in the region.

331
 332 **Table 3: Correlation between Socio-Economic Characteristics and Ageds' Response to Climate**
 333 **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

334

335 Table 4 revealed the Correlation between socio-economic characteristics and aged's
 336 response to climate variability impact of livelihood security in Coastal zone of Nigeria. From the
 337 table, gender and occupation showed weak and positive associations with aged's response to
 338 climate variability impact and they are statistically significant at (r= 0.120, p = 0.001) and (r=
 339 0.202**, p=0.001). This implies that the aged's response to climate variability impact varies on either
 340 being a man or a woman. Also the lower the occupation, the poorer their response in the coaster region.
 341 The result also revealed a weak positive relationship with Income which is statistically significant at (r =
 342 0.548, p=0.000). This means, the lower the income, the higher their response. However, marital status,
 343 Religion and Ethnicity did not present a meaningful relationship. Therefore they are taken not to be major
 344 determinant of response to climate variability impact of livelihood of the aged in Coastal Zone of Nigeria.

345 **Table 4: Correlation between Socio-Economic Characteristics and Ageds' Response to**
 346 **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

347

348 Results in Table 5 showed the Correlation between socio-economic characteristics and
 349 ageds' response to climate variability impact of livelihood security in Sudan Savannah Zone of
 350 Nigeria. From the table, only Education and Occupation showed a positive but weak association
 351 with response to climate variability impact which were statistically significant at (r= 0.281**, p =
 352 0.000) and (r=0.223**, p=0.005). This implies that the lower their Education and Occupation in the zone,
 353 the higher their response. However, gender, age marital status, and income did not present a meaningful
 354 relationship. Therefore they are not taken to be major determinant of response to climate variability
 355 impact by the aged in Sudan Savannah Zone of Nigeria.

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361 **Table 5: Correlation between Socio-Economic Characteristics and Ageds' Response to**
 362 **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

363
 364 Results in Table 6 revealed the correlation between socio-economic characteristics and
 365 ageds' response to climate variability impact of livelihood security in Montane zone of Nigeria.
 366 The result showed that only educational level was statistically significant and had a weak but
 367 positive association with ageds' response to climate variability impact at ($r= 0.347$, $p = 0.000$).
 368 This means, the lower their education, the poorer the quality of their response. However, gender, marital
 369 status, age, ethnicity, and annual income did not present a meaningful relationship. Therefore they are
 370 taken not to be major determinant of perception of climate variability by the aged in Plateau State,
 371 Nigeria.

372 **Table 6: Correlation between Socio-Economic Characteristics and Ageds' Response to**
 373 **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

374

375 5.0 Conclusion and Recommendation

376 It was discovered in the study that the rural aged in the different ecological zones
 377 responded to the climate variability impact by using their different adaptive strategies. The
 378 different adaptive strategies were peculiar to each zone like: rain harvesting, Irrigation farming,
 379 crop diversification, sale of livestock, reduction in frequency of daily food, migration, changing
 380 routing itinery, herding for wages, diversifying of income sources. It was discovered in guinea

381 savannah that the major determinants of their adaptive responses were: their gender, educational
382 status and their occupation. In the Coastal zone, the determinants were: age, education,
383 occupation and their annual income. In the Sudan savannah, the determinants of their responses
384 were their education and occupation while in the Montane zone, their response was only
385 determined by their level of education. There is therefore an urgent need for trainings for the
386 aged populations and also the mainstreaming of local knowledge into climate change adaptation
387 programmes. Also diversification of income sources should be encouraged and government
388 should design socio-economic policies to support the rural aged in response to climate
389 change/variability impact as many of them have poor social economic status.

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APPENDIX

453 **Table2: 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

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