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CLIMATE VARIATION, ITS IMPACT ON NON TIMBER FOREST PRODUCTS AND LIVELIHOOD OF OHAFIA PEOPLE, ABIA STATE NIGERIA

GERALDLINE O. IBE

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ABSTRACT

Increased vulnerability of Non timber forest products to climate variation has overtime, resulted to serious negative consequences on rural dwellers that depend on rain, sunshine and wind for their fruiting, maturity and harvesting, to enhance livelihood. The scope of this study analyzed the effect of climate variability and NTFPs through peoples' perception using a field survey. The objective of the research therefore focused on the socio-economic characteristics of the respondents in the study area, activities of the people that increase the risk of climate variability, the effect of climate variability on the quantity and composition NTFPs in the study area, the perception of people on the effect of climate variability on the NTFPs and the contribution of NTFPs to their livelihood. A total of 216 respondents were sampled, the study adopted a simple random technique which was used to select 9 villages out of the 26 villages in Ohafia Local Government Area through a structured questionnaire. Findings show that large proportion (72.2%) of the respondents censured increased temperature and heavy rainfall (64.4%) as the most reason for decreased yield in NTFPs in the last four years. Majority (88.9% and 58.3%) of the respondents opined that climate variability had reduced fruit yield and price instability respectively. Over 35% said climate variability had brought about species scarcity. 54.2% had no access to safe drinking water, 25.5% of the respondents made very low sales from NTFPs, while 3.2% and 29.6% faced starvation and diseases. Climate variability influence on the availability of Non timber forest products will affect the income status and food security of rural dwellers that depend on it. Vulnerabilities could be reduced through campaign on embracing climate variability plans, funding the campaign through the collaboration of government and foreign countries, re-training extension workers, cash donations and training the rural dwellers.

KEYWORDS: - Climate variability, Food security, NTFPs, Ohafia and Rural dwellers**.**

INTRODUCTION

Over the centuries, the benefits of Non Timber Forest Products have been significant in the lives of people particularly those of rural communities (Udeagha, 2014). Non-Timber Forest Products have continually been an important element of the forest resources completely. People are dependent upon natural resources for meeting a large number of their livelihoods. Food, fodder, firewood and medicine are important non-timber values of forests collected all year round in various locations. Apart from forest plants serving as food, it also serves as medicine.

Climate variability affects NTFPs which in turn influence its contribution to the livelihood of rural dwellers; this results to adjustment in their income and food security levels. The effect of climate variability on NTFPs has led to a decline in the food security of the rural dwellers (Udeagha, 2014). This has called for the attention of all stakeholders concerned. This has affected optimum yield of Gnetum africanum, Pentaclethra macrophylla, Tetrapleura tetraptera, Archachatina marginata etc. In Ohafia Local Government Area, the NTFPs (such as food, fodder, medicine, fuel wood etc) are highly susceptible to ecological degradation because of high rate of poverty and the high dependence on them for livelihood (Ibe *et.al*.2018). Climate variability is the variation in the statistical distribution of average weather conditions over time in any region of the world (Adetayo and Owolade, 2012; Ikehi, 2014; Ikehi *et al*., 2014a).

NTFPs help bridge seasonal gaps in income for many farmers, and they provide a safety net for many rural households during years with low crop yields. Aigbe and Oluku 2012 stated that, forests control global climate impact, therefore they act as key agents of carbon sink in the environment. The rate at which forest resources are destroyed has at present become a global concern. NTFPs include a vast number of edible and non- edible products which are sometimes gathered from the forest by a team of urban people for subsistence or for local and external trade (Jimoh and Adebisi, 2005). Ikojo *et al.,* 2003 viewed that of the unpredictability and varied nature of the NTFPs; a lot of households are still able to meet their

GERALDLINE O. IBE: Department of Forestry and Environmental Management Michael Okpara University of Agriculture Umudike, Abia State, Nigeria.

direct needs by collecting NTFPs from the forest while some others make earnings to meet up with other needs through marketing of already harvested NTFPs.

The communities in Ohafia are experiencing extreme weather events, such as: torrential rainfall resulting in floods, erratic rainfall patterns characterized by irregular on-set and cease of rainy season, increased temperatures, decline in soil productivity resulting in low-crop yields, severe windstorms and increase in plant and animal diseases. Hence, for an intervention programme to succeed in these areas, the people, their socio-economic characteristics, the various factors affecting their livelihood have to be understood. The objectives of this research therefore focused on the socio-economic characteristics of the respondents in the study area, activities of the people that increase the risk of climate variability, the effect of climate variability on the quantity and composition NTFPs in the study area, the peoples' perception on the effect of climate variability on NTFPs and the contribution of NTFPs to their livelihood outcomes in the study.

MATERIALS AND METHODS

Study Area

The study was carried out in Ohafia Local Government Area of Abia State, Nigeria. Ohafia is one of the 17 local government areas in Abia State, which comprises of 26 villages. It is an Igbo speaking region and it is located in the South-eastern region of Nigeria. Ohafia is predominantly known for having a lot of NTFPs, but then, they experience series of harsh weather conditions too. Its geographical coordinates in degrees and decimal minutes are Latitude 5^{o} 36" and 5^{o} 48" N and Longitude 7^{o} 48" and 7^{o} 52" E and altitude of 124m above sea level in the moist rainforest zone, with an average rainfall of 2177mm yearly with relative humidity of about 72% and monthly ambient temperature ranges from 17°C to 36°C (Meteorological Station of NRCRI Umudike, 2004 and 2005). The vegetation is of tropical rainforest (NEST, 2011). There are two distinct seasons in a year – the rainy season which is experienced between early March and October. November to February is the dry period, and then the harmattan comes between December and January. Fig. 1 below shows where Ohafia is located in Abia State.

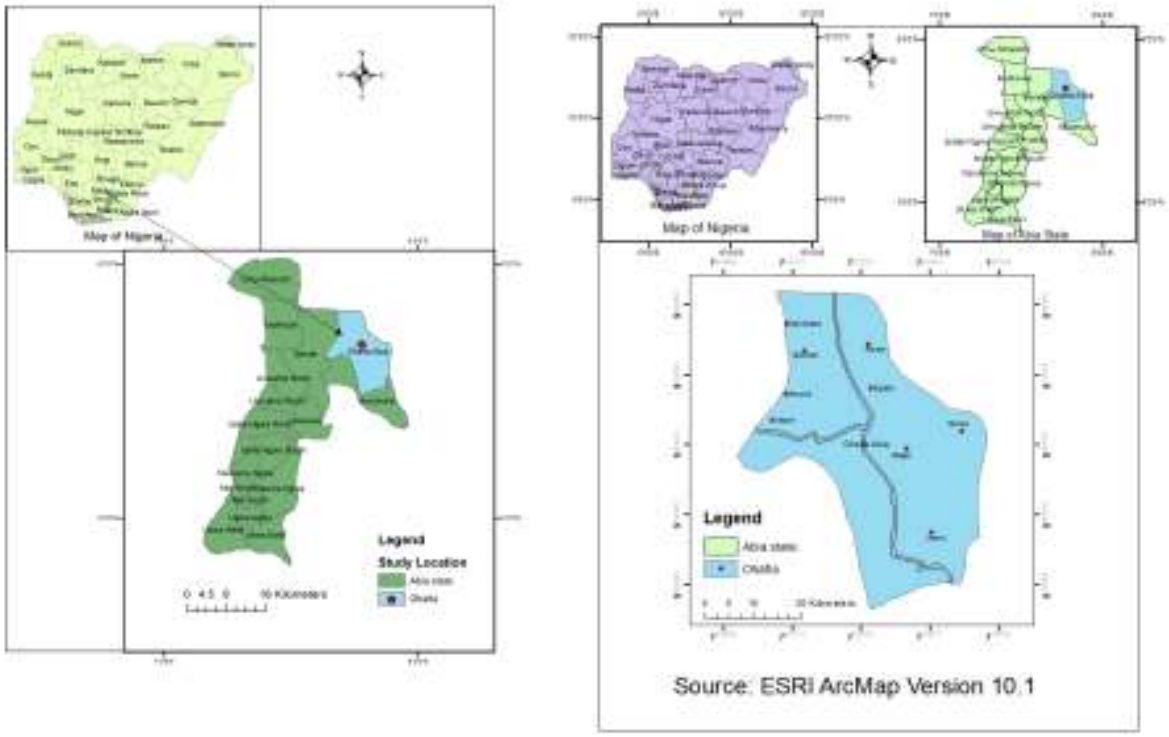

Fig 1: Map

Showing location of the studied villages in Ohafia LGA, Abia State, Nigeria.

Data Collection, Sampling Procedure and Sample size

Data was collected on the socio-economic characteristics, activities of the respondents, perceived impacts of climate change on the quantity and composition of NTFPs, the contribution of NTFPs to the livelihoods from 216 respondents.

The study adopted a simple random sampling technique which was used to select 9 villages out of the 26 villages in Ohafia Local Government Area (Bernard, 2005). Systematic sampling method was then used to select every 6th house in each village, so as to attain every corner of the households. A total of 216 Household heads were interviewed. The respondents selected were 20% of the total population from each of the nine villages. (Odobode, 1999). Qualitative tools used to elicit information from the households, were participatory tools such as Focus Group Discussions (FGDs), In-depth Interviews (IDIs) with key informants (village leaders) as well as field notes and direct observations; these were

focused on what was seen. The FGDs were two groups from each of the sampled locations made up of male groups comprised of 5 elderly and 5 youths, female groups comprised of 5 elderly and 5 youths. The IDIs comprised of 3 key informants from each village, these included (Ezeogo, Queen mother and Chief Farmer). The same questions were channeled to all the respondents.

Data Analyses

In analyzing objective 1, which sought to examine the socio-economic characteristics of the respondents in the study area, the data collected was analyzed using both descriptive statistical methods. In analyzing objective 2, which sought to identify the activities of the respondents that contribute to climate change in the study area, means and percentages were used. To analyze objective 3, which sought to examine the effect of climate variability on the quantity and composition NTFPs in the study area, this was analyzed using growth analysis and descriptive statistics. Thereafter, an ANOVA *f-test* was used to test the null hypotheses that there are no significant trends in climate variability on NTFPs in the study area. To analyze objective 4, which sought to ascertain the contribution of NTFPs to the livelihood outcomes of the respondents in the study area, it was analyzed using regression analyses technique.

RESULTS AND DISCUSSION

Socio-economic characteristics of the sampled households

Table1 reveals that majority (26%) of the respondents were between the age of 25- 34 years. This showed that the household heads were still in their productive working age. The implication of this is that these household heads were young, energetic and able bodied, and should therefore be able to pursue their livelihood activities with some ease and effectively such that they are able to provide for their households needs adequately. It also implies that the respondent will have a lot of experience as regard to changing climate in their environment. This agrees with the findings of Msalilwa *et al.* (2013), Akponikpe *et al*. (2010) which affirms that age have an influence in the accumulation of knowledge as regards to climate change and variability in a particular locality. Msalilwa *et al*., (2013) and Udeagha (2014) also affirmed that age has a positive relationship with the level of perception on climate change and variability. Majority of the household heads (66.2%) were male, while (33.8%) were female. Thus, it was observed that married women only gather NTFPs close or around fallow lands and farm lands while men and young ladies gather NTFPs deep in the forest areas.

Table 1: Socio-economic characteristics of sampled households

Z	Frequency	Percentage
Age of respondents		
18-24	45	20.8
25-34	56	26.0
35-44	54	25.0
45-54	39	18.1
55-64	22	10.2
Total	216	100.0
Marital status		
Single	75	34.7
Married	121	56.0
Widowed	19	8.8
Separated	1	0.5
Total	216	100.0
Gender		
Male	143	66.2
Female	73	33.8
Total	216	100.0
Educational qualification		
None	18	8.3
Primary	32	14.8
JSS	35	16.2
SSS	95	44.0
OND/HND	28	13.0
B.Sc	7	3.2
PhD	1	0.5
Total	216	100.0
Household head occupation		
Crop/livestock	42	19.4
Crop/livestock/NTFPs	65	30.1
Civil servant	12	5.6
Trading in NTFPs	18	8.3
Trading in Non NTFPs	16	7.4

Health worker	7	3.2
Hair dresser	14	6.5
Fishing	3	1.4
Hunting	5	2.3
Technician/Artisan	5	2.3
Construction worker	7	3.2
Wage labourer	15	6.9
Housewife	7	3.2
Total	216	100.0

Source: Field survey data, 2017

Table 1: cont'd on Socio-economic characteristics of sampled households

Socioeconomic characteristics	Frequency	Percentage
Religion		
Christian	195	90.3
Muslim	2	0.9
Traditional	19	8.8
Total	216	100.0
Household size		
1-5	132	61.1
6-10	66	30.6
11-15	18	8.3
Total	216	100.0
Household type		
Nuclear/monogamous	162	75.0
Nuclear/polygamous	42	19.4
Extended	12	5.6
Total	216	100.0
Duration of living in the community		
Born here	131	60.6
<5yrs	47	21.8
5-10yrs	19	8.8
11- 20yrs	11	5.1
>20yrs	8	3.7
Total	216	100.0
Own farm		
Yes	130	60.2
No	86	39.8
Total	216	100.0
How land was acquired		
Outright Purchased	14	10.8
Inheritance	90	69.2
By gift	8	6.2
By lease	18	13.8
Total	130	100.0
Farm size		
Acre	34	15.7
Hectare	36	16.7
Plot	142	65.7
Others	4	1.9
Total	216	100.0
Household main source of income		
Crop production	60	27.8
Livestock production	13	6.0
Non-timber forest production/trading	44	20.4
Full-time wage/salary	42	19.4
Part-time wage/salary	31	14.4
Remittance from relatives	10	4.6
Others	16	7.4
Total	216	100.0
Household harvest of any NTFP in 2016		
Yes	166	76.8

No	50	23.2
Total	216	100.0

Source: Field survey data, 2017.

Activities of the respondents that contribute to climate variability in the study area

Results (Table 2) showed that several land preparation was practiced by the respondents in the study area. Mould-making is the most commonly practiced land preparation mechanism before planting in the area as reported by 77.8% of the respondents. This was followed by 70.8% of the respondents that practiced ridge farming. This implies that mould and ridge making was commonly practiced by the farmers in the study area. This act of breaking up the top soil has implication for abating soil erosion and degradation. Also, 88% of the respondents are involved in burning of waste. Results also showed that large proportion (87.5%) of the respondents carried out bush burning. This was followed by 53.2% of the respondents that used fertilizer and 46.8% of the respondents that used pesticides/herbicides. This implies that bush burning is a common practiced carried out by the people in the study area. Studies have shown that effect of climate change through bush burning practices in agriculture was a contributor to drought and desertification, which results to loss of biodiversity (Chidumayo *et al.,* 2011). Apart from the soil destruction and desert encroachment caused by bush burning, it has also had a marked increase on the emission of Nitrate, Sulphur, Nitrous oxide, Carbon dioxide and Carbon gases which have tremendous effect in the atmosphere and also formation of acid rain which deteriorate plant life, damage calcium containing soils and also increase the acidity of surrounding lakes and rivers. (Maeda *et al.*, 2011; Msalilwa *et al.,* 2013 and Maeda *et al*, 2011). Table 2 below, majority (52.8%) of the respondents could not say whether their daily job/ farm/ household activities have any effect on the environment while 17.1% are certain that their daily job/ farm/ household activities have an effect on the environment. This implies that there is lack of knowledge of the job/ farm/ household activities that contributes to climate variability among the people. This will affect their ability to discontinue such activities due to ignorance and thus continue to contribute to the issues that affect their environment and the climate.

Result further showed that majority (97.3%) of those that were aware that their daily job/ farm/ household activities have effect on the environment have not done anything to reduce these activities. 97.3% posited that they don't know what to do; 94.6% of them saw it as nature's way of punishment; 86.5% of them did not feel the necessity to do anything; 89.2% of them knew what to do, but have no fund to finance it while 86.5% of the respondents see it as too big a problem for them to handle or do anything about it. This suggests that the changes in the environment under study are influenced by the activities of the people of the area without them knowing about it. Therefore, effort to control climate change in the study area cannot be successful without adequate orientation of the people on the necessity to reduce their farm and non- farm activities that affect their environment and leads to climate variability.

Table 2: Activities of the respondents that contribute to climate variability

Anthropogenic activities of the respondents in the study area	Frequency	Percentage
***Land preparation mechanisms before planting in the area**		
Shallow planting	55	25.5
Ridge making	153	70.8
Moulds making	168	77.8
Others	36	16.7
***Common types of farm activities that are carried out in the area**		
Bush burning	189	87.5
Use of pesticides/herbicides	101	46.8
Use of fertilizer	115	53.2
Farming near water bodies	31	14.4
Deforestation	41	19.0
Slash and burn	36	16.7
Continuous cropping	22	10.2
Over grazing	2	0.9
Burying of fuel wood	43	19.9
Others	19	8.8
***Means of transportation in the area**		
Bicycle	114	52.8
Motor	129	59.7
Cycle	83	38.4
Vehicle	44	20.4
***Equipment use in households**		
Chemicals	43	19.9
Insecticides	80	37.0

Firewood	120	55.6
Generator set	77	35.6
Energy bulb	112	51.9
Air fresheners	37	17.1
***Access to water**		
Streams/rivers	172	79.6
Underground/personal	39	18.1
Piped/public	66	30.6
Rain water harvest	115	53.2
Bottled water vendor	15	6.9
Others	24	11.1
***Disposal of household waste**		
Burning	190	88.0
Ground dumping	18	8.3
Burying	15	6.9
Stream disposal	1	0.5
Littering on the streets	1	0.5
Throwing into drainage/water ways	2	0.9
Others	8	3.7
Do ones' daily job/farm/ household activities have any effect on the Environment		
Yes	37	17.1
No	65	30.1
Don't know	114	52.8
Total	216	100.0
Anything done to reduce these activities		
Yes	1	2.7
No	36	97.3
Total	37	100.0
***Why couldn't you do anything**		
Don't know what to do	36	97.3
Didn't feel the necessity to do anything	32	86.5
Know what to do but have no money	33	89.2
It's too big a problem	32	86.5
Its nature's way of punishment	35	94.6

Source: Field survey data, 2017

*** Multiple response recorded**

Awareness of climate variability and its effect on the NTFPs in the study area

The distribution of the respondents by their assertions of the effect of climate variability on the NTFPS in the study area (Table 3). This revealed that a greater percentage (67.6%) of the respondents have heard of climate change. From the proportion of respondents who are informed of climate change, it is obvious the chances of climate change information circulating to the people were quite high; majority got their information from the radio. Only a small proportion of the respondents (31.9%) who were uninformed of climate change may still remain easily vulnerable to the impact of climate change. Possession of information on climate change may imply that the respondents may easily take coping or adaptive measures in the event of climate change hazards while lack of information on climate change may imply that the respondents may not be well informed on how to cope with climate change hazards. Such uninformed population may out of their ignorance, inadvertently aggravate climate change impacts. Therefore, climate variability in the study area is real but it is imperceptible to some of the rural dwellers. Given the fact that climate change is largely anthropogenic, this low commitment of the respondents to the fight to mitigate the effect of climate change level in communities of the world means that out of ignorance, people may continue to carry out those activities that accelerate climate change. From the result, it is obvious that respondents in the study area are not completely committed to mitigating climate change issues in the area and its surrounding. This may be a reflection of the lack of climate information earlier reported. The result has implications for adaptation of the impact of climate change in the study area. This finding is consistent with NEST (2011) and Umoh and Eketekpe, (2010), and it is a challenge to extension agencies. There exists a perceptible decrease in NTFPs yield in the last four years in the study area. This is expected to influence the contribution of NTFPs to the total household income of the people which will translate into poor living standard among the farmers that depends on the collection and trading of NTFPs as a means of boosting their household income. This finding supports that of Maeda *et al.* (2011) who predicted that climate change may affect crop yields by 2030. Therefore, NTFPs in most rural communities will continue to decrease with climate change if nothing is done rapidly to interpose the situation.

Table 3: Awareness of climate variability

Climate Change Awareness	Frequency	Percentage
Awareness of climate change		
Yes	146	67.6
No	69	31.9
Don't know	1	0.5
Total	216	100.0
***Source of awareness**		
Television	163	75.5
Radio	199	92.1
Newspaper	53	24.5
Internet	24	11.1
School	42	19.4
Government agents	26	12.0
Friends/family	19	8.8
Local council	31	14.4
Religious gatherings	42	19.4
What was done with the awareness of climate change		
Nothing	163	75.5
Praying	51	23.6
Telling others	2	0.9
Total	216	100.0
Importance of the knowledge of climate change		
Very important	74	34.3
Quite important	106	49.1
Not very important	28	13.0
Not important	20	9.3
Total	216	100.0

Source: Field Survey Data, 2017 *** Multiple response recorded**

Table 3 Climate variability effect on NTFPs

Climate variability effect on NTFPS' Quality and Composition	Frequency	Percentage
Feeling a decrease in NTFPs yield in the last 4 years		
Yes	131	60.6
No	26	12.0
Don't know	59	27.3
Total	216	100.0
***Reason for the decrease in NTFPs yield in the last 4 years**		
Heavy rainfall	139	64.4
Irregular rainfall	114	52.8
Increased temperature	156	72.2
Increased flood frequency	60	27.8
New insects emergence	19	8.8
River dryness	36	16.7
Desertification	2	0.9
Seasonal changes	73	33.8
Invasive species	9	4.2
Increased land salinity	4	1.9
Humidity pattern	3	1.4
Others	13	6.0
Effect of climate variability on NTFPs		
Reduced fruit yield	192	88.9
Price instability	126	58.3
Loss of farmland	87	40.3
Reduced fodder	39	18.1
Reduced roots and herbs	30	13.9
Causes scarcity of species	76	35.2
Lower the productivity of medicinal plants	29	13.4
Shading of leafs and immature flowers/fruits of NTFPs	73	33.8
Effect of climate variability on livelihood of the people		
Inaccessibility to safe drinking water	117	54.2

Lack of capital	113	52.3
High cost of transportation	96	44.4
Low sales from NTFPs	55	25.5
Bad roads	86	39.8
Waste disposal on pathways	17	7.9
Lack of electricity due to excessive wind that damages poles	34	15.7
Starvation due to lack of food especially from NTFPs	7	3.2
***Indicators of climate change in the area**		
Temperature variability	178	82.4
Precipitation	66	30.6
Unusual natural/seasonal changes	127	58.8
Flooding	65	30.1
Irregular rainfall pattern	90	41.7
Breakdown in NTFPs yield	52	24.1
Desertification	12	5.6
River dryness	22	10.2
New insects emerged	14	6.5
Invasive species/prying plants	14	6.5
Humidity pattern	4	1.9
Others	18	8.3

Source: Field Survey Data, 2017

*** Multiple response recorded**

Quantity of harvested NTFPs in the last four years in the study area

Results (Table 4) showed that the quantity harvested of *Pentaclethra macrophylla* -Ugbaga (Oil Beans) by the households in the study area declined significantly ($P < 0.05$) from an average of 8.15^a in 2013 to 5.07^d in 2016. An average growth rate of only 17% was recorded. There was significant difference at $P < 0.05$ in the quantity of *Pentaclethra macrophylla* - Ugbaga (Oil Beans) harvested by households in the last four years in the study area. Similarly, the quantity harvested of *Xylopia aethiopicum* - Uda (Guinea Pepper) by the households in the study area declined significantly ($P < 0.05$) from an average of 9.72^a in 2013 to 7.33^d in 2016. An average growth rate of only 10% was recorded in the quantity of *Xylopia aethiopicum* - Uda (Guinea Pepper) harvested by households in the study area between 2013 and 2016. There were significant differences at $P < 0.05$ among the harvested NTFPs over the four years. These findings imply that there is a decrease in the quantity of NTFPs harvested by the household in the study area in the last four years. This will negatively affect the livelihood of the people in the study area, since most of these rural people depend on NTFPs as a source of generating income to support their standard of living. This finding is consistent with Udeagha (2014) who noted a decrease in NTFPs harvested by sampled households in Cross River State, Nigeria.

Table 4: Variation in the average quantity harvested of NTFPs by households in the study area in the last four years in kg.

NTFPs	Unit of measurements weighed in kg/ton	2013	2014	2015	2016	Anova F probability	Growth (%)
Ugbaga(Oil Beans)	Bucket	8.15^a	7.11^b	6.06^c	5.07^d	0.000	17
Uda(Guinea Pepper)	Cup/kg	9.72^a	8.84^b	7.95^c	7.33^d	0.002	10
Ukazi (Gnetum)	Bundles	10.98^a	9.97^b	8.97^c	8.43^d	0.001	9
Ochiogochio (Tetraptera)	Basins	6.67^a	5.67^b	4.69^c	3.52^d	0.005	24
Ikolo (Snail)	Basins	8.41^a	7.71^b	6.46^c	5.44^d	0.008	16
Nmanu anu (honey)	Bottles	7.81^a	7.01^b	5.90^c	5.23^d	0.000	14
Mmimmi (Pepper fruit)	Cup	8.03^a	7.73^b	7.73^c	7.14^d	0.009	4
Mgborogwu (roots)	Bottles	9.45^a	9.15^b	7.31^c	6.45^d	0.000	14
Anuofia (Bushmeat)	None	6.71^a	5.21^b	4.09^c	3.02^d	0.002	31
Osu, Erue (mushrooms)	Basins	6.62^a	4.62^b	4.33^c	3.66^d	0.000	23

Source: Field Survey Data, 2017 Value in each row followed by different superscripts is statistically different at (*P* <0.05). Mean separation was done using Duncan Multiple Range Test.

Quantity of sold NTFPs in the last four years in the study area

Result (Table 5) showed that the quantity sold of *Pentaclethra macrophylla* - Ugbaga (Oil Beans) by the households in the study area declined significantly (P < 0.05) from an average of 6.68^{a} in 2013 to 3.90^{d} in 2016. An average growth rate of only 20% was recorded in the quantity of *Pentaclethra macrophylla* - Ugbaga (Oil Beans) sold by households in the study area between 2013 and 2016. There was significant difference at P < 0.05 in the quantity of *Pentaclethra macrophylla* - Ugbaga (Oil Beans) sold by households in the last four years in the study area. There were significant differences at P < 0.05 among the sold NTFPs over the four years. An average growth rate of only 22% was recorded in the quantity of *Agaricus bisporus* - Osu, Erue (mushrooms) sold by households in the study area between 2013 and 2016. There was significant difference at P < 0.05 in the quantity of *Agaricus bisporus* - Osu, Erue (mushrooms) sold by households in the last four years in the study area. These findings imply that there was a decrease in the quantity of NTFPs sold by the household in the study area in the last four years. This will negatively affect the livelihood of the people in the study area since most of these rural people depend on NTFPs as a source of generating income to support their standard of living.

Table 5: Variation in the average quantity sold of NTFPs by households in the study area in the last four years in kg.

NTFPs	Unit of Measurement weighed in kg	2013	2014	2015	2016	Anova F probability	Growth (%)
Ugbaga(Oil Beans)	Bucket	6.68^{a}	6.39^{b}	4.66^{c}	3.90^{d}	0.004	20
Uda(Guinea Pepper)	Cup	8.85^{a}	6.89^{b}	6.64^{c}	6.12^{d}	0.005	14
Ukazi (Gnetum)	Bundles	8.35^{a}	7.38^{b}	7.85^{c}	7.38^{d}	0.001	5
Ochiogochio (Tetraptera)	Basins	5.47^{a}	4.42^{b}	4.20^{c}	3.15^{d}	0.001	21
Ikolo (Snail)	Basins	6.64^{a}	5.55^{b}	5.21^{c}	4.39^{d}	0.002	15
Nmanu anu (honey)	Bottles	6.09^{a}	5.68^{b}	4.83^{c}	4.28^{d}	0.005	13
Mmimmi (Pepper fruit)	Cup	6.42^{a}	6.05^{b}	7.05^{c}	5.51^{d}	0.000	16
Mgborogwu (roots)	Bottles	7.29^{a}	6.14^{b}	6.10^{c}	5.38^{d}	0.003	11
Anuofia (Bushmeat)	None	4.63^{a}	3.33^{b}	3.48^{c}	2.15^{d}	0.001	32
Osu, Erue (mushrooms)	Basins	5.49^{a}	3.97^{b}	3.98^{c}	3.08^{d}	0.001	22

Source: Field Survey Data, 2017 Value in each row followed by different superscripts is statistically different at (*P*<0.05). Mean separation was done using Duncan Multiple Range Test.

Variations in the average price of NTFPs in the last four years in the study area

Table 6 shows the variation in the average price of NTFPs in the market in the study area in the last four years. The result showed that for all the NTFPs considered in the study, there was significant increase in their average price between 2013 and 2016. The growth rate in their average prices were negative, which suggests that the average prices of these NTFPs increases overtime. The increase in the prices of *Pentaclethra macrophylla* - Ugbaga (Oil Beans); *Xylopia aethiopicum* - Uda (Guinea Pepper); *Gnetum africanum* - Ukazi; *Tetrapleura tetraptera* - Ochiogochio; *Archachatina marginata* - Ikolo (Snail); *Apis mellifera* - Nmanu anu (Honey); *Dennetia tripetala* - Mmimmi (Pepper fruit); Mgborogwu (Roots); Anuofia (Bushmeat) and *Agaricus bisporus* - Osu/Erue (Mushrooms) in the studied area, suggests that there is scarcity in the supply, this means a decline in the availability of the NTFPs overtime and thus, allows for the invisible hands of demand and supply to influence the unit prices of these NTFPs produces in the studied area. The higher price for the 2016 season than in the 2013 season is an indication of decreased supply of the product thus creating a demand gap which pushed the price upward. The NTFPs were relatively low in abundance in the 2016 season than in the 2013 season and this affected the supply of the product these seasons. The villagers were also in the position to actually bargain for the selling price of the product unlike when it very abundance, the broker normally take advantage of it and offer low price. That is when NTFPs products are in abundance the brokers become price makers vice versa. They villagers become price taker since they will be in the position to determine the market price at that particular season.

Table 6: Variation in the average price of NTFPs in the study area in the last four years in kg.

NTFPs	Unit of measurement weighed in kg	2013	2014	2015	2016	Anova F probability	Growth (%)
Ugbaga(Oil Beans)	Bucket	1573.83^{d}	1674.28^{c}	1839.87^{b}	1989.05^{a}	0.002	-7
Uda(Guinea Pepper)	Cup	38.13^{d}	41.41^{c}	45.50^{b}	50.00^{a}	0.000	-9
Ukazi (Gnetum)	Bundles	378.42^{d}	415.85^{c}	456.97^{b}	502.17^{a}	0.004	-9
Ochiogochio (Tetraptera)	Basins	79.19^{d}	86.45^{c}	95.00^{b}	100.00^{a}	0.001	-7
Ikolo (Snail)	Basins	473.56^{d}	498.48^{c}	547.78^{b}	601.96^{a}	0.000	-8
Nmanu anu (honey)	Bottles	747.88^{d}	803.31^{c}	882.75^{b}	1003.13^{a}	0.000	-9
Mmimmi (Pepper fruit)	Cup	45.34^{d}	47.72^{c}	52.44^{b}	57.63^{a}	0.002	-8
Mgborogwu (roots)	Bottles	1536.80^{d}	1684.91^{c}	1851.55^{b}	1990.91^{a}	0.003	-8
Anuofia (Bushmeat)	None	4861.56^{d}	5171.88^{c}	5683.38^{b}	6046.15^{a}	0.002	-7
Osu, Erue (mushrooms)	Basins	448.88^{d}	504.36^{c}	554.25^{b}	577.34^{a}	0.001	-8

Source: Field Survey Data, 2017 Value in each row followed by different superscripts is statistically different at (P < 0.05). Mean separation was done using Duncan Multiple Range Test

Trend in the revenue from the sales of NTFPs in the last four years in the study area

Result (Table 7) showed that for all the NTFPs considered in the study, there was significant decrease in revenue accruing to the collectors between 2013 and 2016. The growth rates in their average prices were negative, suggesting that the revenue from the sales of NTFPs decreases overtime. The Duncan multiple range tests show that there was significant difference (P < 0.05) in the revenue accruing to NTFPs collectors between 2013**(10515.44^{b}, 337.44^{a,} 433.12^{a,} 3145.06^{a}, 4554.50^{b}, 11196.32^{b} , 22507.40^{a}, 2465.66^{a})** and 2016 **(7757.30^{d}, 306.00^{b} , 315.00^{d}, 2642.60^{d} , 4293.40^{c} , 10711.10^{c} ,12999.22^{d}, 1778.21^{d})** seasons respectively. The revenue that accrued to the respondents in the 2013 was significantly higher (P < 0.05) than the 2016 season. The higher revenue for the 2013 season is an indication of increased supply of the product. People with little economic elasticity are likely being at the risk of increased poverty since their dependence on NTFPs is going to reduce, due to low availability of the product recently. These may still continue into the future if adequate measure and policies to livelihood are not put in place to increase their resilience to adapt to this shortfall in supply of NTFPs in the studied area. The higher revenue for the 2013 season is an indication of increased supply of the product. People with little economic elasticity are likely be at the risk increased poverty since their dependence on NTFPs is going to reduce, due to low availability of the product recently. As these may still continue into the future if adequate measure, policies and surrogate to livelihood are not put in place to increase their resilience to adapt to this shortfall in supply of NTFPs in the studied area. This result is consistent with the finding of Heubes *et al.* (2012) and Heubach (2011) predicted a negative impact on the economic return from NTFPs due to impact of climate and land use changes in West Africa. These environmental changes will strongly affect the provisioning ecosystem service of NTFPs (Heubes *et al* ., 2012 , Heubes *et al* ., 2013).

Table 7: Trend in the revenue from the sales of NTFPs by households in the study area in the last four years in kg.

NTFPs	Unit of measurement weighed in kg	2013	2014	2015	2016	Anova F probability	Growth (%)
Ugbaga(Oil Beans)	Bucket	10515.44^{b}	10706.37^{a}	8579.62^{c}	7757.30^{d}	0.002	-11
Uda(Guinea Pepper)	Cup	337.44^{a}	285.37^{d}	301.94^{c}	306.00^{b}	0.001	-4
Ukazi (Gnetum)	Bundles	3158.24^{c}	3069.38^{d}	3587.45^{b}	3706.01^{a}	0.001	-5
Ochiogochio (Tetraptera)	Basins	433.12^{a}	382.35^{c}	399.00^{b}	315.00^{d}	0.000	-12
Ikolo (Snail)	Basins	3145.06^{a}	2766.01^{c}	2854.14^{b}	2642.60^{d}	0.000	-6
Nmanu anu (honey)	Bottles	4554.50^{b}	4559.66^{a}	4265.78^{d}	4293.40^{c}	0.002	-2
Mmimmi (Pepper fruit)	Cup	290.92^{c}	288.89^{d}	369.67^{b}	375.17^{a}	0.004	-8
Mgborogwu (roots)	Bottles	11196.32^{b}	10344.02^{d}	11285.42^{a}	10711.10^{c}	0.000	-2
Anuofia (Bushmeat)	None	22507.40^{a}	17243.97^{c}	19806.41^{b}	12999.22^{d}	0.000	-23
Osu, Erue (mushrooms)	Basins	2465.66^{a}	2003.03^{c}	2205.35^{b}	1778.21^{d}	0.001	-13

Source: Field Survey Data, 2017 Value in each row followed by different superscripts is statistically different at ($P < 0.05$). Mean separation was done using Duncan Multiple Range Test.

The percentage of the responses on the level of availability of NTFPs in the last four years is shown in the Figs.2 to 4. The figures show that Ugbaga (Oil Beans), Uda (Guinea Pepper), Ukazi (*Gnetum spp.*), Ochiogochio (*Tetraptera spp.*), Ikolo (Snail), Nmanu anu (Honey), Mmimmi (Pepper fruit), Mgborogwu (Roots), Anuofia (Bushmeat) and Osuerue (Mushrooms)were in abundance in 2013 and 2014 in the studied area, but, were found to be declining in the year 2015 and 2016.

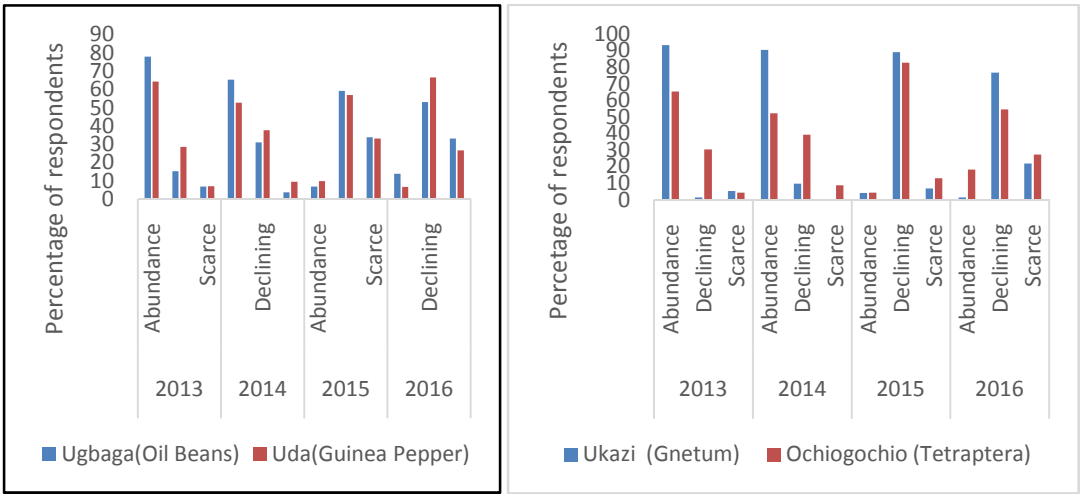

Fig: 2: Variation in the availability of Ugbaga(Oil beans), Uda(Guinea pepper), Ukazi (Gnetum), and Ochiogochio (Tetraptera)in the study area in the last four years.

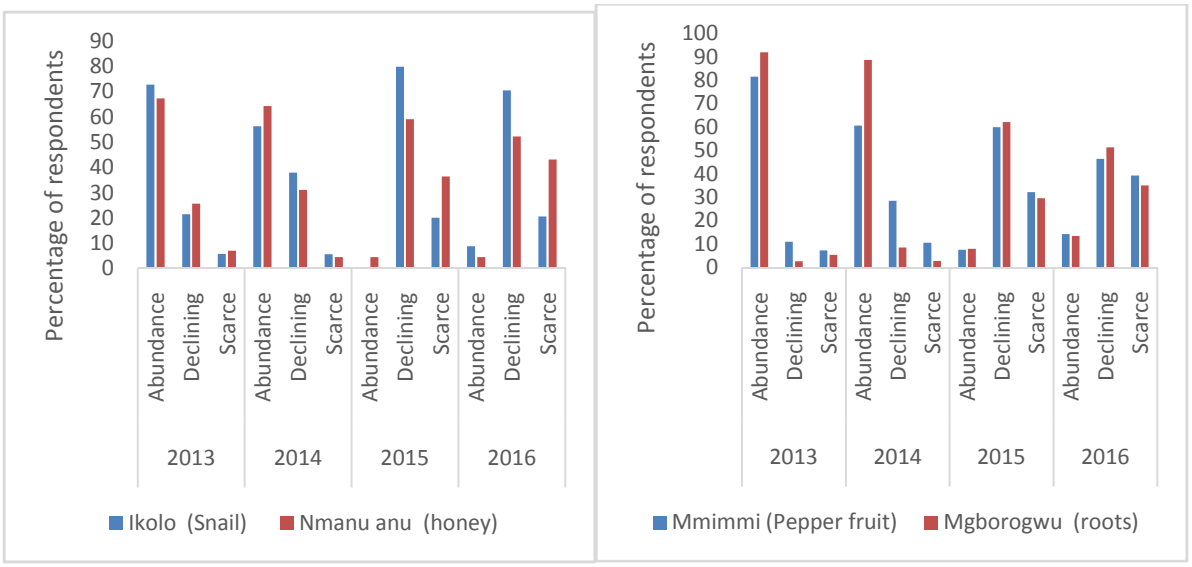

Fig: 3: Variation in the availability of Ikolo(Snail), Nmanu anu(Honey), Mmimmi (Pepper fruit) and Mgborogwu (Herbs) in the study area in the last four years.

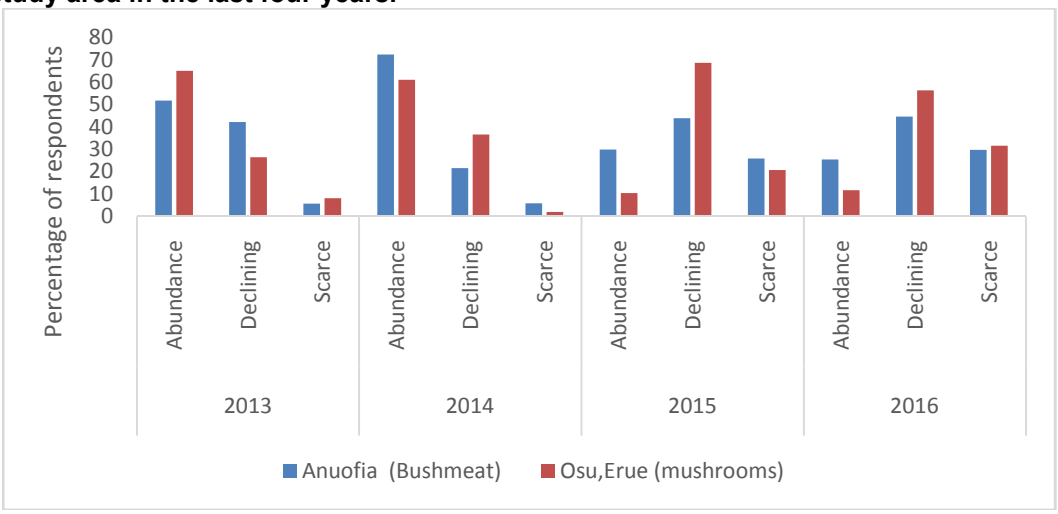

Fig: 4: **Variation in the availability of Anuofia (bush meat)and Osu-erue (mushroom) in the study area in the last four years.**

Perception of the respondents on the observed weather change in the study area in the last 4 years.
From the respondents (Table 8), there were high invasive species (42.0% and 43.5%) emerged in 2013 and 2014. The rainfall pattern was predominantly high (47.9 %) in 2013 but relatively low (45.3%) in 2015. Deforestation has been excessively practiced throughout the 4 years. Changes in the amount of rain, increased intensity, and changes in rainfall patterns would weaken the root system of trees and increase the rate of wind- throw in forests, destruction and die off of many tree species that are intolerant to water logging (NEST, 2011, Abiodun *et al*., 2013). This will contribute to overall decline in forest cover and herbaceous understory productivity, thus affecting forest products, including NTFPs for human consumption and use. In 2015 and 2016, large proportions of the respondents reputed that the observed flooding frequency was moderate and high respectively. This implies that probably there was an increase in the frequency of flooding. Increased flooding can be expected following periods of intense rain in areas with poor infiltration rates, potentially causing water logging and decline in non-adapted forest (NEST, 2011; Abiodun *et al*., 2013).

Table 8: Perception of the respondents on the observed weather change in the study area in the last 4 years.

Observed weather change	2013			2014			2015			2016		
	High	Medium	Low	High	Medium	Low	High	Medium	Low	High	Medium	Low
Invasive species emerged	42.0	33.7	24.3	43.5	44.0	12.5	22.7	55.2	22.1	18.8	35.9	45.3
Rainfall pattern	47.9	40.1	12.0	14.1	39.6	46.4	10.9	43.8	45.3	53.3	37.1	9.6
Temperature	26.5	49.2	24.3	46.8	30.6	22.6	16.0	34.0	50.0	51.8	33.8	14.4
Flood frequency	36.6	40.6	22.9	41.2	37.8	21.1	36.9	39.4	23.8	40.7	30.2	29.1
River erosion/dry up	63.5	4.7	31.7	66.3	8.1	25.6	59.0	9.9	31.2	65.6	27.0	7.4
Deforestation	79.2	3.9	16.9	84.2	5.0	10.8	82.8	10.0	7.2	87.1	1.3	11.6
Seasonal changes/wind force	66.8	5.5	27.7	57.2	9.5	33.3	50.4	29.3	20.3	67.2	28.6	4.2
Land salinity	48.7	13.3	38.1	56.6	23.0	20.4	57.0	28.1	14.9	56.9	23.4	19.7
Sunshine intensity	58.2	30.1	11.7	30.3	3.2	66.5	50.3	36.2	13.5	70.6	25.7	3.7
Humidity pattern	46.3	37.2	16.5	52.8	32.3	14.9	28.6	15.5	55.9	42.8	46.8	10.4
Wind force	49.3	26.2	24.5	30.4	49.5	20.1	14.0	40.0	46.0	61.6	29.3	9.1

Source: Field Survey Data, 2017

The diagrammatic presentation of the collected four years monthly data on rainfall, temperature, relative humidity, sunshine and wind force from the meteorological centre National Root Crops Research Institute (N.R.C.R.I) Umudike Abia state, Nigeria which is the verification of the certitude in the observations of the respondents on climate change is shown in Figs. 5 to 9 below counting from left to right.

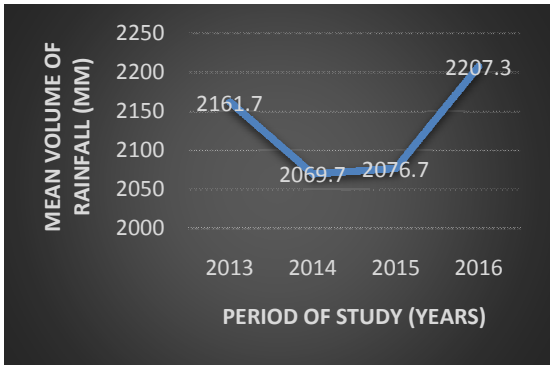

Fig. 5: Rainfall Volume

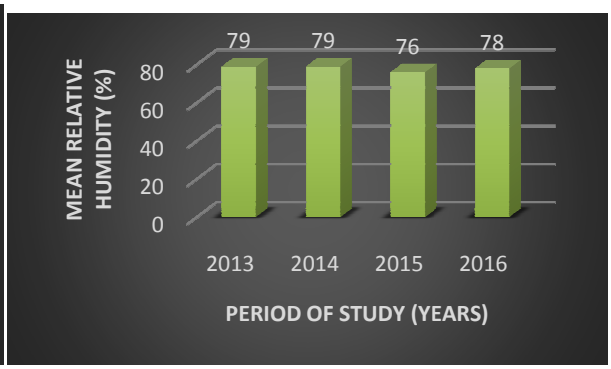

Fig.6: Relative humidity

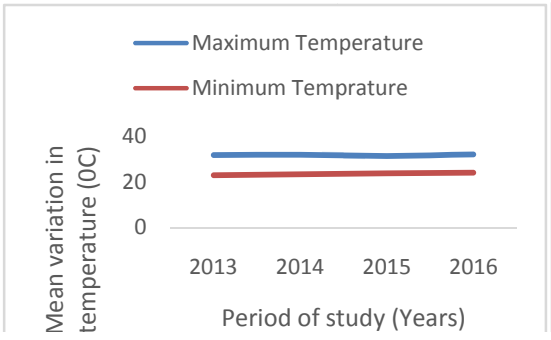

Fig. 7: Temperature variation

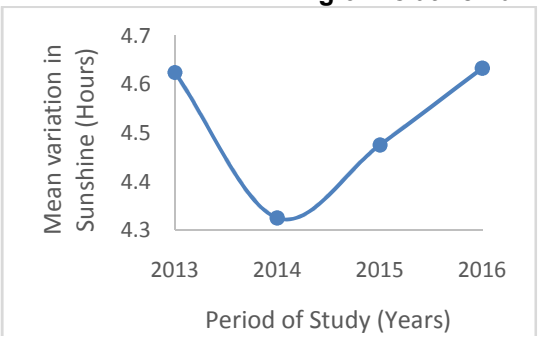

Fig.8: Sunshine hours

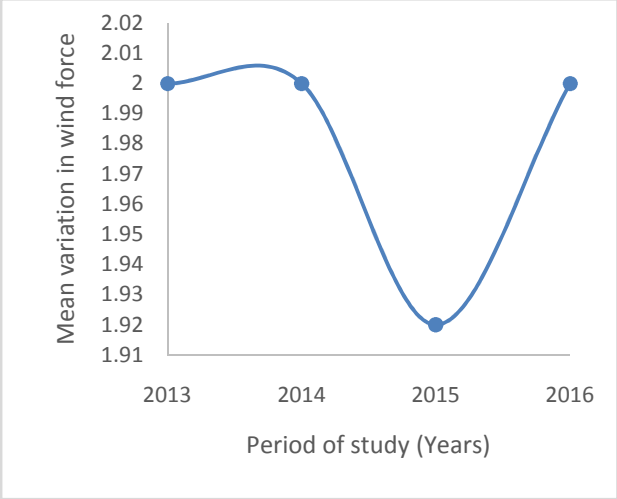

Fig. 9: Wind force Variation

Contribution of NTFPs to the livelihood outcomes of the respondents in the study area.

The distribution of the respondents to the contribution of NTFPs to their livelihood is presented (Fig. 10). The Figure showed that majorities (91.7%, 77.3%, 89.8%, 50.9% 61.1% and 69%) respectively of the respondents reputed that NTFPs contributes to their household livelihood through income, jobs, food. Few proportions (45.4%, 40.3% and 29.6%) elucidated that NTFPs serves recreation, of medicinal roots and shrubs and fodder for their animals. NTFPs contributes so much to the food, income, shelter, job provision, relaxation, livestock nutrition and the nutrients need of the households under study. According to Nkwatoh *et al.,* (2010) livelihood of most rural households is also dependent on NTFPs collection and trading. Trade in NTFPs played a very important role in contributing to rural household economy, thus helping the rural households to meet both their food and non-food needs. This finding is consistent with Vihotogbe, (2012); Vihotogbe *et al.,*(2014c) and Vihotogbe *et al.,* (2015) who averred that NTFPs plays a vital role in rural areas and

contributes to both food and non-food needs of rural households.

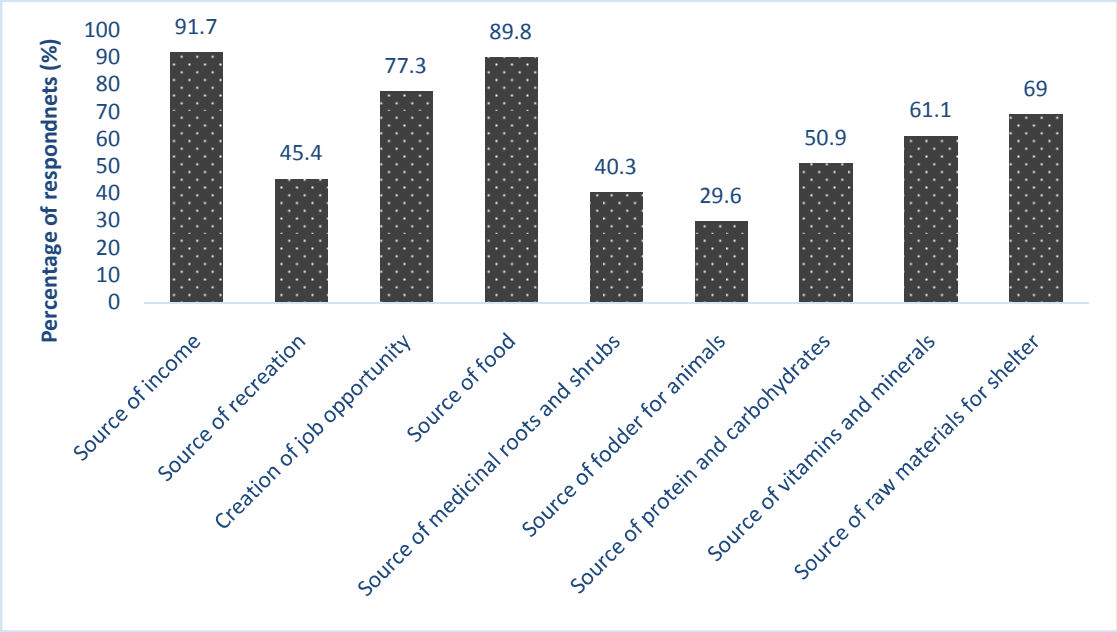

Fig.10: Contribution of NTFPs to the livelihood of the households (Multiple responses was recorded)

The total and mean amount in naira earned from NTFPs by the respondent

Results (Table 9) showed that the respondents earned highest amount from Anuofia (Bushmeat) followed by Mgborogwu (Roots) while their least earning was from Ochiogochio (*Tetrapleura Tetraptera*) followed by *Dennetia tripetala* - Mmimmi (Pepper fruit). The cumulative amount of NTFPs harvested by all the respondents in the study area was ₦4, 864,550 with a mean value of ₦486, 455. The disparity between the value

of NTFPs harvested and value of NTFPs sold by the respondents in the study area suggests that NTFPs contributes to the food and income needs of the households under study. Therefore, non-timber forest products may offer sources of income and an opportunity for poverty alleviation in rural areas under study. This finding is consistent with Mulenga *et. al.,* (2012). According to Mulenga *et. al.,* (2012), households engage in trade of Non-Timber Forest Products (NTFPs) because of low capital requirements and they relatively gain easy access to markets. NTFPs help bridge seasonal gaps in income for many farmers, and they provide a safety net for many rural households during years with low crop yields.

Table 9: The total and mean amount of naira earned by the respondents from NTFPs.

S/N	NTFPS Harvested	Unit of Measurement weighed in kg	Quantity Harvested	Quantity Sold	Unit price (₦)	Amount Harvested (₦)	Amount Sold (₦)
1	Ugbaga(Oil Beans)	Bucket	694 (5.07)	534 (3.90)	1989.05	1428500 (10427.01)	1060000 (7737.23)
2	Uda(Guinea Pepper)	Cup	682 (7.33)	569 (6.12)	50	46150 (496.24)	33700 (362.37)
3	Ukazi (Gnetum)	Bundles	1358 (8.43)	1173 (7.38)	502.17	672750 (4178.57)	582600 (3664.15)
4	Ochiogochio (Tetraptera)	Basins	278 (3.52)	249 (3.15)	100	27600 (349.37)	24900 (315.19)
5	Ikolo (Snail)	Basins	555 (5.44)	443.5 (4.39)	601.96	330800 (3243.14)	265800 (2631.68)
6	Nmanu anu (honey)	Bottles	335 (5.23)	274 (4.28)	1003.13	334100 (5220.31)	275560 (4239.38)
7	Mmimmi (Pepper fruit)	Cup	421 (7.14)	384 (6.51)	57.63	22500 (381.36)	19600 (332.20)
8	Mgborogwu (roots)	Bottles	355 (6.45)	296 (5.38)	1990.91	685000 (12454.55)	579500 (10536.36)
9	Anuofia (Bushmeat)	None	196 (3.02)	140 (2.15)	6046.15	1181000 (18169.23)	859500 (13223.08)
10	Osu, Erue (mushrooms)	Basins	234.5 (3.66)	194 (3.08)	577.34	136150 (2127.34)	111400 (1768.25)
	Total					**4,864,550.00**	**3,812,560.00**
	Mean					**486,455.00**	**381,256.00**

Note: Values in parenthesis are mean values while values outside the parenthesis are the cumulative values.

CONCLUSION

This study focused on the activities of the people that increase climate variability, the peoples' perceived effect of climate variability on the NTFPs and the contribution of NTFPs to their livelihood outcomes in Ohafia L.G.A. Abia State, Nigeria. Climate change is one of the greatest environmental, social and economic threats to the livelihood of forest dependent communities in developing countries. Effect of climate variability on NTFPs and livelihood of rural dwellers in Ohafia Local Government Area of Abia State, Nigeria has been identified in this paper. Deforestation has been excessively practiced throughout the 4 years. Changes in the amount of rain, increased intensity, and changes in rainfall patterns would weaken the root system of trees and increase the rate of wind- throw in forests, destruction and die off of many tree species that are intolerant to water logging (NEST, 2011, Abiodun *et al*., 2013). This will contribute to overall decline in forest cover and herbaceous understory productivity, thus affecting forest products, including NTFPs for human consumption and use. A robust finding of the study is that climate variability has an effect on NTFPs and in turn influences the livelihood of the people. Another finding of the study shows that there exists a vast indigenous and traditional knowledge of weather/climate and climate variability and change which could be tapped for sustainable adaptation to climate variability and long term climate change. To elicit this body of knowledge from the indigenous people would require more research time than the present study permits. The knowledge of the rural dwellers in the studied area however, synchronized with that of the meteorological centre at Umudike and this thus, underscores the fact that climate change is happening in the area and it is very perceptible to the rural dwellers.

Recommendations however are that:

1. The study proposed an exercise on massive domestication of NTFP in the neighboring communities and state in Nigeria as very little have been done on domestication, which makes the impact of climate variability greater and its varying impacts on the livelihood of the people
2. It is recommended that the mandates of existing weather stations be modified to include dissemination of climate information to the farmers. Community - based weather/climate information stations should be established. School-based geographical gardens should

be established with a qualified official, preferably a school teacher with background in geography and allied subject.

3. High level of deforestation (mostly NTFPs) for fuel wood purpose, carpentry and other wood activites need to be minimized and adequate sanctions given to defaulters.

4. There should be a more insight into the wealth of vast indigenous and traditional knowledge of weather/climate and climate variability and change of the rural people which should aid in sustainable adaptation to climate variability and long term climate change.

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