

Perceived Effect of Climate Change on Forest Dependent Livelihoods in Oyo State, Nigeria

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Abstract

The study investigated the perceived effect of climate change on forest dependent rural livelihoods in Oyo State, Nigeria with the view of identifying possible adaptation strategies. A total of 208 respondents were randomly sampled from Olokemeji and Onigambari forest reserves in Oluyole and Ibarapa East Local Government Area (LGA), respectively. Data collected were analyzed using frequency distribution, percentages Chi square and PPMC. Result shows that major livelihood activities were farming (100.0%) and trading of forest products (92.8%). Respondents were vulnerable to climate change effects with respect to undefined season (90.4%), shortage of food production (84.1%), reduction in crop yield (80.8%), pest and disease outbreak (77.9%) which affects their livelihood activities. Major adaptation strategies utilized were soil protection through tree planting (88.5%), planting of different varieties of NTFPs and TFPs (87.0%), practicing shifting cultivation (81.8%) and use of organic fertilizer (81.7%). Respondents' use of weather insurance was sparing in the study area. Significant relationship existed between farm size ($r=-0.257$; $p\leq 0.01$), monthly income ($r=-0.319$; $p\leq 0.01$) and perceived effect of climate change. Adaptation strategies ($r=0.309$; $p\leq 0.05$) used was significantly related with perceived effect of climate change. Afforestation should be encouraged among forest dependent farmers in addition to adaptation strategies utilised against climate change. The study recommends the need to educate farmers on the importance and benefit of weather insurance against financial loss due to climate change effects.

Keywords: Climate change, livelihood activities, forest products

Introduction

Climate change is used to describe a systemic change in the key dimensions of climate including average temperature, wind and rainfall patterns over a long period of time (IPCC, 2007). IPCC (2001) reported that Africa was predicted to suffer the most from impacts of climate change. According to Morgan *et al.* (2001), increase in temperature and level of atmospheric carbon dioxide as well as changes in precipitation have notable impact on the world's forests and the forest sector. However, climate change may increase and worsen the threats to forest, forest products and forest dependent people. Identification of cases of vulnerability of people living in and around forest reserves becomes necessary so as to suggest mitigations. Changing climate may increase and worsen the threats to forest and forest products, such as severe floods, drought, increased frequency of forest fires, landslides, increased temperature, rain variability, increase in carbon dioxide, rising sea levels, insects and disease outbreaks.

The importance of forest to man's survival cannot be overemphasized due to the various environmental, social and economic benefits it provides. Forest is a habitat for various species of trees, animals and fishes. More importantly, forest assists in the global cycling of water, oxygen, carbon and nitrogen; lend stability to hydrological system; regular supply of fresh water; prevents flood, soil erosion and situations of river bed downstream (Oregon Forest Resources Institute, 2018; Adebayo, 2009). According to United State Department of Agriculture (2011), forests play a critical role in maintaining the climate, freshwater systems, soils and biodiversity, all of which are critical to food security and other key aspects of human well-being. Forest helps in combating climate change through absorption and reduction of greenhouse gas such as carbon dioxide in the atmosphere. Various kinds of wood and non-wood items are derived from the forest. Forest supplies many products in form of wood which serves as basic material for construction, furniture, paper; and non-wood items which include extractions such as bark, dye, fibre, gum, incense, latexes, oil resins, waxes, shellac and tanning compounds, food, bush meats, flowers, fruits, honey/nuts, leaves, seeds, spices as well as decorative, ceremonial and medicinal items (Adebayo, 2009). Forest contributes to poverty reduction and agricultural stability by protecting the soil. The majority of the rural communities depend heavily on forest products for their livelihoods (MNRT, 2009).

Livelihoods are the sum of ways in which people make a living. Thus, income generation from forests is supplementing the farm income although not many households have the capacity to take advantage of forest-based income generating activities. Increasing agricultural production costs in relation to product prices and increasing living costs in general have pushed people to exploit forest more intensely, particularly on the general lands to generate cash income. Milledge *et al.* (2007) reported that forests support the livelihoods of 87% of the rural poor. However, the vulnerability of many communities in developing countries is immense and their capacity to adapt to future climate change impact is assumed to be very low (Huq and Reid, 2004).

United nation report says that unless government acts now to reduce greenhouse gas emissions (GHG) and adopt measures to protect their people, nobody will be

immune to climate change. One impact is the reduction in yields, which leads to higher prices. The poor are always being hit harder in weather related disasters. Van-Aalst *et al.* (2007) asserted that it is the poor suffering more during the disaster and of course the same hazard causes a much bigger disaster in poorer countries. Climate change effect such as flood cause damage to crops, soil (erosion), houses, infrastructures, food shortages, spread of water borne diseases and disruption of settlements, commerce, transport and pressures on rural infrastructure. It also results in loss of human lives, livestock and uproot of trees. Increased temperatures increase fire risks in areas that experience increased aridity and climate change also promote the proliferation of diseases and pests that attack tree species. All these have a resultant effect on the livelihood of rural people that depend on forests for their subsistence and income. The challenges of climate risks on development and food security are enormous in Africa (Adger, 2006). Nigeria is one of the countries of the world which is potentially most vulnerable to climate change, because of its over dependence on forest.

It is therefore pertinent to investigate the current situation of individuals who depend on the forest for their means of livelihood. Hence, this study examined the perceived effect of climate change on forest dependent livelihoods by forest dwellers. This is a prerequisite for studying the effects and responses to future climate change and for identifying the key determinants of successful adaptation in the future (Adger *et al.*, 2003).

Methodology

The study area is Oyo State, Nigeria. Oyo State is located in south western part of Nigeria and its capital is situated at Ibadan. The population of the study was all forests dependent households in Olokemeji and Onigambari forest reserve of Oyo state. In the two forest reserves, communities in and around the forest plantations within 2km radius were identified. Three communities were randomly selected per reserve to give 6 communities sampled for this study. In Olokemeji forest reserve, Baale Olokemeji, Opete and Idi-ope were selected with respective estimated households of 404, 454 and 1015 while in Onigambari forest reserve, Onipe, Busogboro and Dalley villages were selected with respective households of 664, 1183 and 707. Respondents were sampled proportionately to the number of households in each community. Where the population was less than 500, 10% was used; 5% was used for population between 500-1000 while 2.5% was used for population over 1000. In Olokemeji forest reserve 40, 45 and 25 households were respectively sampled from Baale Olokemeji, Opete and Idi-ope while in Onigambari forest reserve 33, 30 and 35 households were sampled from Onipe, Busogboro and Dalley villages respectively. Hence, a total number of 208 household heads were used for this study. Interview schedule was used to elicit data from respondents. Data collected was analysed using descriptive statistics such as frequency, percentages and mean while inferential statistics such as PPMC was used to test hypotheses stated for the study.

Result and Discussions

Socioeconomic Characteristics of Respondents

The socioeconomic characteristics of respondents as presented in Table 1 show that majority (63.3%) of the respondents were male, while 31.8% were female. This implies that there were more male headed households in the study area. The result is similar to the findings of Morakinyo *et al* (2015) who reported that most households in Nigeria were headed by male. The age category with the highest percentage of respondents was 41-50 years (32.7%). This implies that a greater proportion of the respondents were still in their active ages while others are tending towards old age. Most of the respondents were married (85.6%) which suggests the importance attached to marriage institution and they should be apt to use climate change adaptation strategies in order to combat household vulnerability to climate change effects.

The majority (63.0%) had primary education. This result implies that the majority of the respondents can read and write. Education will enhance respondents' access to information on climate change effects and adaptation strategies to be used. Thus, respondents' knowledge on the various ways to cushion the effects of climate change is enhanced. The results of this study align with Kong (2016) who found that most households sampled around Maasai Mau Forest, Narok County, Kenya were headed by male (83.0%), 87.0% respondents were married, in their active years while 53.0% had primary education. Findings from this study show that Christianity is the dominant religion practiced by 68.3% respondents, 25.5% were Muslims, while only 6.2% were Traditionalists. Household size of most respondents is between 5-8 members and 93.3% had farm size less than 5 ha. The majority earned less than or equal to ₦20,000 monthly were 45.7%, while 32.2% earned between ₦20,001-₦40,000 monthly.

Table 1: Socio-economic characteristics of respondents

Variables	Categories	Percentages (n=208)
Sex	Male	68.3
	Female	31.8
Age (years)	≤ 30	6.3
	31 – 40	24.5
	41 – 50	32.7
	51 – 60	22.6
	>60	13.9
Marital status	Single	3.8
	Married	85.6
	Widowed	6.3
	Divorced	4.2
Education	No formal education	12.5
	Primary	63.0
	Secondary	24.0
	Tertiary	0.5
Religion	Christianity	68.3
	Islam	25.5
	Traditional	6.2
Household size	< 5	12.0
	5 – 8	64.9
	9 – 12	16.8
	13 – 16	6.3
Farm size (ha)	< 5	93.3
	5 – 7	4.8
	8 – 10	1.9
Monthly income (₦)	≤ 20,000	45.7
	20,001 - 40,000	32.2
	40,001 - 60,000	13.9
	60,001 - 80,000	6.3
	>80,000	1.9

Field Survey 2016

Income Generating Livelihood Activities

Table 2 reveals that all respondents engaged in farming activities. Since all respondents engaged in farming, their vulnerability to climate change effects will be more. According to FAO (2005), farming, forestry and fishery are highly sensitive to climate change which will have a serious impact on farmers' production functions. It was found that the majority engaged in gathering of NTFPs (96.2%) and trading of forest products (92.8%). This aligns with Onyekuru and Marchant (2014) who found that forest resources contribute to the livelihoods of households across Nigeria. Similarly, Dube and Phiri (2013) found that food security among African communities in Zimbabwe has always been supported by NTFPs. Corroborating this, Falconer (1994) findings reveal that NTFPs play an important role in the Ghanaian economy by the way of supporting rural livelihoods. Other livelihood activities engaged in by respondents are livestock rearing (31.3%), hired labour (40.9), Hunting (38.5%) and Artisan (29.8%). In Kenya, Langat *et al* (2016) reported that rearing of livestock contributed to livelihoods of communities living close to the forest.

Table 2: Income generating livelihood activities

Income generating livelihood activities	Percentages (n=208)
Farming	100.0
Livestock rearing	31.3
Trading of forest products	92.8
Fishing	5.3
Hired labourer	40.9
Hunting	38.5
Artisan	29.8
Gathering of NTFPs	96.2
Transport business	4.3
Civil servants	1.9

Field Survey 2016

Vulnerability of Respondents to Climate Change Effects

Table 3 reveals that most respondents were seriously and partially vulnerable to climate change effects with respect to undefined season (90.4%), shortage of food production (84.1%), reduction in crop yield (80.8%), pest and disease outbreak (77.9%) which affects income derived from livelihood activities. Onyekuru and Marchant (2014) stated that in Nigeria, people are highly vulnerable to climate impacts because it acts on the very essence of their sources of livelihoods, upon which they depend on daily basis for sustenance. Hence, increased uncertainties in climate variability is a major challenge for sustaining agriculture as well as allied sectors in the face of already declining forest resources.

Table 3: Vulnerability to climate change effects

Items	Not at all	Partial	Serious
Reduction in yield	19.2	38.0	42.8
Flooding	54.8	30.8	14.4
Shortage of food	15.9	47.1	37.0
Undefined seasons	9.6	50.5	39.9
Pests and diseases outbreak	22.1	49.5	28.4

Field Survey 2016

Perception of Climate Change Effects

Table 4 shows that most of the respondents agree that rainfall fluctuation is never in favour of forest products ($\bar{x}\bar{X}=3.96$) and that cultivation of forest products will decrease the problem of land degradation ($\bar{x}\bar{X}=3.96$). Majority of the respondents attest that unpredictable nature of sun intensity negatively affects forest products ($\bar{x}=3.88$). Increase in temperature was perceived as a threat to forest products by respondents $\bar{x} = 3.84$). Other effects of climate change experienced in the area include decreased yield ($\bar{X}=3.56$), high humidity ($\bar{x}=3.24$), disease infection ($\bar{x}=3.16$) and pest infestation ($\bar{x}=2.93$). Findings from this study aligns with Ugwuoke (2013) who reported that farmers in Abia State, Nigeria experienced climate change effects such as poor relative humidity, decrease in agricultural yield, high sunshine intensity,

increase in temperature, change in pattern of rainfall and poor fertility of most soils. High intensity of sun and unpredictable changes in rainfall pattern were also reported among farmers in Ondo State, Nigeria (Thompson and Oparinde, 2015). The result of this study also establishes adverse effects of climate change in rural areas as reported by IPCC (2007).

Table 4: Respondents' perception of climate change effect

Perception statements	Mean	Rank
The rise in annual rainfall had not led to increase yield of forest products	3.56	4 th
Fluctuation of rainfall is never in favour of forest products	3.96	1 st
Forest products are lost to disease infection on the field due to high relative humidity	3.16	6 th
There is high incidence of pest due to change in temperature and rainfall pattern	2.93	7 th
Cultivation of forest products will decrease the problem of land degradation	3.96	1 st
High humidity does not increase yield of forest products	3.24	5 th
Increase in temperature threatens forest products	3.84	3 rd
Unpredictable nature of sun intensity negatively affects forest products	3.88	2 nd

Adaptation Strategies to Climate Change Effects Utilized

Table 5 reveals that 88.5% employ soil protection through tree planting. This agrees with the findings of Ofuoku (2011) that rural farmers in Delta State, Nigeria employ planting of trees as an adaptation measure against climate change. It was discovered that most respondents (87.0%) indicate they employ planting of different varieties of NTFPs and TFPs as an adaptation strategy to climate change. This is consistent with Onyekuru and Marchant (2014) findings that among the adaptation strategy option identified, planting of NTFPs and TFPs stood out as the choice of most farmers. Furthermore, result shows that most respondents practice shifting cultivation (81.8%), use organic fertilizer (81.7%) and irrigation (63.0%) in the study area. This is supported by the report of Okpe and Aye (2015) and Osasogie and Omorogbe (2018) that farmers in Benue State, Nigeria employ the use of chemical fertilizer and irrigation as an adaptation strategy to climate change effects. The use of different planting dates was employed by 62.0% of the respondents. Likewise, in Ekiti State, Nigeria, changing of planting and harvest time was reported as the most widely adaptation strategy used by the farmers (Ajayi, 2016). Soil conservation is another important adaptation strategy used by 58.7% of the respondents. Soil nutrients can be conserved by the use of methods such as mulching, crop rotation and planting of cover crops. Studies have shown the use of mulching, crop rotation and planting of cover crops as adaptation strategies among farmers in Nigeria (Ajayi, 2016; Okoroh, *et al.*, 2016 and Arimi, 2014).

Table 5: Adaptation strategies to climate change effects utilized

Adaptation strategies	Percentages
Planting of different varieties of NTFPs and TFPs	87.0
Different planting dates	62.0
Practicing shifting cultivation	81.8
Increase irrigation	63.0
Use of organic fertilizer	81.7
Increase water conservation	26.9
Soil conservation	58.7
Use of weather insurance	34.6
Soil protection through tree planting	88.5
Desalination	38.9

Field Survey 2016

Relationship Between Selected Independent Variables and Perceived Effect of Climate Change

Table 8 reveals that a negative significant relationship exists between farm size ($r=-0.257$; $p\leq 0.01$), monthly income ($r=-0.319$; $p\leq 0.01$) and perceived effect of climate change. This implies that effect of climate change is more felt by respondents with small holdings who might lack adaptive capacity coupled with limited income compare with respondents with large farm holdings. The inverse relationship between monthly income and perceived effect of climate change suggests that respondents with limited income from livelihood activities are those who perceived climate change effects to be most serious. The relationship between adaptation strategies and perceived effect of climate change ($r=0.309$; $p\leq 0.05$) was positively significant indicating that those who perceived climate change effects to be high utilized adaptation strategies the most.

Table 8: PPMC analysis of selected independent variables with perceived effect of climate change

Variables	r value
Farm size	-0.257*
Monthly income	-0.319*
Adaptation strategies	0.309*

* $P\leq 0.05$. Field Survey 2016

Conclusion and Recommendations

The study concludes that households are mostly headed by men who are adults, married, formally educated and are engage in farming as their primary means of livelihood. Respondents were involved in gathering of non-timber forest products and its sales. Vulnerability of respondents to climate change effects such as undefined season, shortage of food production, reduction in crop yield, pest and disease outbreak was considered serious. The major effects of climate change perceived to

be high were irregular rainfall and unpredictable sun intensity. Adaptation strategies used by most respondents were soil protection through tree planting, planting of different varieties of NTFPs and TFPs and practicing of shifting cultivation. However, respondents' use of weather insurance was sparing in the study area. The study recommends the need to educate farmers on the importance and benefit of weather insurance against financial loss due to climate change effects.

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