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PERCEIVED EFFECTS OF CLIMATE CHANGE ON THE LIVELIHOOD OF NON-TIMBER FOREST PRODUCTS COLLECTORS IN IDO MUNICIPALITY, IBADAN, NIGERIA

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ABSTRACT

The inadequate efforts of the stakeholders towards the reduction of climate change effect have engendered poverty among the masses and poor access to disrupted food products. However, putting together vital adaptation measures could proffer a lasting and effective solution to the challenges.Hence, this paper examined the perceived effect of climate change on the livelihood of non-timber forest products collectors of Ido municipality, Ibadan, Nigeria. Multi-stage sampling wasused to select 80 respondents.Primary data were collected through a well-structured questionnaire. Data were analyzed using descriptive statistical tool such as frequency tables, percentages. The result revealed that 56.3% of the respondents thatengage in the collectionnon-timber forest products were male. Also, 57.6% of the household size was between 6-10 and falls withinthe age range of 41 to 50 years of age (43.8%).Further, 53.8% of the respondents were married, with 47.5% being Christians and also 40.0% haveattended primary school. The findings also revealed that 81.3%of non-timber forest products collectors perceived that they were vulnerable to the effect of climate change, and also 63.1% perceived to experience food shortage. The study revealed that 90.0% of the respondents were engaged in adaptation strategies thatenforced anincreasein farm size. The study concludes that the majority of respondents perceived vulnerability to the effects of climate change in shortage of food and NTFPs.Thus, it was recommended that government should engage forest extension workers in training the collectors of NTFPs on more adaptation strategies that could enforce the improvement of their livelihood.

Keywords:Climate Change, Collectors, Livelihood, NTFPs, Ido Municipality

Introduction

Climate change is defined as a long term change in the distribution of weather patterns over a long period of time of a decade to millions of years (Robledo *et al*., 2008). Thus, inadequate efforts to reduce the effects of climate change measures have brought about the devastating effectssuch as drought, flood, erosion, intense temperature, heavy rainfall and so on, and have persistently dragged the livelihood of people into

impoverishment (Atanga and Tankpa, 2021). The elements of climate change, according to International Institute for Sustainable Development, IISD (2003) are a germane complex web of factors that determine the livelihood of the people. Further, the geographical, climatic conditions, high dependency of the people on natural resources and their limited capacity to adapt to a changing climate have compound effect on existing poverty among the people in the developing nations (IISD, 2003).

Nonetheless, livelihoods are the sum of ways in which people make a living from the available resources of nature with environmental income generation from the forests being a supplementary income to the farm income (Robinson, 2016). In addition, Akinbile*et al*. (2018) reposed that increasing agricultural production costs 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).

The majority of forest farmers in developing countries fulfill livelihood, medicinal needs, nutritional needs from the forest, and they generate parts of their income from selling forest products, which is congruence with non-timber forest products like fuel-wood, medicinal plants, vegetables are an integral part of day-to-day livelihood activities (Sharma and Bharti, 2020). Since the 1990s, the role of non-timber forest products (forest edible produce) has been immense in sustainable forest utilization, and they also contribute to poverty alleviation through the generation of income, provision of food, medicine, and foreign exchange earnings (Nzinzi, 2016).

Often, poor farmers are dependent on economic activities that are sensitive to the climate. For example, agricultural and forestry activities depend on local weather and climate condition; a change in those condition could directly impact productivity levels and diminish livelihood of rural dwellers (USAID, 2007). In developing countries where non-timber products arean important source of livelihood for majority of farmers in the population, it is widely recognized that climate change has caused substantial impacts on the forested ecosystem (Kirilenko and Sedjo, 2007). These non-timber forest products depend highly on climate because climate is the main driver of non-timber forest products and high productivity for a good source of farmers' livelihood (Salinger, 1994).

However, the fall in farmers' productivity could be attributed to an increase in temperature, increase in rainfall, flooding, desertification and drought caused by

climate change. A decrease in the non-timber forest products could also result into reduction in food availability, low income, and poor living standard of collectors of NTFPs (Food and Agriculture Organization of the United Nations, 2015). The reduction in livelihood also led to migration of farmers to diversify into non-farm activities as well as farmers' well-being determined solely by the income from farmers' productivity already decimated by climate change, heightened by the linkage between agriculture, the forest and poverty in particular (Biswas and Mallick, 2021).

Evidence revealed that climate change is a global occurrence, in addition to its impacts on the survival of the people, but the bulk of the adverse effects is being felt in developing countries, especially those in Africa due to their low level of coping capacities (Nwafor, 2007; Jagtap, 2007). There has been shift in rainfall patterns and extreme events such as droughts, flood due to thehigh temperature of the planet, in addition to forest fires which has great value to their survival. Climate plays the most prominent role in the basic input of non-timber forest products, decreasing availability of forest produce such as food, fuel, medicinal herbs, and deprivation of the poor from a supplementary source of income, food and health care (Basu, 2009). At the same time, climate change can disrupt food availability and affect food quality, for example, increases of temperature, changes in precipitation, patterns, and changes in extreme weather events will reduce the non-timber forest products as reported by the United States Environmental Protection Agency; USEPA (2017).It is therefore pertinent to investigate the current situation of individuals who depend on non-timber forest products as means of livelihood with the attendant impact of climate change on their activities and productivity. Based on this background, the following objectives evolved to identify the socio-economic characteristics of the respondents, identify the non-timber products often collected by the respondents, assess the vulnerability of respondents to climate change, determine the respondents perception towards the effect of climate change on non-timber forest products, and identify the adaptation strategies among respondents to mitigate the impact of climate change on non-timber forest products.

Materials and Methods

Study area

The study was carried out in Ido municipality, Ibadan, Nigeria. According to the 2006 population census, the projected population of people in the local government was 148,800 as at year 2022. It has a land mass of 986 square kilometers. Ido municipality was created in May 1986, with its headquarters at Ido, and it was carved out of the former Akinyele municipality which shares

boundaries with Iseyin and Afijo municipality to the west and Odeda municipality to the west and Odeda municipality in Ogun state, Nigeria to the south. The Ido local council formerly has six wards which had been increased to ten for easy exercise of franchise. Among the major towns within the local government area are Apata, Omi -Adio, Ijokodo, Ido, Akufo, and Bakatari well as 612 villages .They are predominantly Yoruba with people from other tribes from various part of the country and outside the country. The basic occupation of the people in the area includes the collection of non-timber forest products. The land is suitable for a wide range of edible fruits. The average temperature is 32^0c, the relative humidity could be as high as 92%, and total annual rainfall of about 1250mm, the area is located within forest belt if the country, particularly in the tropical rain forest.

Sampling Procedure

Multistage sampling procedure was used to select the non-timber forest products collectors in Ido municipality. First stage is the selection of Ido municipality which has 10 wards as Ido, Ilaju, Erinwusi, Akufo, Apete, Onigbinde, Idiya, Omi Adio, Gbekuba, OgundeleAlabi. The second stage is the purposive selection of four wards from the 10 wards based on their involvement in non-timber forest products and these wards were Ido, Ilaju, Akufo, and Omi Adio. The third stage was the purposiveselection of villages where the non-timber forest products (NTFPs) were practiced and the villages were Odufemi and Oloje in Ido, EleyeleOko and Abimo in Ilaju, Akufo and Olokiti in Akufo, Owode and Bankatari in Omi Adio. The fourth stage was the selection of sample size with a simple random sampling technique to select 10 respondents from the selected villages from the four wards in which a total of eighty (80) respondents were selected for the study. Data for this study was collected from both primary and secondary sources. The primary source was through a well-structured questionnaire with interview section. The data collected were analyzed with the descriptive statistics.

Results and Discussion

The result in Table 1 revealed that 56.3% of the respondents who participated more in the farming and collection of non-timber forest products were male which implies that the male gender were more active to gain entry into the forest environment than the female gender. The result corroborates with the submission of Morakinyo *et al*. (2005) who reported that the most household is headed by man, and also hinted that rural men play an active role in the economy of the family. Table 1 also revealed that about 43.8% of respondents that participated more in collection of non-timber forest products were in the age range of 41-50years. Also, the result showed that majority of the respondent (53.8%) were married. This indicated that married people were more

involved in the collection of NTFPs. This is in line with the submission of Jonah (2023) that the majority of individuals engaged NTFPs transaction are married.The result further showed that majority of the respondents (40.0%) had primary education.

This indicated that most of the respondents had elementary education which could enforce the understanding of climate change impact on livelihood and the adaptation process. More so, the result revealed that 58.8% of the respondents were having a household size of 6 -10 people. This indicated that there was agood number of people within the household that could give helping hands in farming engagements of the farmers. Furthermore, the result showed that 42.5% of respondents earned 31,000-50,000naira monthly. This indicated that about second quartile of the people in the study area had monthly income in the region of minimum wage in Nigeria which could help combat climate by engaging tree planting and tree conservation.

Table 1: Socio-economic characteristics of respondents in the study area

Variables	Frequencies	Percentages
Sex		
Male	45	56.3
Female	35	43.7
Age in years		
20-30	6	7.5
31-40	19	23.8
41-50	35	43.7
>50	20	25.0
Marital status		
Single	8	10.0
Married	43	53.8
Divorced	15	18.7
Widowed	14	17.5
Religion		
Christian	38	47.5
Islam	30	37.5
Traditional	12	15.0
Education		
No formal education	26	32.5
Primary education	32	40.0
Secondary education	18	22.5
Tertiary education	4	5.0

Household size		
1-5	30	37.5
6-10	46	57.5
Above 10	4	5.0
Farm size		
Acre	30	37.5
Hectare	27	33.7
Plot	21	26.3
Others	2	2.5
Monthly income		
≤ 30,000	25	31.3
31,000-50,000	34	42.5
51,000-70,000	18	22.5
Above 70,000	3	3.7

The result in Table 2 showed that 62.5% of the respondents collected more of bush meats such as grass-cutters, snails, rodents and squirrels. This finding correlates with the finding of Cavendish (2004) that bush meats are important NTFP throughout Africa and isworth millions of dollars in trade. This is followed by 57.5% of the respondents who collected mushroom in the study area. This indicated abundant availability of mushroom. Also, 55.8% of the respondents in the study area signified the collection of fruits help increase the livelihood of the farmers. This result corroborates with the findings of Food and Agriculture Organization (2021) that sales of collected fruits serves as the enhancer of the livelihood of the people in the rural setting. Further, the other NTFPs which improves the livelihood of farmers were vegetables (52.5%) and palm wine (50.8%).

Table 2: Identification of non-timber forest products often collected in Ido municipality for collectors' livelihood enhancement

Non-timber forest products	Available F %	Not Available F %
Charcoal	32 (39.7%)	48 (60.3%)
Kolanut	30 (47.5%)	50 (52.5%)
Honey	38 (43.8%)	42 (55.0%)
Herbs	38 (50.0%)	42 (55.0%)
Mushroom	42 (57.5%)	38 (42.5%)
Bushmeat	50 (62.5%)	30 (37.5%)
Fruits	42 (55.8%)	38 (44.2%)

Vegetables	48 (52.5%)	32 (47.5%)
Palmwine	50 (50.8%)	30 (49.2%)

Note: F= Frequencies, %= Percentages in parentheses

The result in Table 3 revealed that 81.3% of the respondents were vulnerable to areduction in the growth of crops. This resultcorroborates with the finding of Onyekuru and Marchant (2014) that in Nigeria, farmers are highly vulnerable to climate impacts because of the effects it has on their sources of livelihood. This indicated that most respondents were seriously vulnerable to climate change effects. Shortage of food was severe among 67.5% of the respondents who were vulnerable to the impact of climate change. This indicated that climate change has a great effect on the availability of food in the study area. There was pest and disease outbreak among 61.3% of the respondents that were vulnerable to the effects of climate change, which indicated that climate change could lead to several negative secondary effects on crops like moist environment which is favorable to the growth of microorganisms. The quick decay of fruits and other forest produce was perceived as being serious among 57.5% of the respondents. Also, certain respondents, about 51.3% were vulnerable to flood and erosion in the study area. This conformstoan increase in the frequency of flood and erosion from periods of intense rain in areas with poor infiltration rates, potentially causing water logging and a decline in non-adapted forest as reported by NEST, 1991.

Table 3: Perceived vulnerability of respondents to climate change indicators

VARIABLES	SERIOUS		MILD		NONE	
	F	%	F	%	F	%
Reduction in growth of crops	65	(81.3)	14	(17.5)	1	(1.3)
Shortage of food	54	(67.5)	24	(30.0)	2	(2.5)
Dwindling/Undefined growing season	31	(38.8)	29	(36.3)	20	(25.0)
Pest and disease outbreak.	49	(61.3)	27	(33.8)	4	(5.0)
Scarcity of wild animals or bush meats	31	(38.8)	40	(50.0)	9	(11.3)
Drought	26	(32.5)	27	(33.8)	27	(33.8)
Quick decay of fruits and other forest produce	46	(57.5)	26	(32.5)	8	(10.0)

Depleted fruiting of fruit trees	41(51.3)	31(38.8)	8(10.0)
Reduction in root and herbs	47(58.8)	27(33.8)	6(7.5)
Causes scarcity of species	42(52.5)	31(38.8)	7(8.8)
Flood and erosion	41(51.3)	32(40.0)	7(8.8)

Note: F = Frequencies, % = Percentages in parentheses

Table 4 showed that 62.5% of respondents strongly agreed that climatic change can disrupt food availability which affects sales of non-timber forest products' collectors. This indicated that most NTFPs collectors' perception ofclimate change impact on food availability was adverse. This concurs with Kabir *et al*. (2016) who submitted that majority of NTFPs collectorsperceived change in climate had anadverse effect on productive activities in their vulnerable communities. This is followed by 52.5% of respondents who strongly agreed that climate change was affectingthe livelihood of the NTFPs collectors.

The result corroborates with the findings of (IPCC, 2007) which establishes the adverse effects of climate change on the livelihood of people in rural areas. Also, 50.8% of the respondents strongly agreed that temperature affect the wilting of crops, ripening and maturity of crops. This is in line with Lamaoui *et al*. (2018) that heat intensity is a great biotic stress to reducing forest products productivity on a global scale. Further, about 45.0% of respondents revealed that there was high incidence of pestsdue to change in temperature and rainfall pattern. Also, 44.7% of the respondents strongly agree that the high rainfall cause erosion and wash away nutrient in the soil.

Table 4: Respondents' Perception of effect of climate change on non-timber Forest products

Variables	SA F %	A F %	D F %	SDMean F %
Climate change affects the livelihood of collectors	*42(52.5)	26(32.5)	12(15.0)	0(0.0)3.4
Non-timber forest products are lost to disease infection	30(37.5)	33(41.3)	16(20.0)	1(1.3)3.2

on the field due to high relative humidity				
There is high incidence of pest due to change .01 temperature and rainfall pattern	*36(45.0)	31(38.8)	8(10.0)	5(6.3)3.2
Increase in temperature threatens forest product	35(43.8)	20(25.0)	19(23.8)	6(7.5)3.1
Temperature affect the wilting of crops, ripening and maturity of crops	*40(50.8)	28(35.0)	7(8.8)	5(6.3)3.3
Sunshine affect the productivity of crops due to length of day iephotoperiodism	*35(43.8)	17(21.3)	19(23.8)	9(11.3)3.0
Heavy rainfall cause erosion and wash off nutrient in the soil	*38(44.7)	22(27.5)	13(60.3)	7(8.8)3.1
Climate harbor pest and disease which cause reduction in crop growth	27(33.8)	28(35.0)	20(25.0)	5(6.3)3.0
Climate change can disrupt food availability which affect sales of NTFPs collectors	*50(62.5)	23(28.8)	6(7.5)	1(1.3)3.5

Note: SA= Strongly Agree, A= Agree, D= Disagree, SD= Strongly Disagree, F= Frequencies, %= Percentages in parentheses

Result in Table 5 revealed that 90.0% of the respondents were covering a large forestland area during collection of NTFPs. This is an indication of expansion of land as a coping and adaptation strategy for these forest products collectors. This finding corroborates with the submission of Bele *et al*. (2011) that there is need to increasing the forest land in order to compensate for loses due to climate change. Also, 78.8% of the respondents engaged in farming of different varieties of crops as a coping strategy to climate change. In addition, 77.5% of the respondents engaged utilization of irrigation systems for farming during the prolonged dry seasons and drought, mulching, use of fertilizers, and erosion control measures.

Further, 73.8% diversified from forest products to other cultivated arable crops like rice, beans and so on, so as to mitigate the effect of climate change. Furthermore, 60 % of the respondents engaged in diversification into non-farm activities to reduce their vulnerability to local climate and uncertainty. This corroborates with the submission of Kiani *et al.* (2021) that diversification into other livelihood activities was adopted to mitigate impact of climate change among farmers in different agro-ecological zones of Punjab, Pakistan.

Table 5: Adaptation strategies used for mitigation of climate change impact on non-timber forest products

Variables	Yes		No	
	F	%	F	%
Cover a large forestland area	*72	(90.0)	8	(10.0)
Soil and water conservation	52	(65.0)	28	(35.0)
Increase irrigation	*62	(77.5)	18	(22.5)
Use of weather insurance	16	(20.0)	64	(80.0)
Mulching	*62	(77.5)	18	(22.5)
Diversification into other livelihood activities	*48	(60.0)	32	(40.0)
Engage in farming of crops	*63	(78.8)	17	(21.3)
Soil protection through tree planting	56	(70.0)	24	(30.0)
Use of fertilizers	*62	(77.5)	18	(22.5)
Diversification into multiple crops	*59	(73.8)	21	(26.3)
Erosion control	*62	(77.5)	18	(22.5)

Note: F = Frequencies, % = Percentages in parentheses

Conclusion

The study concluded that the household are mostly headed by men, who are adults and married. Majority of the respondents had primary education. They were engaged in farming as their primary means of livelihood with the monthly income of ₦31,000 - ₦50,000.

The findings also revealed that majority of the respondents perceived that they were vulnerable to the effect of climate change as they experienced reduction in NTFPs collection and shortage of food was considered as the most serious vulnerability in Ido municipality. The findings also revealed the major effects of climate on the non-timber forest products were perceived to be high by the respondents because of its effect on farmers' livelihood and incidence of pest and disease. The findings also revealed that adaptation strategies mostly utilized by the respondents were Increase in their farm size with mixed farming, mulching, erosion control measures and utilization of irrigation.

Recommendation

Based on the findings of the study, there is need for government to engage forest extension workers in training the non-timber forest products' collectors on more adaption strategies such as tree planting and conservation that could improve their livelihood. Furthermore, Agro-climatologists should be introduced to train the farmers on weather forecast with the information and communication technology devices.

References

Akinbile, L.A., Aminu, O.O. and Kolade, R.I. (2018). Perceived Effect of Climate Change on Forest Dependent Livelihoods in Oyo State, Nigeria. *Journ. Agric. Ext.* 22 (2):1-11 Available at https://dx.doi.org/10.4314/jae.v22i2.15

Atanga, R.A. and Tankpa, V. (2021). Climate Change, Flood Disaster Risk and Food Security Nexus in Northern Ghana. *Front. Sustain. Food Syst.* 6th August, 2021. Available at https://doi.org/10.3389/fsufs

Basu, J.P. (2009). Adaptation, non-timber forest products and rural livelihood: an empirical study in West Bengal,India. *Earth and Environmental science* 6:3-8

Bele, M.Y., Somorin, O., Sonwa, D.J., Nkem, J.N. and Locatelli, B. (2011). Forests and Climate Change Adaptation Policies in Cameroon. *Mitigation and Adaptation Strategies for Global* 16: 369-385. Available at https://link.springer.com>article

Biswas, B. and Mallick, B. (2021). Livelihood diversification as key to long-term non-migration: evidence from coastal Bangladesh. *Environ. Dev. Sustain.* 23: 8924-8948. Available at https://link.springer.com

Cavendish, W. (2004). Poverty, inequality and environmental resources: Quantitative analysis of rural

households. Oxford Centre for the study of African Economies 269-279

Food and Agriculture Organization of the United Nations (2015). Climate Change and Food Security: Risk and responses. 122 pages. Available at https://www.fao.org>...

FAO (2001). State of the World Forests. FAO Forestry Paper No.140. 84pp

Huq, S. and Reid, H. (2004).Mainstreaming adaptation in development IDS Bulletin 35(3):15-21. DOI. 10.1111/j.1759-5436.2004.tb00129.x

IPCC (2007). Climate change: Impacts, adaptation and vulnerability, contribution of Working Group II to the Fourth Assessment Reportof the Intergovernmental Panel on Climate change (Cambridge UnivPress,Cambridge,Uk)

International Institute for Sustainable Development, IISD (2003). Poverty and Climate Change: Reducing the vulnerability of the poor through adaptation. 26 pages. Available at https://www.oecd.org>env

Japtap, S. (2007). Managing Vulnerability to extreme weather and climate events: Implications for agriculture and food security in Africa.

Jonah, J. (2023). Economics of non-timber forest products (NTFPs) in Oyo state, Nigeria. *IOSR Journal of Humanities & Soc. Sci*. 18(4): 1-18 Available at https://www.researchgate.net>3096...

Kabir, M.I., Rahman, M.B., Smith, W., Lusha, M.A.F., Azim, S. and Milton, A.H. (2016). Knowledge and Perception about Climate Change and Human Health: Findings from a baseline survey among vulnerable communities in Bangladesh. *BMC Public Health* 6 (266): 1-8. Available at https://bmcpublichealth.biomedcentral >...

Kiani, A.K., Sardar, A., Khan, W.U., He, Y., Gilgic, A., Kuslu, Y. and Raja, M.A.Z. (2021). Role of Agricultural Diversification in Improving Climate Change: An Empirical Analysis with Gaussian Paradigm. *Sustainability* 13: 1-15. Available at https://www.mdpi.com/journal/sustainability

Kirilenko, A.P. and Sedjo, R.A. (2007). Climate change impacts on forestry. *PNAS* 104 (50): 19697-19702. Available at https://doi.org/10.1073/pnas.0701424104

Lamaoui, M., Jemo, M., Dalta, R. and Bekkaoui, F. (2018). Heat and Drought Stresses in Crops and Approaches for their Mitigation. *Frontiers in Chemistry* 19 Available at https://frontiersin.org>full

Milledge, S. H., Gelvas I. K. and Ahrends A. (2007). Forestry, Governance and National Development: Lessons learned from a logging boom in Southern Tanzania. An overview, TRAFFIC East/Southern Africa/Tanzania Development

Partners Group/Ministry of Natural Resources of Tourism, Dar es Salaam, Tanzania. 256pp

Morakinyo, O. M., Adebowale, S. A. and Oloruntoba E. O. (2015). Wealth status and sex Differential of household head: implication for source of drinking water in Nigeria. Journal of the Belgian Public Health Association (2015)73:58, https://doi.org/10.1186/s13690-015-0105-9

NEST (1991). Nigeria's Threatened Environment: A National Profile. Environmental Study/Action Team, NEST, Ibadan.

Nzinzi, M.V. (2016). Assessment of diversity and role of non-timber forest products in the livelihoods of rural communities in Kibauni hills forest, Machakos County. 103 pages. Available at http://erepository.unonbi.ac.ke>...

Nwafor, J. C. (2007). Global climate change: The driver of multiple cause of flood intensity in sub –saharan Africa.

Onyekuru A. N. and Marchant R. (2014). Climate Change Impact and Adaptation Pathways for Forest Dependent Livelihood Systems in Nigeria. African Journal of Agricultural Research Vol. 9(24):1819-1832 retrieved from http://www.academicjournals.org/article/article1402999015_Onyekuru%20and%20M

Robledo, C., Blaser, J., Byrne, S. and Schmidt, K. (2008). Climate Change and Governance in Forest Sector. *Right and Resources Initiative* Available at https://www.researchgate.net>2598

Robinson, E.J.Z (2016). Resource-Dependent Livelihoods and the National Resource Base. *Annual Review of Res. Econs.* 8: 281-306. Available at https://doi.org/10.1146/annurey-resource-100815-095521

Salinger, M. J. (1994). Climate variability, Agriculture and Forests WMO Technical Note 196 pages. Geneva.

Sharma, R. and Bharti, N. (2020). Non-timber forest products value chain towards sustainable livelihood: Exploring linkages and trends using visual optimization network analysis. *Asian Journal of Agriculture and Development* 17 (2): 105-118. Available at https://ageconsearch.umn.edu>...

The World Bank (2008). Biodiversity, Climate Change and Adaptation: Nature-Based Solutions from the World Bank Portfolio. 112 pages. Available at https://documents.worldbank.org>...

United Nations Framework Convention on Climate Change, UNFCCC (2007). Impacts, vulnerabilities and adaptation in developing countries. 68 pages. Available at https://unfccc.int>publications

United States Environmental Protection Agency; USEPA (2017). Climate Impacts on Agriculture and Food Supply. Available at

https://19january2017snapshot.epa.gov >...

USAID (2007). Adapting to Climate Variability and Change: A guidance manual for Development Planning. 31 pages. Available at https://pdf.usaid.gov>PNAD...

Zoellick, R. B. (2009). Climate smart future.The Nation Newspapers.Vintage press Limted, Lagos,Nigeria. Pg.19