

IMPACT OF CLIMATE CHANGE ON THE VARIATIONS OF NON-TRADITIONAL FOREST PRODUCTS IN THE BIRIM CENTRAL MUNICIPALITY, GHANA

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Abstract: Non-Traditional Forest Products which are biologically cultivated products from the forest tend to aid the survival or the livelihoods of the local people. In this regard, occurrences of changes in the quantity of these non-timber forest products has become an issue of concern as the local people tend to suffer indirectly from certain actions they made which has resulted to a change in climate. Climate Change has become a threat to livelihoods due to abnormalities in the rainfall and temperature patterns which diminishes the amount of Non-Traditional Forest Products over comparable periods. Therefore, the incorporation of adaptation measures can serve as ways to reduce vulnerability of the local people to the challenges posed by climate change. However, the aim of this research study undertaken was to provide a credible assessment of how climate change has an impact on Non-Traditional Forest Products in the Birim Central Municipality, also make significant recommendations for the practice of sustainable adaptation measures by local people situated in the vicinity.

Keywords: Non-Traditional Forest Products, climate change, biodiversity, livelihood, adaptation measures.

1. INTRODUCTION

Non-Timber Forest Products (NTFPs) are, in broadest sense, biological resources collected from the wild by rural people for direct consumption/income generation on a small scale (Shackleton, 2004). Non-Traditional Forest Products (NTFPs) is defined as “biological resources of plant and animal origin, harvested from natural forests, manmade plantations, wooded land, farmlands, trees outside forests and or domesticated (FAO, 2008). Collected in natural forests, these products are usually harvested and processed in small amounts. These products fall within four general categories: edibles such as mushrooms; medicinal and dietary supplements, including ginseng, floral products such as moss, grape vines, ferns, and other plant products used for decorations; and specialty wood products including hand crafted products such as carvings, utensils, and containers (Hammett, 1998). The NTFPs have attracted global interest due to the increasing recognition of the fact these forest resources play an important role in meeting the needs of rural communities for food, poverty reduction and sustainable management of forest resources and livelihoods improvement (FAO, 2006).

Climate change is one of the greatest environmental, social and economic threats facing our world today. Scientific evidence confirms that human activities such as burning of fossil fuels (coal, oil and natural gas), agriculture and forest clearing have increased the concentration of greenhouse gases in the atmosphere (IPCC, 2007). The earth’s average temperature is rising and weather patterns are changing. Often, the poor are dependent on economic activities that are sensitive to the climate. For example, agricultural and forestry activities depend on local weather and climate conditions; a change in those conditions could directly impact productivity levels and diminish livelihoods (USAID, 2007). It is widely recognized that climate change has caused substantial impacts and variations on forested ecosystems (Kirilenko and Sedjo, 2007).

In Ghana, the abundance of most non-traditional forest products species is rather low due to the significant variation in the supply or production of Non-Traditional Forest Products (NTFPs) (Ahenkan &Boon, 2011). With respect to ecological conditions, differences in altitude, agricultural activities which destroys the forests that serves as a habitat for NTFP

species and the drainage conditions causes a significant variation in the distribution and abundance of NTFP species (Van Dijk, 1999b). According to FAO (2009), climate change negatively affects the basic elements of food production such as soil, water and biodiversity. Therefore, climate change is a challenge to Ghana, and it affects the local people in diverse ways. These adverse effects of climate change facing the Ghanaian economy are due to lack of capacity to undertake adaptive measures to address environmental problems and socio-economic costs of climate change (Owusu et.al, 2013). Birim Central Municipality experiences substantial amount of rainfall (GSS, 2014). The climatic conditions in the Municipality conform to the general conditions that prevail within the middle belt of Ghana (GSS, 2014). Hence, the impacts of climate change on the variation of non-traditional forest products has already been experienced by communities around forest reserves the municipality. Significantly, future development of NTFPs offers a potential for increasing income, expanding opportunities and diversifying enterprises in rural areas (Ahenkan et al, 2011). This study provides an assessment of how ecological challenges affect the variations of NTFPs in Birim Central Municipality in order to formulate suitable recommendations for the practice of adaptation and mitigation procedures by the rural dwellers in the vicinity.

2. MATERIALS AND METHODS

Study Area

The Birim Central Municipal Assembly is in the south-western corner of the Eastern Region (www.statsghana.gov.gh). The Birim Central Municipality shares boundaries with Birim North and Kwabebirim districts to the North, West Akim to the East, Agona to the South, Birim South to the West Municipality (www.mofa.gov.gh). The Administrative Capital of the municipal is Akim Oda (www.ghanadistricts.com). The population of the municipality according to 2010 population and housing census stands at 144,869 with 69, 304 males and 75,565 females (Ghana statistical service, 2010). The major economic activities are agriculture (50.9%), trade and commerce (20.1%), industry (13.1%) and services (hotels, banking etc.) (www.statsghana.gov.gh).

The Municipality falls within the semi-deciduous forest zone characterized by *Triplochiton scleroxylon* (wawa), *AntarisAfricana* (Kyenkyen) *clorophoraexcels* (Odum) *CeibaPentandra* (Onyina) (www.mofa.gov.gh). This vegetation zone is characterized by tall trees with evergreen undergrowth (www.statsghana.gov.gh). The Municipality falls within the wet semi-equatorial climatic zone and therefore experiences substantial amount of precipitation (www.mofa.gov.gh). This is characterized by a bi-modal rainy season with rainfall between 150cm and 200cm reaching a maximum during the two peak periods of May/June and September/October

(www.mofa.gov.gh). Average temperature ranges between 25.2⁰C minimum and 27.9⁰C (www.mofa.gov.gh). Relative humidity is about 56 and 70 percent (www.mofa.gov.gh).



Source: Ghana Statistical Service (GSS, 2016)

Figure 1: A map showing the study location which is the district of Birim Central Municipal

3. METHODOLOGY

Sampling design and size

Simple random sampling technique was employed for the selection of respondents coupled with the mixed method approach. Simple random sampling (also referred to as random sampling) is one of probability sampling strategy. In simple random sampling, each member of the population is equally likely to be chosen as part of the sample. It has been stated that “the logic behind simple random sampling is that it removes bias from the selection procedure and should result in representative samples (Gravetter, F. J & Forzano, L.B., 2011). The communities for the study are selected purposefully because they include the major forest areas namely; Aproxomase, Akim Asene, Akim Akroso and Akim Oda. Also, the mixed method approach comprises of the qualitative and quantitative methods. A qualitative research entails the use of individual opinions, expressions, and subjective interpretations about the research problem. On the other hand, the quantitative approach encompasses using numbers to describe data or variables, establish relationships among variables, and ascertain whether two or more variables are significantly different. In the case both approaches will be merged to produce viable results. The sample size of the study is sixty (60) household respondents with respect to each of the four communities and taking into consideration the age, gender, educational status, occupation and the number of years stayed in the community.

4. DATA ANALYSIS

Results and data from the study was analyzed by using Statistical Package for Social Sciences (SPSS) version 16.0 software for Windows. Descriptive statistics such as charts, tables and diagrams was used to obtain information through personal observation, interview guide and questionnaires among the four communities namely Aproxomase, Akim Asene, Akim Akroso and Akim Oda. Both qualitative and quantitative methods (mixed methods) of data collection employed were to attain information through personal observation, interview guide and questionnaires among the four communities in the municipality.

Pilot study

To buttress the research undertaken a pilot study was conducted at Forestry Commission of Ghana (Headquarters) in the Birim Municipality. Two forest officers from the climate change unit gave necessary feedbacks, saw to it that the pilot study was fully completed and provided corrections to improve the questionnaire. However, the aim of administering the questionnaires was to obtain adequate responses to the questionnaires pertaining to the research. The first section, of the questionnaire collected demographic data of the respondents, the second part collected data identifying the different types of NTFPs available in municipality, and the third section collected data looking at the significance, the perception and trends of utilization of NTFPs, the fourth part collected pertaining to effects of climate change on NTFPs in the Birim Central Municipality, the fifth part collected data on adaptation alternatives respectively.

5. RESULTS AND DISCUSSION

Profile of the respondents

The field research undertaken, depicts that majority of the respondents were between the ages of 31-45 years and 46-60 years which accounts for 60% of the sample size, the next age category of the respondents which was the next higher response was 22%, it conforms to those within the ages of 18-30 years, while the lowest response are those above 60 years which accounted for 18% of the sample size. In terms of the sexes, out of the 60 respondents 82% were males while 18% were females of the total sample size. Thus, majority of the respondents engaged in farming activities which accounted 50%, followed by the traders with 40%. Hence, 10% worked in the public service and 2% were noted as unemployed. Also, the duration of stay in a community was properly examined to find out how long the people have lived in the community to assess their knowledge on the variation of Non-traditional products over time. The highest response of the 25% of the respondents were noted to have stayed in the community for 41-50 years, followed the next high category of 20% which were those who have lived in the community for 21-30 years, 18% of the respondents had lived in the community for 50 years and above and the lowest category had stayed in a community for 1-10 years.

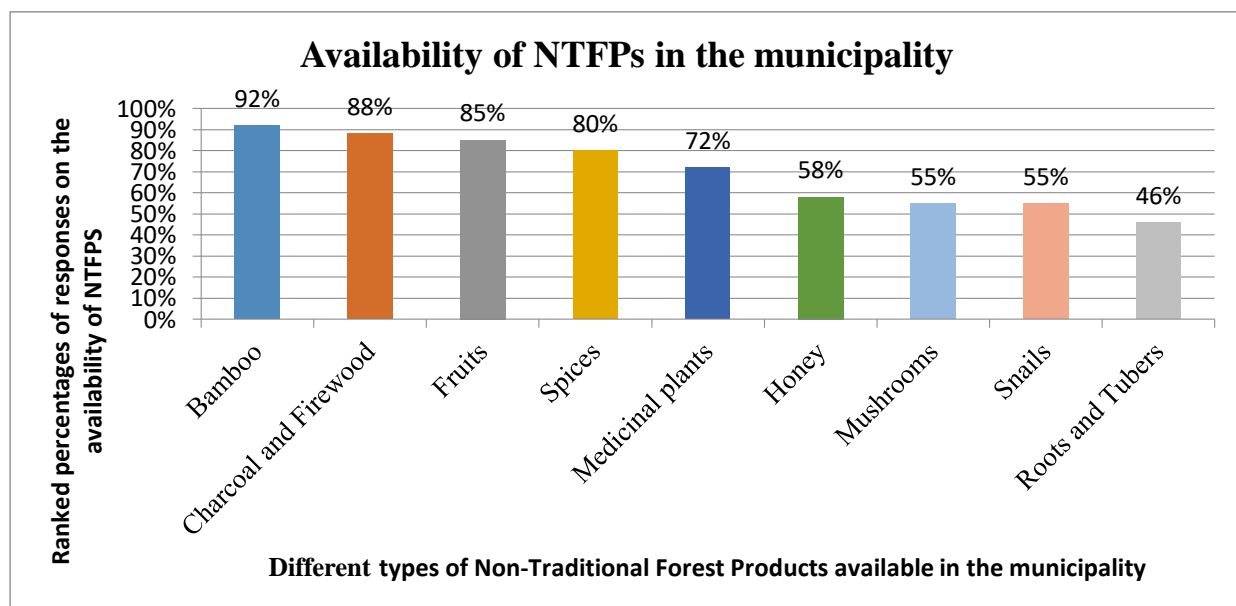
Table 1: Gender of Respondents

GENDER	FREQUENCY	PERCENTAGE (%)
MALE	49	82
FEMALE	11	18

Source: (field survey, 2020)

DIFFERENT TYPES OF NTFPs AVAILABLE IN THE STUDY AREA

The Birim Central municipality is endowed with abundance of forest resources which forms an integral part of the livelihoods of its inhabitants and as part of the research findings, it was necessary to delve in to the common types of Non-Traditional Forest Products available in the Birim Central Municipality for over the past 20 years and till date. Although the respondents made comments about the scarcity of many valuable NTFPs, some forest products are still in a substantial amount or quantity. The common types identified were Mushrooms, Snails, Medicinal plants, Bush meat, Roots and tubers , Fruits, Honey , Spices, Charcoal and firewood and bamboo. With the aid of the Likert –Type Response Anchors, the NTFPs were categorized into levels of abundance respectively code 1 was assigned to Very abundant, 2- Abundant, 3-Rarely Abundant and 4- Scarce in order to differentiate between the NTFPs which are known to be in abundance and others which are rarely abundant from the past to the present. Out of the 60 respondents, the Non-traditional forest product which constituted the highest in terms of level of abundance is bamboo which summed up to 92% of the responses as very abundant among the communities which were understudy in the municipality. Followed by Charcoal and firewood which was 88% ,Fruits-85%, Spices-80%, Medicinal plants-72%, Honey- 58%, Roots and tubers-46% and the least abundant or rarely abundant are mushrooms and snails which constituted 55% due to the occurrence of low rainfall over the past few years



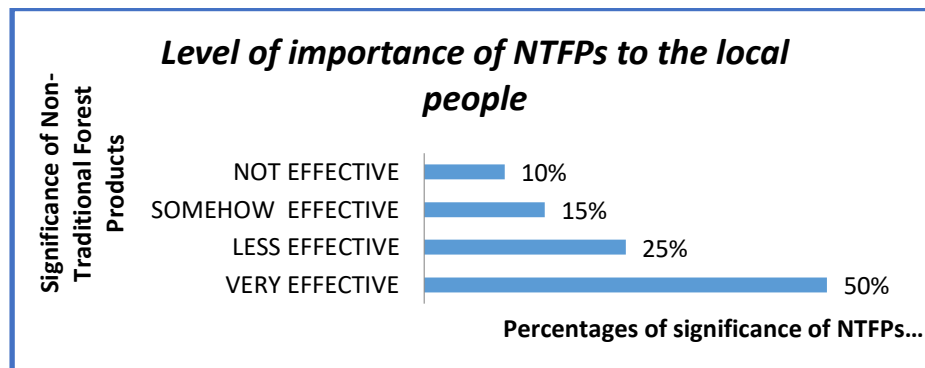
Source; Author's construction, 2020

Figure 2: Different types of non-traditional forest products (Ranked from highest amount of availability to lowest amount of availability).

SIGNIFICANCE, ACCESS AND UTILIZATION TRENDS OF NTFPS TO THE LOCAL PEOPLE

On the basis of significance of the NTFPs in relation to the responses accumulated, 52% respondents out of 60 strongly agreed that NTFPs adequately provide access to safe and nutritious food thereby reducing hunger and unhygienic food rates, followed by 48% who agreed strongly that income is generated to a large extent through the commercialization of NTFPs mainly due to the increasing demand of these forest products they earn some funds and also transporting it to other regions aids them to get more money, whereas 42% strongly agreed that curbing poverty is one of the benefits derived

from the collection of NTFPs, in creating employment or job avenues 25% of the respondents came to consensus that indeed in the secondary utilization aspect many people tend to sell or trade these NTFPs to cater for their survival.



Source: Field survey, 2020

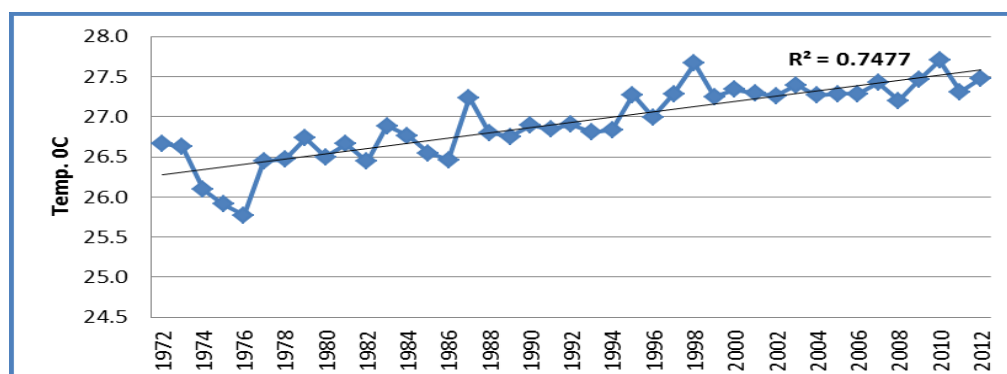
Figure 3: Significance of NTFPs in the Birim central Municipality

EFFECTS OF CLIMATE CHANGE ON THE NTFPs IN THE BIRIM CENTRAL MUNICIPALITY

In the Birim Central Municipality, climate change has caused more harm than good. The factors causing a change in the mean state of the climate is strongly attributed to human activities and perhaps some natural factors. The respondents of the various communities situated in the municipality reported to have experienced a significant change in their climate pattern as they do not receive a greater amount of annual rainfall as compared to the past. Currently speaking, low rainfall has been an issue of concern because it impedes them from accessing most Non-Traditional Forest Products which flourish in heavy rainfall seasons. In relation to the respondents views on whether the average weather conditions of the community has changed over the past 20 years, out of the 60 respondents in which majority have stayed in the municipality for more than 20 years, 63% strongly agreed that indeed, the climate has really changed now as compared to the past. Climate change as it manifests in changing weather patterns particularly high temperatures, rainfall variability, dry spells or drought and many extreme weather events has impacted the availability of the Non-Traditional Forest Products causing a variation and shortage or decline in the amount of these forest products.

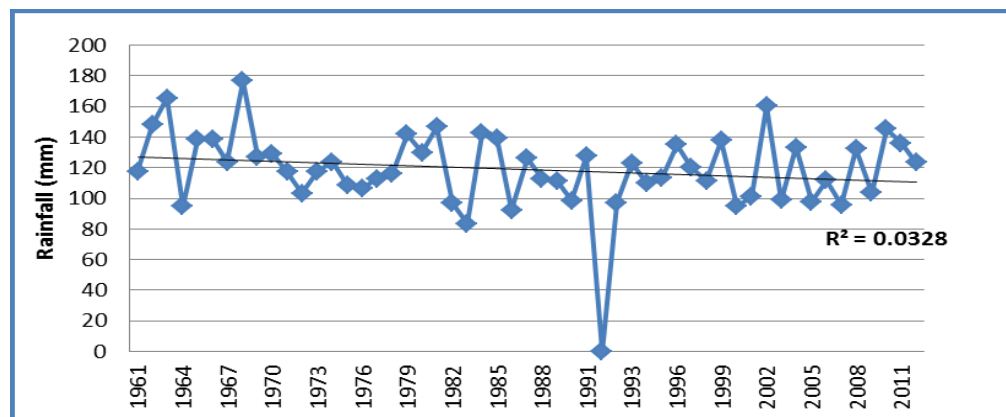
CLIMATE TRENDS OF THE BIRIM CENTRAL MUNICIPALITY OVER COMPARABLE PERIODS

Climate data from the Ghana Meteorological Agency indicates a variation in rainfall and temperature pattern of the study area. Thus, this data is to reveal the credibility of the responses given as to whether the effects of climate change really causes a variation in the Non-Traditional Forest Products.



Source; Accessed from Gmet, 2018

In 1972, there were some undulating changes in the temperature trends but recent temperatures depict that the temperature trend has shown no decrease rather there has been a rapid increase in the trend this has placed unforeseen challenges for the future climate data records (figure 4). Comparatively, the rainfall trend which was very high from 1961-1964 but it has relatively decreased in 1991- 1993 on wards (figure 5). However, both the relative increase in temperature trends and the decrease in rainfall trends emanating from climate change have posed an impact on the variation of Non-Traditional Forest Products.



Source: Based on data from Gmet (2014)

Figure 5: Rainfall trend (Mean annual rainfall) of the study area from 1961-2012)

EFFECTIVENESS OF FOREST MANAGEMENT PRACTICES AND ADAPTION ALTERNATIVES

To counteract these impacts or effects of climate change some actions have been implemented to adapt effectively to climate change such as preventing the cutting down of trees, the implementation of good agricultural practices, participation in co-operative adaptation alternatives, practicing afforestation and putting a halt to bush burning. In view of this, 57% of the respondents mentioned that these forest management practices are less effective, 30% said the measures were effective, 10% indicated that these measures were not effective and 3% said these adaptation strategies is somehow effective to them. The local people addressed the ineffectiveness of these adaptation strategies to lack of logistics on the part of the forest management, the rampant occurrence of bush fires arising from dry spells as a result of the friction between most bamboo trees that spark up the forest fires and the local communities do not participate in the adaptation measures.

However, to counteract these effects posed by climate change on the variation of Non-Traditional Forest Products coping and adaptation mechanisms coupled with local knowledge and innovations such as participation in co-operative adaptation alternatives, improving good agricultural practices, averting deforestation and bush burning can be implemented by the forestry management to reduce or curtail the climate hazards and risks. From the field survey it was observed that the people has little knowledge on these coping strategies, thus they are not aware that their actions and inactions are increasing the greenhouse gases contributing to the increase in climate change rates. On the part of the forestry sector situated in the study area, they do not have sufficient innovations and practices to tackle these climate hazards and risks. The way forward is to provide awareness on the causes of climate change to the indigenous people from the municipality and how the alteration of climatic patterns can affect the abundance of Non-Traditional Forest Products over a long period of time.

6. CONCLUSION

Generally, the research survey indicates that the indigenous people lack an in depth knowledge of how some activities they engage in contribute to the increase in the greenhouse effects. Leading to climate change and how the forest is significant in storing carbon dioxide but from experiencing some drastic effects of climate change they sought to come to terms with the fact they need to practice the adaptation strategies in order, to lessen the impact of climate change on their livelihoods. Also, ensure that the Non-Traditional Products do not become extinct due to decrease in rainfall trends and the increase in temperature trends which is causing a massive variation on these biologically cultivated forest products.

However, the operation of the forest management practices implemented by the government have been noted as ineffective as the indigenous people complained that the forestry commission division in the study area do not engage in afforestation. Also, there is no form of awareness, education, participation of local people in policy making and insufficient logistics have not been applied or provided to curtail the impact of climate change on the Non-Traditional Forest Products.

REFERENCES

- [1] Adger, W.N. (1999). Social Vulnerability to Climate Change and Extremes in Coastal Vietnam. *World Development* 27(2): 249 – 269.
- [2] Ahenkan A, Boon E (2008). Enhancing food security, poverty reduction and sustainable forest management in Ghana through Non-Timber Forest Products farming: Case study of Sefwi Wiawso District, published online by GRIN Publishing at www.grin.com/de/preview/.html(Retrieved (August, 8, 2010).
- [3] Ahenkan, A. & Boon, E. (2011). Non-Timber Forest Products (NTFPs): Clearing the Confusion in Semantics. *Journal of Human Ecology*, 33(1): 1-9.
- [4] Bahl, N. (1994). *Handbook on mushrooms*. Oxford and IBH Publishing CO. Pvt. Ltd., Delhi, India
- [5] Belcher BM (2003). What isn't a NTFP? *International Forestry Review*, 2: 161–168.
- [6] Climate Change (2013): *The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, and G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- [7] Chandrasekharan C (1995). Terminology, definition and classification of forest products other than wood. In: Report of the International Expert Consultation on Non-Wood Forest Products. Yogyakarta, Indonesia. 17-27 January 1995. Non-wood forest products No. 3. Rome: FAO, pp. 345-380.
- [8] Charles, S. (2005) *Forest and Woodland*. Africa Environment Outlook 2, Our Environment, Our Wealth, 196-225.
- [9] Dansi et al., (2008) Traditional leafy vegetables and their use in the Benin Republic Genetic Resources and Crop Evolution, 55:1239-1256.
- [10] De Beer JH, McDermott M 1989. *The Economic Value of Non-Timber Forest Products in South- East Asia*. Amsterdam, the Netherlands Committee for IUCN.
- [11] E. Chidumayo, (2011) "Climate change and the woodlands of Africa," in *Climate Change and African Forest and Wildlife Resources*. Chidumayo, D. Okali, G. Kowero, and M.Larwanou, Eds., pp. 85–101, African Forest Forum, Nairobi, Kenya.
- [12] Easterling, W.E., Aggarwal, P., Batima, P., Brander, K.M., Erda, L., Howden, S.M., Kirilenko, A., Morton, A., Soussana, J.F., Schmidhuber, J. and Tubiello, F.N. (2007). Food, fibre and forest products. In: Parry, M.L., Canziani, O.F., Palutikof, J.P., Hanson, C.E. and Van der Linden, P.J. (Eds.). *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the IPCC*. Cambridge University Press, Cambridge, UK, pp. 273 – 313.
- [13] Food and Agriculture Organization (FAO) 2006. *Can Non-Wood Forest Products Help Contribute To Achieving The Millennium Development Goals?* Rome: FAO, pp. 2-14.
- [14] FAO (2008). *An Information Bulletin on Non-Wood Forest Products*. Non-Wood News, FAO, Rome, 17:12-21.
- [15] Ghana Statistical Service (GSS) (2012): *2010 Population and Housing Census: Summary Reports of Final Results*. GSS, Accra.
- [16] Golam R, Madhav K, Ram PS (2008). The role of non-timber forest products in poverty reduction in India: Prospects and problems. *Development in Practice*, 6: 779 – 788.
- [17] Gravetter, F.J & Forzano, L.B. (2011) "Research Methods for the Behavioural Sciences" Cengage Learning p.146
- [18] Hammett, A.L. and J.L. Chamberlain (1998): Sustainable Use of Non-Traditional Forest Product. Alternative Forest Based Income Opportunities. In: *Natural Resources Income Opportunities on Private Land Conference*. April 5-7th 1998. Hagerstown, Maryland Ed. Jonathan, S.K. Pg 141-147.

- [19] IPCC, I, P. (2007) Climate change 2007, Mitigation of Climate change. Cambridge, United Kingdom and New York, NY, USA XXX pp: Working Group III Contribution to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.
- [20] IPCC, 2007. Summary for Policymakers. In: Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K.B., Tignor, M. and Miller, H.L. (Eds.). Climate change 2007: the physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK.
- [21] Owusu et al. (2013 research) An Assessment of climate and climate change of courses and at the University of Ghana. Tertiary Education Series, 1-11
- [22] Shackleton, Shackleton S (2004) the importance of non-timber forest products in rural livelihood security and safety nets: a review of evidence from South Africa. South African Journal of Science 100: 658-664.
- [23] Van Dijk, J.F.K.W (1996b) An Assessment of non-wood forest product resources for the development of sustainable commercial extraction. In Sunderland, T.C.H., Clark, L.E. and Vantome, P. (eds.) Non-wood forest products of central Africa: current research issues and prospects for conservation and management, Rome, Italy. Pp.37-50.