EFFECT OF SOCIO-ECONOMIC CHARACTERISTICS OF FARMERS ON DEFORESTATION ADAPTATION STRATEGIES IN MUBI-SOUTH LOCAL GOVERNMENT AREA OF ADAMAWA STATE, NIGERIA

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Abstract

The study examines the effect of socio-economic characteristics of farmers on deforestation adaptation strategies in Mubi South Local Government Area of Adamawa State, Nigeria. Primary data were collected from 120 farmers using purposive and random sampling techniques. The data collected were analysed using descriptive statistics, Likert-Scale and Multiple regression analysis. Result of the analysis revealed that most (86.7%) of the respondents were within the ages of 20-50 years, educated (97.5%), male (86.7%) and married (70.0%) with household sizes of 6-10 persons (58.3%). Most of the respondents (91.7%) had between 11 and 21 years of farming experience. Similarly, the use of fuel efficient wood stove, use of corn straw for cooking, domestication of medicinal plants and conservation agriculture were ranked foremost among the deforestation adaptation strategies being used by the respondents in the area. In determining the relationship between socio-economic characteristics of the respondents and deforestation adaptation strategies, the result of the multiple regression used shows that, age, education level, farming experience and extension contacts positively influences deforestation adaptation strategies. Among the constraints faced by the respondents include: lack of capital (23%), resistance to change (22.3%), and lack of awareness (22.0%). It is recommended that Government and other NGOs should provide adequate funding to engage in various deforestation adaptation strategies by sustaining in its environmental initiative programmes under the current agricultural transformation agenda and efforts should be intensified in educating farmers through concerted efforts of extension agents and agricultural radio programmes with the view of ensuring proper guide and educating farmers on effective deforestation strategies to be adopted.

***Key words*:** *Adaptation, Deforestation, Characteristics, Farmers, Socio-economics, Strategies*

INTRODUCTION

Forest provides cover to the earth's land surface and many environmental benefits including a major role in the hydrologic cycle, soil conservation, and prevention of climate change and preservation of biodiversity (Ekhuemelo and Akeh, 2015). Forest resources can provide long-term national economic benefits; at least 145 countries of the world are currently involved in wood production (Anderson, 2006). Deforestation is also known as forest decline, forest fragmentation and degradation, loss of forest cover, and land-use conservation. Deforestation is defined as clearing of any area of its natural vegetation cover, which normally leads to decrease in plants population resulting in loss of plant biodiversity (Aliyu *et al.*, 2014). It is also defined as the indiscriminate felling of trees without their replacement (Mustapha *et al.*, 2012).

The contemporary world is facing an environmental crisis on account of heavy deforestation. For years, remorseless destruction of forest has been going on and we are unable to comprehend the dimension until recently. However, it is obvious that the area of tropical rainforest is diminishing and the rate of tropical rain forest destruction is escalating worldwide, despite increased environmental activism and awareness (Docena, 2010).

According to Becek and Odihi (2008), human activities are globally recognized as the principal cause of deforestation. Energy shortages are the greatest challenge, particularly, in rural areas of Nigeria. For instance, grid electricity and other

conventional sources of energy are not reliable or in short supply. Nigeria has a population of over 170 million people with an average population growth rate of 2.5% (Food and Agriculture Organization, 2009).Fifty two percent (52%) of the population live in the rural areas with 70.8% in absolute poverty and living on less than US $1.25 per day and do not have enough to pay for fuel (World Bank, 2006). With this population growth and without concomitance of economic growth or technological advancement the high rate of deforestation is unavoidable. According to the United Nation's Framework Convention on Climate Change (UNFCCC, 2010), the overwhelming direct cause of deforestation is agriculture; with subsistence farming responsible for 32%, logging 14% and fire wood removal make up 5%. Nigeria has the worst deforestation rate in the world, which can be attributed to increase in population with high poverty level bulk of the population depend on forests for their energy needs (International Institute of Tropical Agriculture, 2011).

In an attempt to reduce the effects of deforestation on livelihoods, farming households were compelled to develop some adaptation strategies, as farming households responds to changing environmental circumstances in a variety of ways. Thus, it is experiential that the survival attitudes caused by deforestation encouraged the development of local people consciousness about environment and its conservation (FAO, 2009). There are different ways of adapting to deforestation in agriculture among which include; crop diversification, mixed crop-livestock farming systems, use of alternative sources of energy, domestication of medicinal plants, conservative agriculture, using different crop varieties, changing planting and harvesting dates, and mixing less productive, drought resistant varieties and high-yield water sensitive crops are among the important adaptation option that farmers uses.

Every year, about 13 million hectares of forest are converted to other land uses (FAO, 2010), leading to biodiversity losses, soil erosion, and massive carbon dioxide (CO_2) emissions. At the same time, demand for timber products is rapidly increasing, especially in the developing world. FAO (2009) projection mentioned an annual worldwide increase of 1.5% of saw wood consumption, 3.3% of wood-based panels and 3% of paper for the 2005-2020 period. Agricultural expansion is the major cause of deforestation. Indeed about 70% of the total deforestation in the 1990s was credited to agricultural expansion (Eleri *et al.*, 2012). Over the years, sustainable management of forest resources has been of primary concern due to its potentials impact on biological diversity and importance in maintaining global ecological function (Areola, 1987) as cited by (Adefila and Madaki, 2014). In spite, of its importance, the natural tropical high forest continued to diminish rapidly in the African continent, thus leading to dwindling sustainable forest management. Nigeria could face the possibility of timber and fuel wood scarcity towards the end of the century. It is predicted that within the next fifty years, unless adequate measures are taken, most humid tropical forestland area in Africa could be transformed into unproductive land and the deterioration of the Savannah into desert will be accelerated (Munich, 2010).

To combat the emerging environmental problems many nations across the globe have been involved in afforestation and reforestation on the already deforested and un-utilized lands. In Nigeria, afforestation programme started after the amalgamation in 1914, and initially it was directed against desertification (Udofia *et al.*, 2011). But the programme has been popularized through the annual tree planting campaign exercise started in 1981 throughout the country (Udofia *et al*., 2011). In addition, several efforts are being made by both the federal, state and local governments towards reclaiming the various degraded and marginal lands in the various parts of the country. Such efforts are being implemented by the recently established Agency for the Great Green World, Forestry Research Institute, Federal College of Forestry Resources among others. These strategies were all aimed at increasing global and national concerns in addressing the issues of deforestation. However, there has not been any empirical study into the effects of socio-economic characteristics of the respondents on deforestation adaptation strategies in the study area. Given the key roles, they play in adaptation to deforestation to improve their socio-economic characteristics and farming activities. It is therefore, imperative to analyse the adaptation strategies employed by farmers to deforestation in Mubi South Local Government Area of Adamawa State, being an area bordering with fast approaching Sahara in Nigeria. Consequently, the study answered the following research questions:

i. What are the socio-economic characteristics of the respondents?

ii. What are the adaptation strategies employed by the respondents in the study area?
iii. What are the effects of socio-economic characteristics of the respondents on adaptation strategies?

iv. What are the constraints faced by respondents in adaptation to deforestation in the study area?

MATERIALS AND METHODS

The study was conducted in Mubi South Local Government Area of Adamawa State. Mubi South is located in the North Eastern Part of country. It lies between latitude $10^0$30' and $10^0$05 North of the equator and between longitude 13^0 10' and $13^0$30' East of the Greenwich Meridian, having an average elevation of about 400m to 1500m (Adebayo, 2004). The area falls within Sudan Savannah belt of Nigeria's vegetation zones with short grasses, shrubs, and tall trees. (Adebayo, 1999). Dry season lasts for a minimum of five months (November –March) while the wet season spans from April to October. Annual rainfall ranges from 900mm to 1050mm (Adebayo, 1999). The area has a land mass of 1,261.24km^2 and population density of 187.2 per square kilometers (National Population Commission, 2006). The area is bounded by Mubi North Local Government Area is bothered by Mubi North from the North, Cameron Republic to the East and Maiha Local Government Area to the West.

The major economic activities of the inhabitants are agriculture (crop and livestock production). There are also civil servants and small-scale traders among them. The major crops grown in the area include; maize, sorghum, cowpea, millet and groundnut. During the dry season, some residents engage in cattle fattening (Adebayo, 2004).The dominant ethnic groups in the area are Gude, Fulani and Hausa (Adebayo, 2004). Similarly, other ethnic groups from different parts of Nigeria and other countries also resides in the area.

Data for this research were collected from primary source with the aid of semi-structured questionnaire supplemented by verbal interview to the respondents during survey where they cannot read or write. First stage involved purposive selection of eight out of ten wards in the study area (worse affected by deforestation). The list of the registered farmers obtained from the Adamawa Agricultural Development Programme (ADADP) office was used as sampling frame.

The second stage of the sampling was obtaining the list of 1920 farmers from the selected wards of Mubi-South local Government Area of Adamawa State. Finally, 120 respondents were randomly selected using proportionality factors adopted by Adebayo and Olayemi (2005) and the formula is expressed as:

$S = \frac{\rho}{p} \cdot \frac{Q}{1}$ …….. (1)

Where:

S = Total number of respondents sampled
ρ = Population of farmers in each ward
P = Total population of farmers in the study area
Q = Total number of questionnaires administered

Both descriptive and inferential statistics were employed to analyse the data. Descriptive statistics include (frequency distribution, percentages and mean) to achieve objective i and iv. While 3-point likert ratings were employed to analyse objective and ii and inferential statistics (multiple regression) was used to achieve objective iii.

Descriptive statistics is expressed as;

Descriptive statistics

$$X = \sum \frac{fx}{n} \quad \text{..... (2)}$$

Where X = mean, ∑fx = Sum of individual observation and

n = Sample size

Likert – type scale

The respondents were categorized in accordance to three point likert-type scale (very great extent, great extent and little extent) to determine the level of deforestation adaptation strategies employed by the respondents, with mean score of equal and above the cut-off mean of 2.5 was declared as important deforestation adaptation strategies employed by the respondents and any mean lower than 2.5 was classified as less important.

A = Number of responses per category
N = Sampling size
Z = Likert score for each category

(A x Z /N) …… (3)

Multiple regression analysis

Multiple regression analysis was used to determine the effect of socio-economic characteristics on the deforestation adaptation

strategies employed by the respondents. Various functional forms (linear, semi-log, exponential and double log) were used. Linear function gave the best fit and is explicitly stated as;

$Y = bo + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + \mu$…… (4)

Y = Adaptation to deforestation strategies (% number of adaptation strategies used by the respondents).

X_1 = Age (years)

X_2 = Gender (Male = 1: Female = 0)

X_3 = Level of education (Number of years spent in school)

X_4 = Farming Experience (Years)

X_5 = Extension contact (number per year)

X_6 = Farm size (Ha)

μ = Error term

RESULTS AND DISCUSSIONS

Respondent's Socio-economic Characteristics

Table 1 shows the age of the respondents. The result shows that majority (86.7%) of the respondents were within the ages of 20-50 years, while the remaining 13.3% were between the ages of 51 and 70 years. This indicates that majority of the respondents were youth, more energetic and could afford to engage in agricultural production and other non-farm economic activities, therefore labor demanding strategies could be employed. This is in line with the findings of the studies of Oseoneoba (1992) and Mustapha *et al.* (2012) who reported that labor demanding strategies could be employed by the young farmers than the older farmers. The Table revealed that majority (86.7%) of the respondents were male, while female constitute only 13.3% in the study area. The possible reason for this could be attributed to labor intensive nature of employing deforestation strategies, which the male can withstand than the female respondents. This finding is in consonance with that of Krishna, (2004) who stated that more male are found to have engaged in forest related activities than their female counterparts because of its labor intensive nature. Marital status refers to the categories of the respondents involved in the study as to whether they are married or otherwise. The table shows that the marital status of the respondents. It was revealed that 70.0% of the respondents were married, while (26.7%) were single and (2.5%) and (0.8%) accounted for the rest widowed and divorced respectively. This may be due to the fact that married respondents are more engaged in the strategies because they have to farm to feed their family, therefore they have to engaged in these activities to prevent the effect of deforestation on their farms so as to improve their productivity and invariably leading to increase in their income, social and economic requirements. The distribution of the respondents by household size as presented in this table shows that most of the respondents (58.3%) have household size of 6-10 persons, while about 28.3% have household size of 1-5 persons and 13.3% have household size of 11 persons and above. This implies that adaptation strategies that will demand intensive labor could be easily met by the respondents. This is in agreement with the findings of Gwary (2010). There are a lot of research findings which asserts that, household size or dependency ratio affects the adaptation of strategies to deforestation (Mustapha *et al*., 2012). The result further, shows that respondents with no formal education constitutes only 2.5%, while majority (97.5%) had one form of education or the other which include primary education, secondary education, National Certificate in Education / Diploma, Bachelor of Science/Higher National Diploma and post graduate studies. The result shows that majority of the respondents were literate and this implies that the respondents could apprehend the techniques of adaptation strategies against deforestation that may likely come their way. This agrees with the findings of Van de Giesen *et al*. (2010) who opined that literacy level could improve the adoption of strategies for adaptation to deforestation. Farmers experience is critical to any adjustment due to deforestation. Okulona (2010) revealed that an experienced farmer would observe faster and better changes from the onset of rain, the prevailing pest incidences, desertification threats and poor

yields due to drought and flooding. The result of respondents' years of farming experience shows that 91.7% of the respondents had farming experience of between 11 and above 21 years of farming experience. The implication could be that they employ adaptation strategies against deforestation base on their experience. Primary occupation refers to the major occupation engaged by the respondents for a livelihood. The table shows the respondents' primary occupation. A large proportion (60.8%) of the respondents had farming as their primary occupation. This can therefore, enable them to make use of available natural resources to promote food security. This finding is in line with those of Oladosu *et al*. (2002) who said that, rural Nigeria is characterized by small scale agrarian livelihood as well as certain other primary production activities. Farm size refers to actual farm size the respondents used for the cultivation of agricultural products. The table indicates the respondent's farm size. The result shows that majority of the respondents (82.5%) had between 1 and 5 hectares of land for cultivation. While 12.5% had a farm size above 5 hectares and the remaining 5.0% had less than one hectare. This shows that about 87.5% of the respondents are small-scale farmers who usually depend on the use of energy and crude implements for production activities. This implies that farmers in the study area were small-scale farmers operating at subsistence level. This corroborates Ofuaku's (2011) observation where he asserted that farmers in Central Agricultural Zone of Delta State whose mean farm size was 3.5 hectares were a small-medium holder farmer, who still depends on the use of energy sapping crude implement. This table shows the number of the respondents contact with extension agents. The result indicates that majority (80.0%) of the respondents had no contact with extension agents at all. However, only 10.8% had contact with extension agent twice a year. While, 6% and 4% had about 4 to 6 contacts annually. The remaining 0.8% of the respondents had more than 7 contacts with extension agents per annum. From the result, it can be seen that there was low level of extension contact with the respondents. This may affects the Knowledge and skills of the respondents in employing various deforestation adaptation strategies in the study area. The study is in cognizance with the findings of Mustapha *et al.*, (2012) who opined that low level of extension services affects the awareness and use of adaptation strategies against deforestation.

Table 1: Socio-economic Characteristics of the Respondents

Variable	Frequency	Percentage
Age (Years)		
20 – 30	18	15.0
31 – 40	53	44.2
41 – 50	33	27.5
51 – 60	15	12.5
61-70	1	0.8
Total	**120**	**100**
Gender		
Male	104	86.7
Female	16	13.3
Total	**120**	**100**
Marital Status		
Single	32	26.7
Married	84	70.0
Widowed	3	2.5
Divorced	1	0.8
Total	**120**	**100**
Household Size		
1-5	34	28.3
6-10	70	58.3
11-15	10	8.3
16-20	4	3.3
21-25	2	1.7
Total	**120**	**100**
Educational Attainment		
No formal Education	13	10.8
Primary School	7	5.8
Secondary School	30	25.0
NCE or Diploma	50	41.7
BSc and HND	20	16.7
Total	**120**	**100**
Farming Experience		
1-5	2	1.6
6-10	8	6.7
11-15	19	15.8
16-20	33	27.5
Above 20	58	48.4
Total	**120**	**100**

Primary Occupation		
Farming	73	60.8
Student	3	2.5
Trading	17	14.2
Artisan	9	7.5
Civil servants	18	15.0
Total	**120**	**100**
Farm Size		
< 1	6	5.0
1-5	99	82.5
6-10	15	12.5
Total	**120**	**100**
Extension Contact		
No contact	96	80.0
1-2	13	10.8
3-4	6	5.0
5-6	4	3.3
> 6	1	0.8
Total	**120**	**100**

Source: Field survey, 2016

Distribution of the Respondents by Adaptation Strategies Employed against Deforestation

Table 3 shows the various adaptation strategies employed by the respondents against deforestation. The result shows that, the use of fuel-efficient wood stove is the most (ranked 1st) popular strategy being adopted by the respondents in the area. This implies that the respondents are likely to use alternative sources of energy if given the opportunity; this could help to reduce the impact of deforestation in the study area. This was followed by use of alternative energy (corn straw for cooking) ranked second. Furthermore, domestication of medicinal plant was a significant (ranked 3rd) strategy in the area. This is because high premium is placed on such plant, which makes felling of such trees less likely because of its medicinal value. Conservation agriculture is also another significant strategy in the area (ranked 4th). Similarly, economic/medicinal plants are being protected in the area as a deforestation adaptation strategy in the area (ranked 5th). This is because, the medicinal/economic values of such plants, which mostly outweigh its use as fuel or timber in the area has made the felling of such trees less likely. The use of cow dung for cooking is another significant strategy in the area (ranked 6th). This is due to the fact that, the area is endowed with livestock, which makes the use of cow dung popular as a cooking fuel. Other non-significant strategies include creating of farm forest, planting of shelterbelt, use of long duration variety of trees and the practice of zero tillage among others.

Table 2: Distribution of Respondents by Adaptation Strategies Employed Against Deforestation

S/No	Strategies	Very great extent	Great extent	Little extent	Total	Mean	Rank
1	Use of fuel efficient wood stove	98 (81.66)	15 (12.50)	7(5.83)	331	2.75	1
2	Protection economic trees	58 (48.33)	49 (40.83)	13(10.83)	285	2.35	5
3	Practice of zero tillage	12 (10.00)	87 (72.50)	21(17.5)	231	1.92	8
4	Use of cow dung for cooking	65 (54.16)	31 (25.83)	24(20.00)	281	2.34	6
5	Use of corn straw for cooking	79 (65.83)	41 (34.16)	- (0)	319	2.65	2
6	Creation of farm forestry	16 (13.33)	35 (29.16)	69(57.50)	187	1.55	11
7	Domestication of medicinal plants	78 (65.00)	30 (25.00)	12(10.00)	306	2.55	3
8	Use of alternative energy	21 (17.50)	28 (23.33)	71(59.16)	190	1.58	10
9	Planting of drought tolerant trees	11 (9.16)	20 (16.66)	89(74.16)	162	1.35	13
10	Planting of long duration variety of trees	43 (35.83)	27 (22.50)	50(41.66)	233	1.94	7
11	Planting trees as shelterbelt	29 (24.16)	31 (25.83)	60(50.00)	209	1.74	9
12	Integrated farming system	9 (7.50)	29 (24.16)	82(68.33)	167	1.39	12
13	Conservation agriculture	74 (61.66)	35 (29.16)	11(9.16)	303	2.52	4

Source: Field survey, 2015

Effect of Socio-Economic Characteristics of Farmers on Adaptation Strategies

In explaining the effect of socio-economic characteristics of farmers on adaptation strategies among the respondents, the multiple regression model used gave results of the parameter estimates of these variables as presented in Table 3.The result shows that age (X_1) has a coefficient of 0.0554 and significant at 1%. This entails that as an individual advances in age, it is more likely for the individual to adopt more strategies due to experiences he acquire on various adaptation strategies to deforestation either through his field experience, interaction with others or his engagement in various programmes which he might have read, seen, heard. This is in agreement with the finding of Ademola and Oyesola (2012), who found that an increase in one's age increases his chances of employing various strategies for adaptation to deforestation.

The coefficient of years of formal education attainment (X_3) is statistically significant at 5% level and has a positive relationship with adaptation strategies to deforestation. Specifically, the probability of employing adaptation strategies to deforestation is increased by 0.0228 for respondents with higher level of formal education. This suggests that, increase in years of formal education increases the likelihood of employing adaptation strategies to deforestation. This is as expected, since the level of education should positively influence the adoption of environment friendly activities. The result coincides with that of Ojo *et al*. (2013) that increase in educational status of farmers positively influence their perception of adoption of improved technologies and practices. The coefficient of farming experience (X_4) is statistically significant at 1% and exhibits a positive relationship with adaptation strategies to deforestation. This implies that, increase in the farming experience activities increases the possibility of farmers employing adaptation to deforestation strategies. Therefore, farmers involved in farming activities tend to adhere more too various adaptation strategies than those who are having less farming experience. This may be because farming experience brings about specialization and adherence to activity.

Extension contact (X_5) has a positive coefficient and statistically significant (1%) relationship with adaptation strategies to deforestation. This signifies that the higher the number of extension services the more the farmers will use the strategies. This could be because, extension service will influence the decision of farmers towards employing various adaptation strategies to deforestation, and the level of employing adaptation strategies to deforestation will increase by 0.0079. This implies that, an increase in extension contact will increase the possibility of farmers to adopt and employ various adaptation strategies to deforestation. This is due to the fact that extension contacts contribute to farmer's awareness, and consequently improved adaptation of various strategies to deforestation. This finding corroborate that of Aliyu *et al.*, (2014) who revealed that, extension contact with farmers increases the likelihood of increase in adaptation of strategies to deforestation.

Table 3: Result of Multiple Regression Analysis

Variable	Coefficient	Std. error	t-Statistic
Age(X_1)	0.055444	0.009552	5.804692**
Gender (X_2)	0.305477	0.220040	1.388281
Educational level (X3)	0.038612	0.016723	2.308891*
Farming experience (X4)	0.070928	0.015641	4.534856**
Extension Contact (X5)	0.622227	0.229956	2.705852**
Farm size (X6)	0.146191	0.202886	0.720556
C	2.586200	0.559387	4.623275**
R^2 = 0.62			
Adjusted R^2 = 0.600			
F- statistic = 30.85			

Source: output from Eviews 7.1 software *, ** Significant at 5 and 1%

Constraints to adaptation of deforestation strategies

The distribution of constraints faced by respondents is presented in Table 4. Foremost among these constraints were; resistance to changes (22.3%), lack of awareness (22.0%), Inadequate capital (23.1%), weak extension services (12.6%) and then poor transportation network (20.0%). Other constraints includes: cultural issues and poor leadership. This indicates that most of the respondents could have access to strategies for adaptation to deforestation if at all these constraints were well addressed in the rural areas, there will be intensive adoption of various deforestation strategies to overcome environmental crisis faced by the respondents in the study area.

Table 4: Constraints to Adaptation of Strategies for Deforestation

Constraint	Frequency	Percentage
Resistance to change	55	22.3
Lack of awareness	54	22.0
Inadequate capital	57	23.1
Weak extension services	31	12.6
Poor transportation network	49	20.0
Total	246*	100

Source: Field Survey, 2016 *Multiple response

Conclusion

Results from the findings revealed that respondents in the study area were in their active and productive age and had acquired one form of formal education or the other. Adaptation of strategies to deforestation is dominated by married male respondents with majority having a household size of between

6-10 persons and farming experience of between 1 to 10 years. Majority of the farmers have less access to extension contact. They are faced with a number of constraints, which could be attributed to the fact that they live in rural areas, and the role assigned to them by culture and gender makes them more vulnerable and voiceless. In addition, they have to employ a number of strategies which are aimed at mitigating the environmental and climatic challenges confronting them. There is therefore, the need for the rural farmers to diversify their opportunities so that they can be able to cope with exigencies of climate and environmental issues.

It is therefore recommended that:

i. Government policy should be tailored towards enhancing tree plantation campaign by providing an atmosphere that will encourage tree plantation and taking other measures that will address environmental issues. This will help in curtailing deforestation in the country as well as reducing the huge amount being spent by government on addressing atmospheric issues leading to sustainable productive lands.
ii. Since various environmental programs constituted has not performed creditably in ensuring a protected environment, stakeholders should encourage farmers to acquire basic education as this will create an enabling environment for extension agents to communicates and convey these idea of various deforestation adaptation strategies.
iii. Group formation among rural population should be encouraged and adequate capacity building on various aspect of land husbadry be initiated, develop and sustain. Also, support for inclusive group-based activities should be included in rural development policy. This will reduce conflict within cooperative societies and promote renumerative adoption of various strategies that can take care of deforestation.

REFERENCES

Adebayo, A.A. and Dayya (2004) (Ed) Adebayo, A.A, *Mubi Region: A geographicalsynthesis.*Pp 19-23 Paraclete Publisher Yola – Nigeria

Adebayo, E.F. and Olayemi, J.K. (2005) Application of Goal Programming to ResourceAllocation Behaviour of Dairy Producers in Adamawa State, Nigeria. *Journal of Sustainable Department and Environment.* 1:60-69

Adebayo, A. A. (1999). Climate, sunshine, temperature, evaporation and relative humidity. In Adebayo, A. A. and Tukur, A. L. (Eds.) Adamawa State in Maps. Yola, Nigeria: Paraclette Pub. Pp.20-22.

Adefila, J. O. and Madaki, J. (2014) Role of farmers Cooperatives in Agricultural Developmentin Sabuwa Local Government Area of Katsina State, Nigeria. *Journal of Economics and Sustainable Development.* ISSN 2222-1700 Vol. 5, No.12. 2014

Ademola, A.O and Oyesola, O.B. (2012) Adaptation strategies of selected tree crop farmers toclimate variation in Oyo State, Nigeria. *Journal of Agricultural Extension and Rural Development* . Vol. 4 (19), pp. 522-527

Aliyu, A., Modibbo, M.A., Medugu, N.I andAyo, O. (2014). Impact of deforestation on socio-economic development of Akwanga Nassarawa State. *International Journals of Science, Environment and Technology*, Vol.3, No.2, 2014, 403-416

Anderson, E. (2006). Urban landscape and sustainable cities: *Ecology and society*. From <http://www.ecologyandsociety.org/vol11/issl/art34/.2006> (Retrieved January 29th, 2007

ASMLS (1999). Adamawa State Ministry of Land and Survey (ASMLS), Annual report, Adamawa State, Nigeria.

Becek, and Odihi, J.O. (2008). Identification and Assessment of Factors affecting ForestDepletion in Brunei Darussalam.*The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*xxxvii (B2): 209-214.

Docena, H. (2010). Philippnes: Deforestation through mining subsidized by CDM project.*WRM'sbulletin No 161,* December 2010.

Eleri, B.O., Ugwu O., and Onuvae P., (2012). Expanding Access to Pro-poor Energy Services in Nigeria. A Consultation Paper prepared by International Centre for Energy, Environment and Development (ICEED) with support from Christian Aid.

Ekhuemelo, D.O and Akeh, F, (2015). Survey of afforestation efforts between 2010 – 2014 in Makurdi Local Government Area of Benue State, Nigeria. *Nigeria Journal of Agriculture, Food and Environment.* 11(2): 97-102

FAO, (2009), State of the World Forest. Technical report FAO, Rome; FAO.

Food and Agriculture Organization of United Nation (FAO) (2009). Tree planting practice in African Savanna forestry paper FAO Rome, Pp: 170 -185

FAO, (UN Food and Agriculture Organization). 2010. Sustainable Crop Production Intensification through an Ecosystem Approach and an Enabling Environment: Capturing Efficiency through Ecosystem Services and Management. 22nd Session of the FAO Committee on Agriculture, 16 – 19 June, Rome.

IITA,(2011). Deforestation: Nigeria ranked worst in the World. A publication of International Institute of Tropical Agriculture. *http://www.thisdaylive.com/articles/deforestation-Nigeria-ranked-worst-in-the world/103321*

Mustapha, S.B, Bzugu, P.M, Ali, I.M, Abdullahi, A. (2012). Determinant of adaptation to deforestation among farmers in Madagali Local Government Area of Adamawa State, Nigeria. *Russian Journal of Agricultural and Socio-Economic Sciences*,No. 8(8)/ 2012

Ofuaku, A.U. (2011). Rural Farmers' Perception of Climate Change in Central Agricultural Zone of Delta State of Nigeria. *Indonesian Journal of Agricultural Science 12 (2)*, 63-69.

Ojo, C.O., Bawa, D.B., and Chuffor, L., (2013). Effect of Women's socioeconomic characteristics on household fuel consumption in Damboa Local Government Area of Borno State, Nigeria. *Research* on Humanities and Social Sciences

Okulona, R.A., and Ikuomola, A.D. (2010). *American journal of Social and Management Sciences.*The socio-economic implication of Climate Change, Desert Encroachment and Communal Conflicts in Northern Nigeria. http://www.scihub.org/AJSMS.Retrieved 14/06/2015.

Oladosu, I.O., Ogunwale, A.B. and Ayanwuyi, E. (2002). Farmers perception of effects of deforestation on agricultural production and economic activities in selected rural communities in Orire Local Government Area of Oyo State, Nigeria. *International journal of Business and common Market Studies* Vol. 1 (1): 209 – 216.

Oseoneoba, G.J. (1992). Fuel wood exploitation from natural ecosystem in Nigeria: socio-economic and sociological implication. *Journal of Rural Development,* Vol. 1 (1): 141 -155.

Udofia, S. I., Akpan-Ebe, I. N., Uluocha , O. B. and Ekpoh, G. I. 2011a. Survival assessment of forest plantations in Abak Local Government Area, Akwa Ibom state, Nigeria *Nigerian Journal of Agriculture, Food and Environment*. 74:92-96.

UNFCCC, (2010) Glossary of climate change acronyms.

World Bank, (1999). Rural Travel and Transport Project. Washington D.C: World Bank