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ASSESSMENT OF EFFECTS OF DEFORESTATION ON FOREST RESOURCES CONSERVATION IN BENUE NORTH-WEST, NIGERIA

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ABSTRACT

Anthropogenic activities are causing Benue State's forests to disappear, and some academics have proposed that urban forest management and community involvement can slow the rate at which forest resources are being destroyed. Therefore, the purpose of this study was to assess the effects of deforestation on forest resources conservation in Benue North-West, Nigeria. 392 respondents were chosen using a stratified random sample technique with multiple stages. Both descriptive and inferential statistics were used in the collection and analysis of the data. The effects of deforestation on the conservation of forest resources in the research area were similarly measured using a Likert scale assessment. The study's findings showed that animal grazing (ANG), farming operations (FMO), charcoal production (CHP), infrastructure development (IFD), population expansion (POP), and forest fire (FOF) were the main causes driving deforestation. With a probability coefficient of 1.9%, the manufacturing of charcoal was determined to be the primary cause of deforestation in the research area. Illegal logging and farming operations came in second and third, with probability coefficients of 1.88% and 1.86%, respectively. According to the study, the main impacts were habitat destruction, biodiversity loss, desert encroachment, rising temperatures, plant and animal extinction, soil degradation, water body loss, pollution, and climate disruption. The main detrimental consequences of deforestation on forest resources were determined to be habitat destruction (WMS=4.2>3.05), followed by soil degradation which exhibited moderate effects (WMS=2.99 < 3.05), whereas pollution was evaluated as having the lowest effect (WMS=2.49 < 2.95). According to the findings, deforestation can harm the diversity of plants and animals, resulting in erosion, flooding, and the loss of important commercial and medicinal trees. To stop the effects of deforestation, it is advised that people use farming practices that promote afforestation and replanting.

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INTRODUCTION

Forests are vast areas of land predominantly defined by densely-tall woody and non-woody vegetation as well as other communities of flora and fauna in symbiotic relationships (Olagunju, 2015). Forest is an intricate system made up of plants and trees that protect biodiversity, providing home to terrestrial, aquatic and improving the quality of life forms on earth According (Popoola, 2014). to the Food and Agriculture (2002), a forest is an area where trees cover ten percent or more of the land. Onyeanusi and Otegbeye (2012) described forests as huge tracts of land covered with densely growing trees and shrubbery. According to Tee (2010), forests serve as stores of a variety of goods and service that human's need on a daily basis to meet their basic needs. Timber and non-timber forest products (NTFPs), often known as non-wood forest products (NWFPs), are the two main categories into which forest products are typically divided. According to Eleanya (2014), forest resources continue to be essential to the survival of homes,

communities, and countries in a variety of ways.

They provide food, fuel wood, wood for furniture and other non-timber forest products for households' consumption. Udo (2013) observed that, forests and forestry contribute to human wellbeing through food security, job creation, and poverty reduction and as well act as phyto-medicinal cures for diseases. They play critical role for environmental beautification, biodiversity conservation, ecotourism and mitigation of climate change and environmental degradation.

Eleanya (2014) and FAO (2005) posited deforestation is a process where vegetation is cut down for economic or social reasons without any simultaneous replanting. Odediran *et al.* (2013) reported that, global deforestation is threatening environmental sustainability and the very high rate of deforestation in Nigeria has detrimental effect. Ogunwale (2015) and Adebayo (2010) opined that, deforestation simply put is the clearing away of forests. It is the process by which an area gets stripped of its natural forest vegetation and resources. This can be caused by systematic felling, indiscriminate logging, or the complete removal of existing vegetation for arable agriculture or industrial uses. It typically causes destabilization of forest ecosystems and the surrounding environment.

As a result, it is clear that much of the State's vegetated land area is currently being used for agricultural purposes (SIGWA, 2001). However, the rate and intensity at which farming operations negatively affect the vegetation may vary, depending on the nature of the modernization of the farming activities and the level of awareness of the farmers (Nyagba, 1995; SIGWA, 2001; Adeola et al., 2004; Therefore, the purpose of this study is to assess the effects of deforestation on the forest resources conservation in Benue, northwest Nigeria.

MATERIALS AND METHODS

Study Area

Benue State is one of the states located within the north central geopolitical zone of Nigeria. Geologically, it falls within the Benue trough from where the State derives its name. It lies between Lat. 6 º 5' and 8 º 5'N and Long.7 º 47' and 10 º E (Ocheri and Ahola, 2014). The State shares boundary with Nassarawa state in the north and Taraba State in the northeast. In the south, it shares boundary with Cross River State, while the southwest boundary is shared with Enugu and Ebonyi States respectively (Halima and Edoja, 2016). To the west, it is bounded by Kogi State, while a short international boundary is shared with the Republic of Cameroon around Kwande LGA (Nyagba, 1995).

The study area is drained principally by River Benue and its tributary, the river Katsina-Ala. Other rivers include Aya, Guma, Konshisha, Logo, Okpokwu, Obi, and Oyongo. The climate of the area is controlled by two major air masses, namely South-West trade wind and North-East trade. Benue State fells within the Koppen's Aw climate Classification which experiences marked wet and dry seasons. Rainfall in Benue State averages seven (7) months in the year with annual total, ranging from 1,200 – 2,000mm from May to October (Nyagba, 1995). Annual rainfall total is generally higher in the Southern parts of the state than the Northern parts and this is clearly reflected in the lusher and denser nature of the vegetation (Ologunorisa and Tersoo, 2006).

Dry season is dominated with dry dust laden harmattan wind originating from Sahara Desert. Temperature in the study area is particularly high in the months of March and April.

The vegetation is characteristically that of the tropical moist and wet forest with a well-defined three-layer structure in much of the region. This vegetation ranged from mangrove and swamp forests in the coastal south to tropical rain forests to the savannah woodland in the northern part of the state (Fon et *al.*, 2014). The parent materials forming soil in Benue State are largely of sedimentary origin. These produce the deep loamy soils, the basis of agricultural production in most parts of the State. The soils are fine-textured with poor internal drainage. A common feature of the soils is the movement of clay within the soil profile.

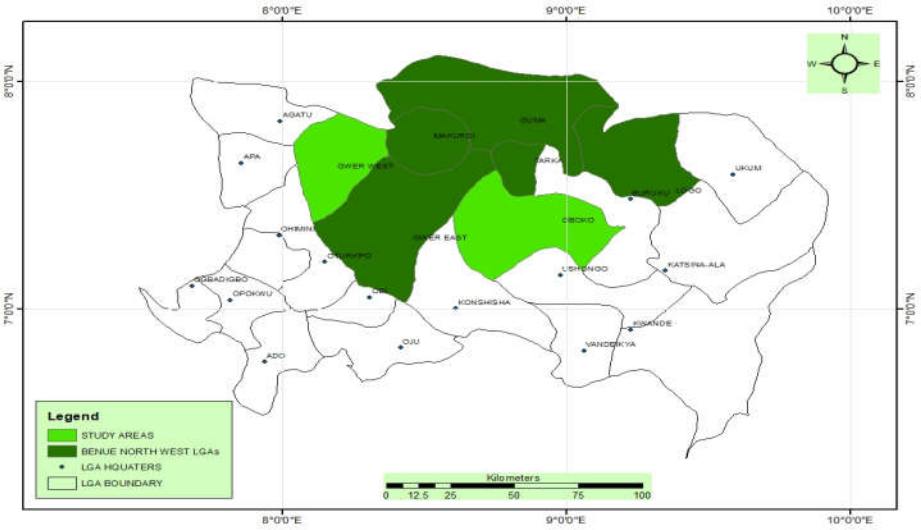

Figure 1: Map of Benue State
Source: Remote Sensing and GIS Laboratory, Geography Department, Federal University of Technology, Minna.

Sampling Techniques

A multi-stage and stratified random sampling technique was adopted in sampling the population for the study to evaluate the effect of deforestation in Benue North West.

Stage 1: Out of seven (7) LGAs in Benue North-West, two (2) were randomly selected at 30% sampling intensity as used by (Dagba *et al.,* 2017).

Stage 2: 5% localities were randomly selected from each of the two LGAs using the 1991 Population figure.

Stage 3: the 1991 population figure of the selected localities was projected to 2019 using 2.8% growth rate. The numerical expression for the 2.8% growth rate is shown below;

$P_t = P_o (I+r)$

Where; P_t = population projection figure for 2019 for any locality

P_o = existing population as at 1991

L = Constant

r = population growth rate (2.8% = 0.0028)

t = number of years population was projected (2019 – 1991 = 28years) (Jennifer. *et al*., 2007; Buba *et al*., 2017).

Stage 4: Taro- Yamene (1967) formula at 5% error degree of tolerance was used for determination of the projected population sample size as shown below;

$$n = \frac{N}{l+N\,(e)^2}$$

Where;

n = projected population sample size

N = Total size of projected population

l = Constant

e = error degree of tolerance 0.005 as used by (Dagba *et al.,* 2017)

The sample size of each locality was determined using the formula.

$$n = \frac{n \times Nh}{N}$$

Where; nh = Locality sample size

n = projected population sample size

Nh = Locality population (projected)

N = Total size of projected population

The entire sample size for the study was 392

Data Collection

Primary and secondary sources were used to gather data for the study. The study's primary data entail using a semi-structured questionnaire, conducting in-person observations of the factors driving deforestation in the study region, and visiting the study area to gather firsthand information on the geography, people, climate, and natural vegetation. The purpose of the semi-structured

questionnaire was to gather data on the human factors that contribute to deforestation and how deforestation affects the preservation of forest resources in the research region. Prior to being given to the respondents, the questionnaire underwent pre-testing and validation. Thus, 392 respondents who were sampled for the study were given the validated questionnaires. The study's secondary data was gathered through a survey of the literature from books, theses, and dissertations.

Data Analysis

The primary data collected were analyzed using appropriate statistical tools as shown below;

Descriptive statistics such as frequency mean and percentages were used to analyze the socioeconomic characteristics of respondents in the study area. Binary Logistic Regression (BLR) Model was used to ascertain the factors influencing deforestation in the study area (Ogunwale 2015). While a five point Likert scale rating format uesd by Emaikwu, (2011) was adopted to measure the effects of deforestation in the study area. The weighting scale was derived from the following values with respect to effects of deforestation; Very High (VH) = 5, High (H) = 4, Moderate (M) = 3, Low (L) = 2, Very Low (VL) =1 (Dagba *et al*., 2017).

RESULTS AND DISCUSSION

Results

Socio-economic characteristics of respondents in Benue North West, Nigeria

Table 1 present the findings on the socioeconomic characteristics of the respondents in Benue North-West, Nigeria. The findings showed that 76.80% of respondents were men and 23.20% of respondents were women. This demonstrated that there were more men than women engaged in deforestation operations. The age distribution of respondents showed that the largest percentage of respondents—35.5%—were between the ages of 31 and 40, Followed with 41 and 50 (26.80%). However, 13.5% of respondents were 50 years of age or older, while 24.2% of respondents were under 30.

On household size, 54.3% had 6 – 10 persons, followed by 30.60% with 11 – 15 persons while 10.5% had 1 – 05 persons. Based on ethnicity, this study identified two major ethnic groups; Tiv (99.70%) and Junkum (0.30%). This implies that, most of the study population within Benue North West, Nigeria was Tiv. This also revealed that, majorities of respondents of the study population do not acquire formal education (36.20%) while 25.80%, 22.20% and 15.80% had first school leaving certificate (FSLC), secondary and tertiary education qualification.

The study found that 71.20% of respondents were married, whereas 11.70%, 10.70%, and 6.40% were widowed, divorced, or single. This suggests that a sizable portion of those surveyed in Benue North West, Nigeria, were family-oriented. Furthermore, 99.2% of respondents identified as Christians, compared to 0.80% who observed traditional religion. Also, this survey revealed that a sizable portion of participants (38.30%) had 21–30 years of farming experience. Next in line are 33.90%, 27.30%, and 0.60% of responders who have been farming for 11–20 years, 30 years or more, and 1–10 years, respectively.

Table 1: Socio-economic characteristics of respondents in Benue North West, Nigeria

Variables	Socio-economic characteristics	Frequency	Percentage (%)
Gender	Male	301	76.80
	Female	91	23.20
	Total	**392**	**100**
Tribe	Tiv	391	99.70
	Junkum	01	0.30
	Total	**392**	**100**
Age	< 30 (Years)	95	24.20
	31 – 40 (Years)	139	35.50
	41 – 50 (Years)	105	26.80
	Above 50 (Years)	20	13.50
	Total	**392**	**100**
Religion	Christianity	389	99.20
	Traditional	03	0.80
	Islam	-	-

	Total	**392**	**100**	
Marital status	Single	46	11.70	
	Married	279	71.20	
	Widow(er)	42	10.70	
	Divorced	25	6.40	
	Total	**392**	**100**	
Academic Qualification	Non Formal	142	36.20	
	Primary.	101	25.80	
	Secondary.	87	22.20	
	Tertiary	62	15.80	
	Total	**392**	**100**	
Household Size	01 – 05	41	10.50	
	06 – 10	213	54.30	6.5
	11 – 15	120	30.60	
	16 – 20	16	04.10	
	Above 20	02	0.50	
	Total	**392**	**100**	
Farming experience	01 - 10 (Years)	02	0.60	
	11 - 20 (Years)	133	33.90	
	21 - 30 (Years)	150	38.30	25.5
	Above 30 (Years)	107	27.30	
	Total	**392**	**100**	

Source; Field Survey, (2020)

Factors influencing deforestation in Benue North West Ecological Zone, Nigeria

Human Factors Influencing Deforestation

Table 2 presents a binary logistic regression estimate of the human factors impacting deforestation in the northwest Nigerian region of Benue. According to the statistical and probability criteria used in the analysis shown below, the results did not differ substantially (P>0.05) from all of the variables that were measured. This accounted for the substantial lack of difference (P>0.05) between charcoal production (CHP), farming activities (FMG), illegal logging operations (IGL), fuel-wood exploitation (FWE), animal grazing (ANG), infrastructure development (IFD), population growth (POP), and fire forest (FRF). This suggests that every variable had a major effect on the fall in forest cover, which in turn caused biodiversity loss.

Table 2: Human factors influencing deforestation in Benue North West Ecological Zone, Nigeria

Variable	B	S.E	Wald	Df	Sig	Exp. (B)	Ranking
Charcoal Production	0.067	0.158	0.178	1	0.67	1.935	1
Farming Activities	0.149	0.170	0.772	1	0.38	1.889	2
Illegal logging	0.222	0.187	1.404	1	0.24	1.861	3
Fuel-wood exploitation	0.184	0.192	0.909	1	0.34	1.901	4
Animal grazing	0.117	0.152	0.597	1	0.44	1.201	5
Infrastructural development	0.019	0.054	0.119	1	0.73	1.019	6
Population Growth	0.008	0.019	0.159	1	0.69	1.008	7
Forest fire	-0.005	0.030	0.025	1	0.87	1.005	8
Constant	1.237	0.592	0.604	1	0.44	1.028	

Significant level = 0.05, Sig. = Significant, B = Binary regression, Exp. (B) = Exponential binary, DF = degree of freedom and S.E = Standard Error

Source: Field Survey, (2020).

Effect of Deforestation on forest resource Conservation in Benue North-West, Nigeria

The distribution of respondents according to how deforestation affects the preservation of forest resources in the research area is shown

in Table 4. The most compelling effect, according to respondents in the study area, was habitat destruction (WMS=4.42>3.05). This was followed by biodiversity loss (WMS=3.87>3.05), desert encroachment (WMS=3.84>3.05), temperature increase (WMS=3.81>3.05), species extinction (WMS=3.34<3.05), soil degradation (WMS=2.99<3.05), loss of water bodies (WMS=2.87<3.05), climatic disruption (WMS=2.69<2.95), and pollution (WMS=2.47<2.95).

Table 4: Effects of deforestation on forest resource conservation in Benue North-West, Nigeria

Test Variable	VH	H	M	L	VL	N	WS	WMS	D
Habitat destruction	259(1295)	73(292)	33(99)	19(38)	08(08)	392	1732	4.42	H
Loss of biodiversity	121(605)	171(684)	46(138)	37(74)	17(17)	392	1518	3.87	H
Desert encroachment	88(4440)	198(792)	61(183)	34(68)	11(11)	392	1494	3.84	H
Increase in temperature	139(695)	142(568)	36(108)	48(96)	27(27)	392	1494	3.81	H
Extinction of flora/fauna	90(450)	118(472)	71(213)	64(128)	49(49)	392	1312	3.34	M
Soil degradation	51(255)	70(280)	141(423)	87(174)	43(43)	392	1175	2.99	M
Loss of water bodies	25(125)	64(256)	168(504)	106(212)	29(29)	392	1126	2.87	M
Pollution	19(90)	51(204)	102(306)	150(300)	71(71)	392	9781	2.49	L
Climatic disruption	51(255)	27(108)	102(306)	175(350)	37(37)	392	1056	2.69	L

NB = values outside the bracket are mean of frequency distribution of respondents while values in the brackets are products of Likert Scale Value., NH = Very High, H = High, M = Moderate, L = Low, VL = Very Low, WS = Weighted Score, MWS = Mean Weighted Score, D = Decision, Number of respondents (N) = 392, Mean score (MS) = 3.0, Upper limit (UL) = 3.05 and Lower limit (LL) = 2.95.

Source: Field Survey, (2020).

DISCUSSION

Socio-economic characteristics of respondents in Benue North West, Nigeria

An analysis of respondents' socioeconomic characteristics showed that there were somewhat more men in the sample than women. The findings of this study on gender categories supported the findings of Wahab et al. (2014) and Igwe (2016), who observed that men are more likely than women to engage in deforestation. The results of the study on ethnic groups showed that the majority of people within the study area were Tiv (99.7%) and indigenous locals, compared to Jukum (0.03%). This was in contrast to Wahab et al. (2014), who identified various ethnic groups within the study on assessment of socio-economic activities and sustainable rural development in Oba hill forest reserve, Osun state, Nigeria.

The largest proportion of respondents in the sampling size were in the age range of 31 to 40 years (35.50%), followed by those in the age range of 41 to 50 years (26.80%), under 30 years (24.20%), and above 50 years (13.59%). The research area's community's increasing trend was demonstrated by the age categories of the respondents. In line with Igwe's (2016) report on deforestation: Impacts on the socio-economic activities of the people of Ekwusigo local government area, Anambra State, Nigeria, the implication of this age group showed a declining productivity stage of respondents due to the increased number of years with respect to deforestation activities.

Furthermore, only 24.20% of the studied population is the youngest, and 13.59% of the study's respondents are too old to be considered productive. This suggested that the young, agile people in the research area were busy and capable of doing any work that would earn them money. These results concur with those of Abiola et al. (2016) and Tsue et al. (2016), who established that individuals in this age group (youth), are primarily engaged in agricultural activities. However, they disagree with those of Aliyu et al. (2014), who identified an age bracket of 40 to 60 years (mostly adults and farmers who engaged in some kind of tree felling).

This result is an indication that, there is tendency of mounting pressure on the available natural resources in the area since most (71.2%) of the respondents were married with a tendency of increasing family size and providing for their basic needs. Result of this study on marital status agreed with report by Wahab *et al*. (2014) and Igwe (2016) who posited that, higher population of married persons are involved in deforestation activities than single, widow(er), divorced etc to in providing for the family needs.

The education level of the respondents within the study area revealed that, 36.20% do not have formal education while 25.80% had only primary education. This means that, majority of the respondents do not have the Universal Basic Education (UBE) qualification which implies that, farming population in the study area. Educational level can have great influence in assimilation of knowledge or compliance to rules, regulations and laws within a given community. The findings in this study is in agreement with Lamino *et al.* (2016) and Omale *et al.* (2019) who stated that, a typical characteristic of rural Nigeria where people are mostly non-formal education holders while Ibrahim *et al.* (2015) reported a negative relationship between education and area of forest lost in Nigeria.

Additionally, this study revealed that the households with the largest populations (54.30% and 30.60%) were those with the largest household sizes (6–10 and 11–15). This indicated that the study area had the potential for rapid population growth and that over time; there would be greater pressure on the use of forested land, which could lead to deforestation activities due to high food consumption, population growth, the need for farmland, and housing development. According to their occupations, a substantial number of respondents had extensive farming skills. This suggested that the research area's farming activities and farmland expansion are probably going to be high, which could have a detrimental effect on the management of forest resources.

Result of this study is in consonant with report by Igwe (2016) on deforestation: Impacts on the socio-economic activities of the people of Ekwusigo local Government Area, Anambra State, Nigeria. Result of this study is also in tandem with the assertion of Abere and Opera (2012) that, from the economic point of view, deforestation has created a negative impact on the average Nigerian.

Factors influencing deforestation in Benue North West Ecological Zone, Nigeria

The results of human factors, which are common in most communities in our forest sector, had a significant influence. Some of the factors that may lead to the loss of forest area include poverty, ignorance, agricultural growth, settlement, and revenue creation. This result confirms the findings of Ogunwale (2015) and Ibrahim et al. (2015), who discovered that deforestation increases in proportion to increases in rural-urban migration, poverty, ignorance, and agricultural growth. Furthermore, according to Mortimor (1989), in the absence of job opportunities, rural dwellers would be forced to sell wood as a feasible source of income, resulting in a drier climate that jeopardizes human survival by negatively impacting the ecological balance of our surroundings

As population increases, there will be an increase in demand for agricultural lands, settlements and food which all impact negatively of forest resources. This agreed with the work by Alao (2003) who opined that, high demand for timber by different end uses for construction purposes, furniture, sawn timbers and wood for energy (charcoal and fuel-wood) in Nigeria.

The result of natural factors influencing deforestation in the study area implies that, natural factor (such as climate/global warming, wildfire, flood, pest and disease) had no any serious effect (significant effect) influencing deforestation in the study area. This could be as a result of rare occurrence of these factors within the study area. The result is in line with the reports that, many uncertainties still exist in regards to the longer term rates of global warming, the unfolding dynamics of weather patterns, feedbacks between climatic and other environmental changes and thresholds (Arnell, 2000; IPCC, 2007; Bonan, 2008; Schuur *et al.,* 2008; Zheng and Yoon, 2009; Colman and Power, 2010; Dallmeyer *et al.,* 2010; Aliyu *et al.,* 2014). The loss of species generally renders ecosystems less resilient to disturbances such as fires, and the impact of insect pests, diseases and invasive alien species. Climate change can affect forests by altering the frequency, intensity, duration and timing of droughts and fires as well as storms and associated landslides (Dale *et al.,* 2001). Results of this study on effects of natural factors of deforestation agrees with the opined report that, the exact consequences of deforestation cannot be foreseen clearly at present, but plant and animal species' phenologies are sensitive to changes in temperature, rainfall and humidity, seasonal cycles and may also react to the increased levels of CO_2 in the atmosphere whereby, some species may gain an advantageous competitive edge over other species (IPCC, 2007; Schuur *et al.,* 2008; Colman and Power, 2010; Ghazoul and Sheil, 2010; Igwe, 2016).

Effect of Deforestation on forest resource Conservation in Benue North-West, Nigeria

Investigations on how deforestation affects the protection of forest resources shows that habitat degradation has the most impact, followed by biodiversity loss, desert encroachment, temperature increases, and extinction of plants and animals. The findings also showed that the fall in forest activities due to deforestation was a major factor in the protection of none biodiversity in Benue North-West Nigeria. These reasons included soil degradation, loss of water bodies, pollution, and climatic disruption. Charkeseliani (1990), Agarwal (1992), and Isese (2019) have observed that deforestation is frequently linked to a number of problems, including forest decline, soil degradation, and a loss of genetic and biological diversity.

A substantial reduction in water body conservation was found in Benue North-West as a result of the effects of deforestation on forest resource conservation. The outcome supports the findings of Pimm and Jenkins' (2010) document, which claims that the pace of extinction is currently more than 100 times higher than its natural rate and is approaching levels that were previously unthinkable.

Conclusion

Based on the result of this findings, majority of the respondents within the Benue North-West, Nigeria were young, agile, married, non-formal-education and have been residing in the area over a period of time. The study also revealed that, lack of awareness and illiteracy amongst members of the community due to the low level of access to forest extension agents and services has limiting effects on community compliance to forest activities thereby leading to environmental challenges due to deforestation activities. The study also revealed that, human and natural induced factors also played a positive role in influencing deforestation activities within the Benue North-West region thereby leading of

loss of valuable forest resources which is not limited to economic and medicinal trees. This study revealed that deforestation has negative effect on both animal and plant diversity which includes loss of valuable forest species, reduced animal's population due to habitat destruction and plant biomass, extinction and reduced species richness and evenness.

Recommendations

This study suggests ways to mitigate the environmental problems associated with deforestation in the study Area as follows;

i. There is a need for a pragmatic approach in the form of policy formulation through proper legislation prohibiting the general public from indiscriminate tree felling, open grazing and forest fire due to lush vegetation by creating ranches and feedlots.
ii. There should be adequate access to forest extension services which could enhance high Level of awareness and compliance with forestry laws in the study area.
iii. Agriculture growth and increased population were also considered as major factors affecting forest cover within the study area; thus, there is the need to sensitize the people dwelling around the forested areas of the importance of agro-forestry and the need to embark on such practices.
iv. Government, NGOs and individual should endeavor to encourage the need of training and retraining of personnel and farmers by organizing regular workshops and seminars for knowledge on the effects of deforestation on environmental challenges.

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