Assessment of Population Growth on Vegetation Cover in Numan, Demsa and Lamurde Lgas Areas of Adamawa State

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Abstract

This study examined the effects of population growth on vegetation exploitation in Numan, Demsa and Lamurde LGAs of Adamawa State. The primary data was obtained from the field through the used of structured questionnaire, while the secondary data includes satellite images Thematic Mapper (TM) of 1986, Enhance Thematic Mapper (ETM) of 2001 and Enhance Thematic Mapper Plus (+ETM) of 2017. Other secondary data include population data which was collected from National Population Commission Adamawa State. 383 household heads respondents were selected to represent the population, using a marginal error of 5

Index terms— population growth, vegetation cover and exploitation.

1 Introduction

apid pace of population growth, urbanization and industrialization has led to serious environmental concerns in the developing countries. Over the past three decades natural resources especially vegetation have depleted remarkably resulting from accelerated pace of economic and social transformation. Economic changes such as large increases in population, agricultural output, industrial production, capital accumulation, and innovative technologies have transformed natural resource base, both as a source of factor inputs and as a by-product of pollution associated with economic activity. The continuously accelerated and unabated environmental degradation in Nigeria is unhealthy for people's health and livelihoods, the survival of species, and ecosystem services that are the foundation for long-term economic development **??**FAO, 2017).

Forest provides critical sources of food, medicine, shelter and building materials, fuel and cash income. More that 15million people in Sub-Sahara Africa earn their income from forest-related enterprise such as fuelwood and charcoal sales, small-scale saw-milling, commercial hunting and handicraft production **??**Kaimowtz, 2003). Forest products play important roles in supporting rural livelihoods and food security in many developing countries. Forest provides critical sources of food, medicine, shelter, and building materials, fuels and cash income. More than 15 million people in Sub-Sahara Africa earn their income from forest-related enterprises such as firewood and charcoal sales, smallscale saw-milling, commercial hunting and handicraft production. Forest resources supply nearly half total wood requirements of the country and its dwindling rapidly (Iheke and Eziuche, 2016).

There are alternative views on populationenvironment linkages. Most theories of population and environment are expounded primarily in relation to agricultural resource usage, the neoclassical theory contends that population growth will increase demand and thus force producers to become more efficient (Talbot, 2010). The classical theory is based on Matlthus in that resources cannot keep pace with population. Dependency theories state that the relation of developed to developing nation is that of dependence and is explosive of the environment (Okwori, Ajegi, Ochinyabo and Abu, 2015). Intermediate variable theories view population growth a proximate cause of environment degradation, but they can be applied mutandis mutatis to all types of natural resources (Mohsin and Usman, 2005). From the natural science perspective, humankind is one of the many species competing for the resources of the biosphere. As the resources of any ecosystem are finite, so is the latter's carrying capacity; hence, beyond a point, each additional inhabitant has a negative impact on the

productivity of resources; Policy-wise, this perspective leads to advocacy for population stabilization (United Nation, 2011).

Population factors were seen, sometimes, as inhibitors of sustainable development: demographic factors, combined with poverty and lack of access to resources in some areas, and excessive consumption and wasteful production patterns in others, cause or exacerbate problems of environmental degradation and resource depletion and thus inhibit sustainable development and pressure on the environment may result from rapid population growth, distribution and migration, especially in ecologically vulnerable ecosystems (United Nations, 2010).

Man depends on the products of the natural environment for his multifarious needs, for example his food, shelter and clothing. Man exploits swamps, forest, grasslands, rocks, the atmosphere, water and other resources of his natural environment to satisfy these basic needs. The crucial role of vegetation to life has resulted to intervened advertently causing serious disturbance to natural equilibrium (Animashaun, 2002), Today, the rate of exploitation of natural resources is faster than the time it would take nature to replenish them. With increasing anthropogenic pressures at local, regional, and even global scales, an understanding of both the nature of change and the responses of natural systems to change becomes pertinent. Human beings generally have been viewed as destructive intruders to natural ecosystems; hence, this suggests stringent rules and legislation that will protect the vegetation and its resource deposit (Babagana, Mohammed and Garba, 2012). In as much as human beings are viewed this way, human population and the environment have a very strong complementary linkages or relationships. In actual fact, biodiversity conservation efforts especially vegetation can only be sustained if human beings give their support.

2 a) Statement of the problem

The rapid increase of human population is putting an incredible strain on our environment. While developed countries continue to pollute the environment and deplete its resources, developing countries are under increasing pressure to compete economically and their industrial advancements are damaging as well. The demands that this growth places on our global environment are threatening the future of sustainable life on earth (Population ReferenceBureau2007). More population means more space to construct houses and availability of more consumer goods. It also requires more means of transport, more consumption of fossil fuels and more pollution of air, land and water. Thus growth of population leads to exploitation of natural resources (Vegetation), land and water.

Nigeria population is currently estimated at 192 million individuals with growth rate of 2.5% against the backward growth rate of the country economy (National Bureau of Statistics, 2016). The high population growth of Nigeria is described as a ”risk factor” by the Economic Recovery and Growth Plan. The Federal Government of Nigeria declares the nation’s growth as one of the unsustainable factors of the economy of the country.

Rapid The extent of which needs to be investigated for the sake of planning to mitigate further decline in vegetation cover. However, population growth tends to increase the pressure of population on land, leading to rise in vegetation exploitation because of the scarcity of the co-operant factors to increase demand of vegetation. This is in addition to the adverse effect that population growth has on standard of living, employment, capital formation, environment, social infrastructure and agricultural development **??**Jhingan, 2005). If the present population trends continue in this area, the demand for vegetation resources will also rise and the implications on the vegetation will be huge and may have ripple effects on poverty and environmental sustainability.

Cursory observation of vegetation stock in the area reveals that it is under pressure, to this extent the study is aimed at assessing the effects of Population Growth and Poverty on Exploitation of Vegetation Resources in Numan, Demsa and Lamurde LGAs of Adamawa State and to make recommendation towards poverty reduction strategies, population growth control, planning and environmental sustainability in the study area. ii. Population and socio-economic activities According to the National Population Census (2006), Numan, Demsa and Lamurde LGAs had a total Population 381,120 people, with Numan 91,459, Demsa 178,407 and Lamurde 111,254 while the population projection for 2016 stand at 509,400 people with an annual growth rate of about 2.83%. The population is multiethnic, people with different shades of work, income group, cultural background, education and religion live together in the area.

Mahmud (1997) observed that the economic resource of Demsa, Numan and Lamurde LGAs centered on agriculture with crops like, cotton, groundnut, rice, cowpea, sorghum, bean, millet, maize and guinea corn, other include craft, fishing etc. It is also an important area for cattle, sheep and goat rearing. Irrigation is done along the riverbank with mostly vegetable gardening; fishing is also carried out at the riverbank. Others are employed in services such as administrative, industrial and commercial sectors. The area can be considered a very vital community to the state’s economic growth and development considering the large number of the indigenes involvement in agricultural activities such as farming, fishing, cattle rearing and large number of produce made available for exportation outside the state (Khobe, Sanu and Kwaga, 2009).

The major occupation of the people of Numan, Demsa and Lamurde is farming as reflected in their notable vegetation zone Northern Guinea Savannah Zone, their cash crops are cotton and groundnut while food crops include maize, yam, cassava, guinea corn, millet and rice. The village communities living on the banks of the rivers engage in fishing. Trade also flourishes in the area with the area hosting several markets which provide platforms for the exchange of a variety of commodities. Other important economic activities in area include hunting, leather works and production of charcoal (Information Unit Numan L.G.A. 2013).

3 b) Types and sources of data

The primary data collected for this study include; background of the household head, occupational characteristics, income level, while the secondary data includes population **??**ata

4 d) Method of data Analysis

The study employed host of analytical tools based on the objectives. Descriptive and inferential statistics were the analytical tools used for the study. The descriptive tools include the used of average and percentage. The inferential statistics include Regression analysis, ArcGis 10.2 software was used for the Land Use Land Cover Analysis (LULC) and the Normalized difference Vegetation Index (NDVI) analysis. ii. Changes in level and pattern of exploitation of forest vegetation resources in the study area.

5 i. Extent and pattern of change in population growth

Land Use Land Cover Change Detection Analysis and Normalized Difference Vegetation Index (NDVI) were used to examine the changes in pattern of landuse land cover classes and the vegetation of the study area.

6 iii. Normalized difference vegetation index (NDVI)

NDVI was used to distinguish healthy vegetation from others or from non-vegetated areas using red and near-infrared reflectance values and this was integrated in the post-classification analysis to discriminate between the green cover and barren lands. The importance of the NDVI is to determine the density of green on a patch of land. Theoretically, NDVI threshold value ranges between -1 to +1. Measured value range from -0.35 (water) through zero (soil) to +0.6 (dense green vegetation). Based on grey scale this corresponds to a pixel digital number of 135 or higher. The more positive the NDVI the more green vegetation there is within a pixel.

This research used NDVI based on the red band and near-infrared band of Landsat imageries and this was derived using expression given in Equations 1 and 2 for Landsat imageries respectively.NDVI = NIR -R NIR + R ?????.. (1) TM4 -TM3 TM4 + TM3 ?????.. (**2**)

Where; NIR= the spectral reflectance measurement acquired in the near-infrared region (band) R= the spectral reflectance measurement acquired in the red region (band).

In the case of Landsat image data TM4= near infrared band, TM3= red band. The 1986, 2001 and 2017 satellite images were reclassified based on the NDVI threshold values.

7 III.

8 Results

9 a) Relationship between population growth and Vegetation cover

Results obtained from the regression analysis (Table **??**.1) show that there is an inverted V-shaped curve relationship between population growth and vegetation cover. The panel regression curve of population and Normalized Difference Vegetation Index (NDVI) is shown in Figure **??**.1. The first turning point, where the relationship between population density and NDVI changes from negative to positive correlation, occurs at the population of 198,243 in 1986 while the NDVI is 0.423 (48%) of the total Land area. The second turning point, where the relationship between population density and NDVI changes from positive to negative correlation, occurs at the population of 297,350 in 2001 with NDVI of 0.325 (32.5%) of the total land area cover.

The study shows that there is a long-term inverted V-shaped curve relationship between population growth and vegetation cover, which means that the vegetation cover tends to decrease gradually over time with the increase in population growth.

The influenced of population growth on vegetation cover in the study area can be considered as two effects, one is the consuming destruction effect. Population growth is inevitably resulting in increasing demands for life necessities. To meet these demands, large areas with good vegetation cover were being exploited for construction of houses, roads, factories and shops, and the vegetation resources were plundered, resulting in a vegetation cover decrease. Vegetation is an essential element for human development, and it can help improve the living environment as well as providing productive materials and a source of energy for humans. With the population growth, the demands for the ecological functions provided by vegetation in the study area have increase. Evidence from this study shows that rapid population growth, in combination with other factors, contributes to increasing vegetation exploitation. Growing populations mean increased demand for food, and a corresponding need to convert forests to agricultural land. Land shortages in traditional farming areas result from the combination of several factors among them a growing the long-term relationship between population growth and vegetation cover can be separated into two stages in the study area where there are frequent human activities and the influence of climate change on vegetation cover changes. At the first stage, there is an inverse relationship between population growth and vegetation cover. As the vegetation cover is relatively high and the public facilities are imperfect at the early stage of population growth, the vegetation cover decreases fast with the population growth when

the consuming destruction effect is much stronger than the planting construction effect. While the second stage, there is an inverse relationship between population growth and vegetation cover. With the population continuing to expand beyond a certain limit, the consuming destruction effects surpass the planting construction effect, and then vegetation cover tends to decrease with population growth.

10 b) Comparison of NDVI results of 1986, 2001 and 2017

An image differencing technique was used whereby NDVI values from three images were subtracted from each other to obtain changes in NDVI. This was subsequently converted to a NDVI (representing vegetation density). Thus, by using the NDVI result of three different years' image **??**1986, 2001and 2017) vegetation changes were calculated with NDVI= (NIR-RED) / (NIR+RED). Where NIR is the near infrared band response for a given pixel and RED is the red response. Green and healthy vegetation reflects much less solar radiation in the visible (channel 1) compared to those in the nearinfrared (channel 2). More importantly when vegetation is under stress, the channel 1 value may increase and the channel 2 values may decrease.

The interpretation of the NDVI image results, revealed an irregular pattern of vegetation cover in Demsa, Lamurde and Numan LGAs. Periods of remarkable vegetation decrease as well as increase have been identified.

The maximum values of the vegetation index were decreases from 0.423 in 1986 to 0.325 in 2001and decreases to 0.305 in 2017. From 1986 to 2017 there was by far reduction in the NDVI value by 23.1% figures 3.2a, Figure **??**.2b and Figure **??**.2c respectively.

Generally, the result of the NDVI values shows that the vegetation cover in general was reduced and the forests in particular ware depleted, the trend shows there was depletion of natural vegetation but an increase in agricultural activities which were associated with increasing participation in out-grower, non outgrower activities of the pre and post Savanna sugar scheme and the increasing irrigation activities, rice and maize farming throughout the year in part of Numan and Lamurde LGAs as the dark green colour can be seen in area closer to the riverbank where irrigation and agricultural activities are mostly found. The major reason for depletion of the vegetation in general and natural vegetation in particular is due to high deforestation rate, and high population pressure. Similar the increased in the pixel value were concentrated around area of higher irrigation activities and along the river Benue through, the increasing NDVI between 1986 to 2001 only reflected increasing in green vegetation resulting from irrigation activities, the present of river Benue through and the Savannah sugar farm and factory, but studying the results of the NDVI shows a significant decrease of trees cover and scrubs toward the southern part of the map. There exists a direct relationship between human population and poverty on vegetation demand, hence, the cutting down of wet wood can be said to be on the increase. The rate of consumption of fuel wood in study area exceeds the rate of production. It is therefore right to say this renewable source of energy would sooner or later be scarce, should these form of exploitation continue.

On the issue of vegetation exploitation in the study area the result shows that 73.1% exploited the vegetation for fuel wood, 11.2% uses the vegetation for roofing and fencing of their houses, 7.0% uses the vegetation as sources of vegetable for cooking in their houses, 4.7% exploited the vegetation and used it as fencing pole to fenced their houses and 3.9% of the respondents uses vegetation for fruits and served as medicinal for cure of various ailment (herb). The distribution of households by types of energy used, 65.3% which constituted majority of the respondents used firewood exclusive, 0.3% used charcoal exclusive, 5% of the respondents used both firewood and charcoal, 26.9% used firewood and kerosene, 0.5% used gas as source of energy for cooking.

The household size has direct linkage with the quantity of fuel wood exploitation. This implies that larger families exploit more fuel wood than their counterparts with smaller families. occupation and gross annual income are the prominent economic resources which have direct link with the household fuel wood exploitation. This implies that the households who are fully involved in farming and having considerable gross annual income exploit more fuel wood than the households who are not fully involved in farming and have low gross annual income. The dependency on fuel wood for household energy security is higher among proximate families than the distant families. Similarly, the higher the forest resource possession in the households lower is the dependency on forests for fuel wood. Access to alternative energy sources is the crucial variable having direct impact on fuel wood exploitation, hence, the families who have higher access to alternative energy sources have lower dependency on fuel wood. The result of the multiple regression analysis in table **??**.3 indicated that the determinant factors viz., household size, occupation, education, marital status, gender and income, forest resource possession and access to alternative energy source had significant contribution to the fuel wood exploitation and thus, were the potential predictors in explaining the variation in the fuel wood exploitation. The positive Coefficient of number per household, occupation, marital status and income implies that the more the number of married people in a population the higher the consumption of vegetation and vice versa.

Number of people in households tends to increase the demand for fuelwood, the implication is that as the family increases the demand for fuelwood also increases, the use of fuelwood is a cost-saving mechanism to cope with prevailing economic realities so that the limited funds can be used to meet other basic family needs. Education was found to inversely affect the consumption of fuelwood in the area. For every increase in income of household heads, fuelwood consumption decreases. Increase in income increases the purchasing power of people; hence, households may increase the consumption of other alternative sources of domestic fuel such as kerosene and gas, thereby reducing the consumption of fuelwood while decrease in income level of the head of households tends to increase the use more wood fuel to meet their domestic requirements. A critical implication here is that

more pressure is brought to bear on the patchy vegetation and, as time goes on, the movement of wood fuel in the form of commercially processed charcoal will intensify, bringing much pressure on the largely overexploited forests in the study area.

The rural people exploit enormous quantity of fuel wood mostly from the forests and their farms and utilize same for cooking, fencing, vegetable, and roofing. Households' dependency on fuel wood as a source of energy is overwhelming. The fuel wood is chief, exceptionally preferred and cheap energy source because the area is characterized by resource poor, low income and peasant farmers with inadequacies of socioeconomic and biophysical infrastructure. The analyses herein suggest that varying degree of household's fuel wood exploitation is primarily driven by several socioeconomic and biophysical conditions. The study has evidently shown that there is a huge pressure on natural forests for fuel wood to meet household energy security resulting in deforestation and degradation of the natural environment.

High rate of poverty in the country contributes connects much to deforestation, reason because 73.1% exploited the vegetation for fuel wood, as a result of it, high numbers depends on wood fuel widely known as Charcoal in the country for their live hood for people in the rural areas and urban areas with its modern constructed charcoal burners. With the high demands of this product called charcoal which is been produced through cutting down of forest trees comes high rate of deforestation, also another source of income for many people. This charcoal production has severe effects to our forest reserves. Over consumption of this wood fuel has led to deforestation and habitat loss with its combustion that generates emission impact to the climate change.

The growth in population affects economic growth, leads to a decline in per capita income and deepens poverty. This mismatch which results in the population-poverty cycle also has imminent consequences on environmental degradation and raises concern about sustainable development and human welfare.

Diversification of alternative energy sources, reduction of the prices of alternative energy sources, provision of rural infrastructure, development and promotion of low-cost technologies for reducing fuel wood consumption, implementation of afforestation programmes, substitution of fuel wood and awareness Volume XXI Issue I Version I 35 ( ) development towards environmental protection and biodiversity conservation will have a significant impact on reducing pressure on natural forests in the study area.

11 IV. Conclusion and Recommendations

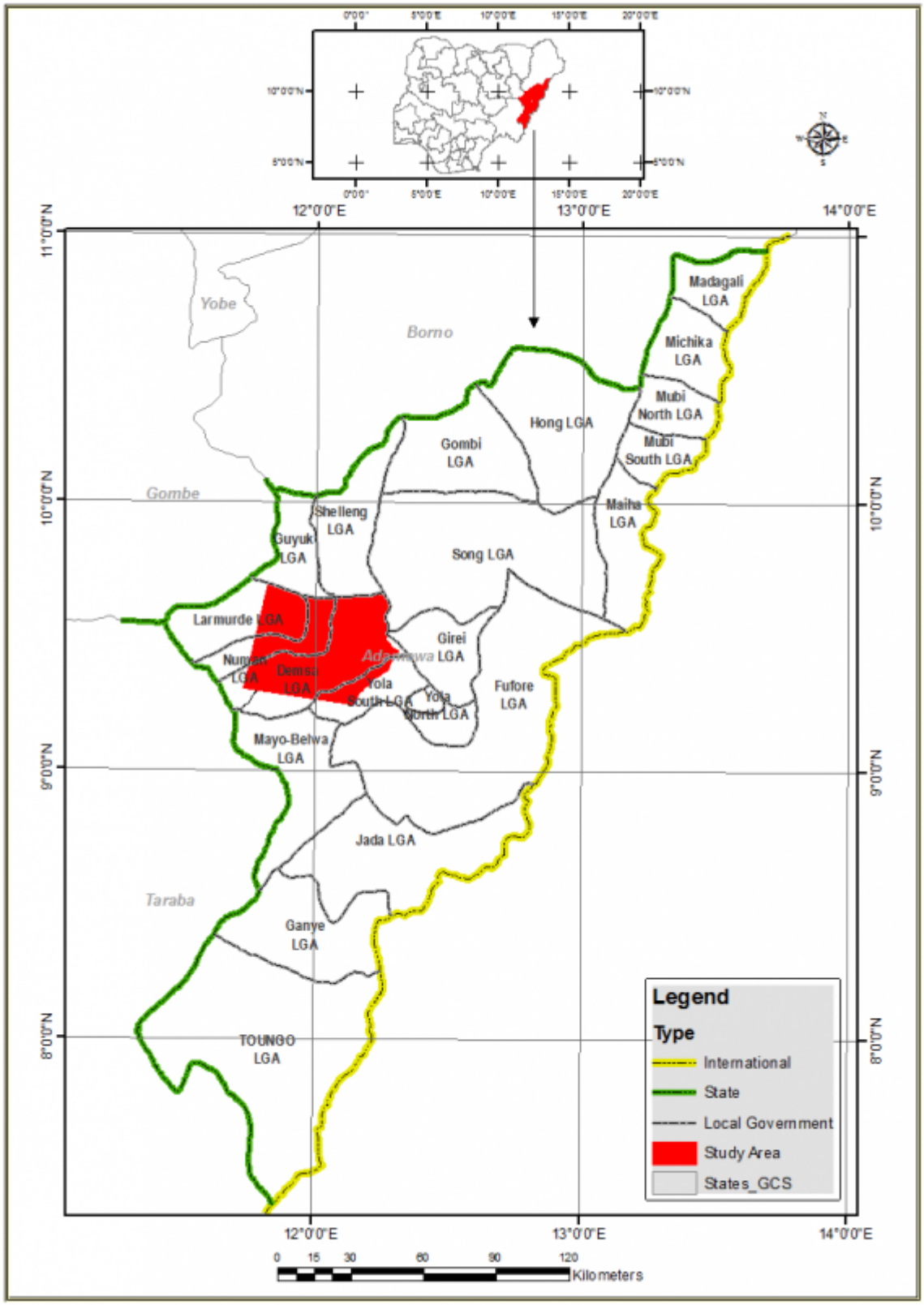
The findings of this research revealed that, the population of the study area is increasing at an alarming rate with an average increase per year of 11608 that is an increment of 2.2% per year. Further increase in population will lead to increase in demand for natural resources (land, pasture, water etc) that may inadvertently lead to over exploitation of the vegetation resources and inexorable degradation of the environment.

The NDVI status of the vegetation cover shows both decrease and increase in the pixel value which was associated with the pre and post establishment of the Savannah sugar factory and the increased in irrigation activities toward the river Benue through as the darker green pixel value were seen concentrated at Savannah.

Finally, vegetation resources play multiple roles at global as well as local levels. vegetation are sources of economically valued products like industrial wood, fuel-wood, non-wood forest products such as fibre, food, medicines. In essence it is a source of income and employment. It also provides maintenance of biological diversity (habitats, species and genetic resources), and controls against climate change. Burgeoning population affects forest stock. People living around the forest reserve for and livelihood. However, the rapidly growing population has mounted a lot of pressure on the reserve which is not well protected thereby leading to rapid depletion of forest resources in the reserve. Based on these findings, it is therefore recommended that: Government should address and check population expulsion, through; birth control, educating the populace, as well as restricting the number of immigrants from neighboring countries. [1] [2]

[1] Assessment of Population Growth on Vegetation Cover in Numan, Demsa and Lamurde Lgas Areas of Adamawa State

[2] © 2021 Global Journals Year 2021 B Assessment of Population Growth on Vegetation Cover in Numan, Demsa and Lamurde Lgas Areas of Adamawa State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Borno
Gombe
Taraba
Adamawa
Madagali LGA
Michika LGA
Mubi North LGA
Mubi South LGA
Hong LGA
Gombi LGA
Maiha LGA
Shelleng LGA
Guyuk LGA
Song LGA
Larmurde LGA
Girei LGA
Nuwan LGA
Demsa LGA
Yola South LGA
Yola North LGA
Fufore LGA
Mayo-Belwa LGA
Jada LGA
Ganye LGA
TOUNGO LGA
Legend
Type
International
State
Local Government
Study Area
States_GCS
0 15 30 60 90 120
Kilometers

Figure 1:

$$r = \frac{\log(P_{t+n} / P_t)}{n * \log_0} * 100$$

11

Figure 2: Figure 1 . 1 :B

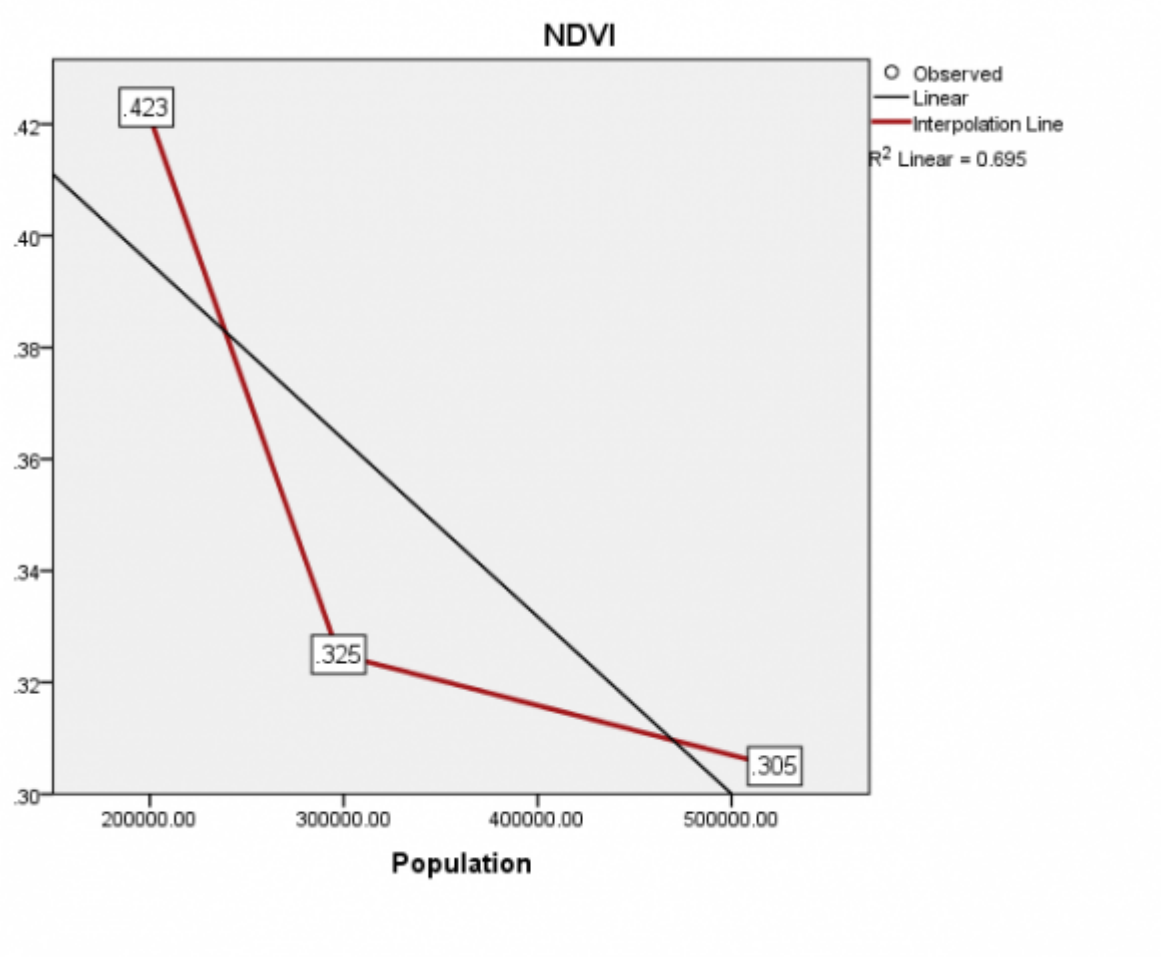

Figure 3:

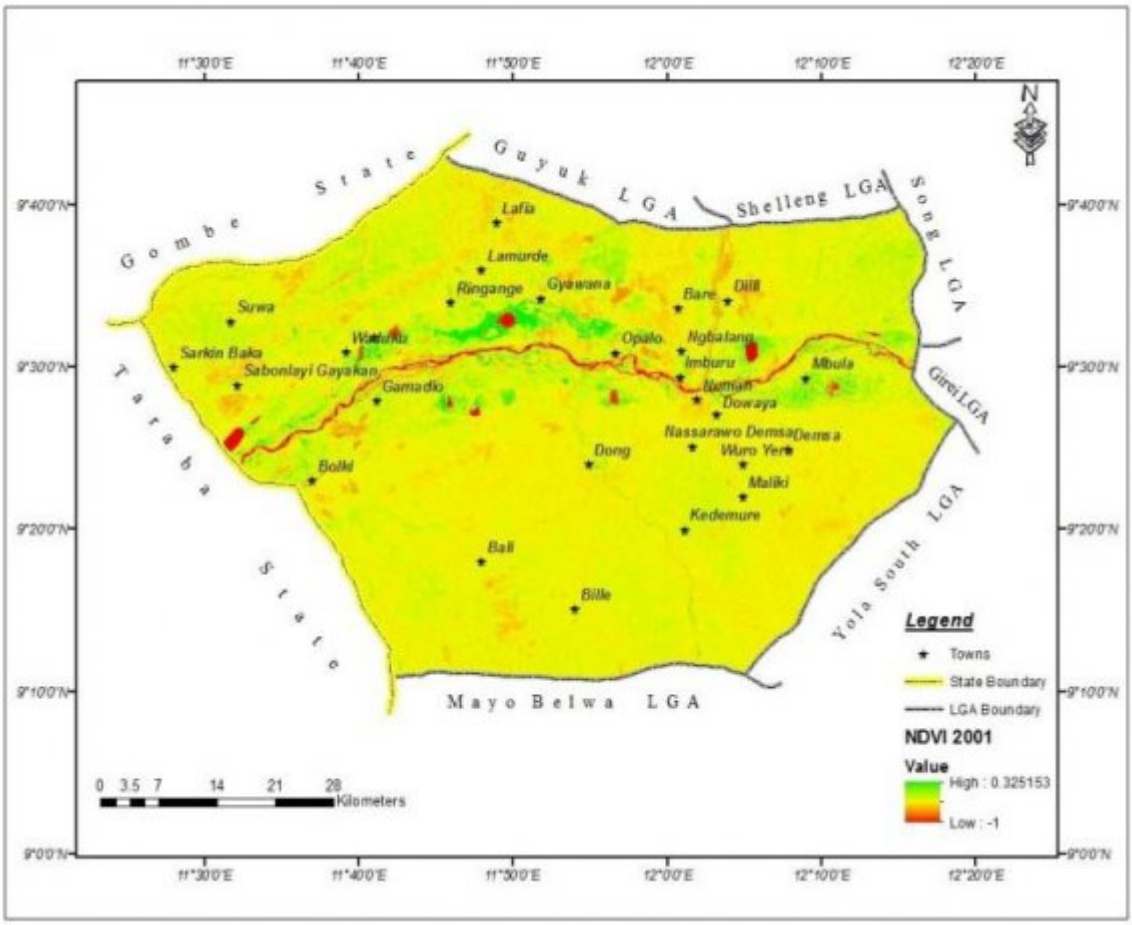

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Figure 4: Figure 3 . 1 :

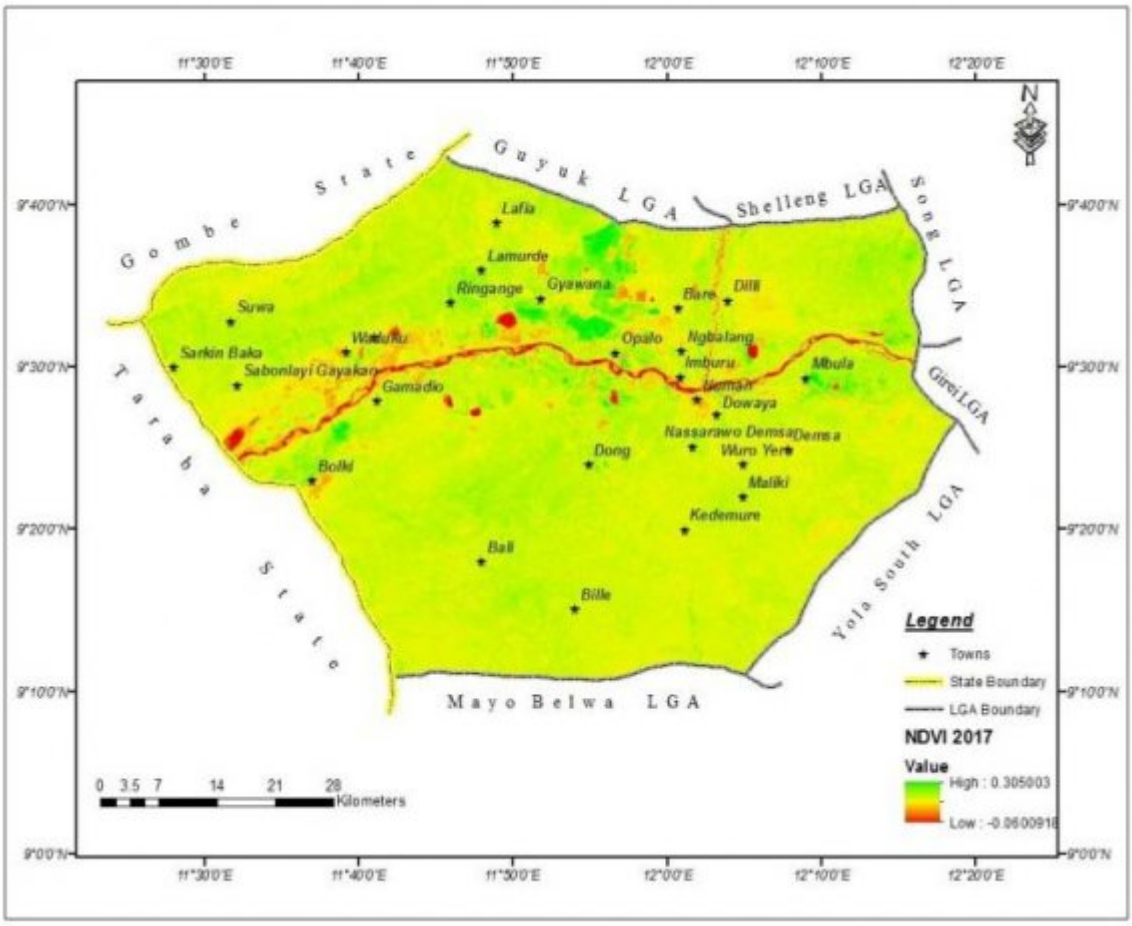

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Figure 5: Figure 3 .Figure 3 .

21

Landsat Tm 1986	186	53	30 x 30	7	21 st Dec. 1986	USGS
Landsat ETM+ 2001	186	53	30 x 30	8	22 nd Dec. 2001	USGS
Landsat ETM+ 2017	186	53	30 x 30	11	10 th Dec. 2017	USGS

Source: United State Geological Survey, 2017

[Note: c) Instruments for Data collectionArcGis 10.2 software was used for the Land Use Land Cover (LULC) and NDVI analysis. Data collected from the questionnaire was coded in spread sheet (MS EXCEL 2010). MiniTab version 22 was used for the descriptive statistic and regression analysis.]

Figure 6: Table 2 . 1 :

number of people, a high population density, and the accumulation of previous population growth.

	Dependent Variable: NDVI					
Equation	Model Summary R Square	F	df1	df2	Sig.	Parameter Estimates Constant
Linear	.695	2.278	1	1	.373	.459

The independent variable is Population.

Year 2021

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NDVI =

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Figure 7:

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Figure 8: Table 3 . 1 :

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NDVI Value	1986	2001	2017
Maximum Pixel Value	0.423	0.325	0.305
Minimum Pixel Value	-1	-1	0.060

[Note: Source: Analysed from 2017]

Figure 9: Table 3 . 2 :

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Coefficients
a

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig
1	(Constant)	.392	.528		.741	.45
	Income	2.628E-6	.000	.029	.515	.60
	Gender	-1.556	.306	-.358	-5.080	.000
	Marital status	1.019	.170	.426	5.989	.000
	Education	-.006	.113	-.003	-.052	.959
	Occupation	.149	.084	.085	1.773	.077
	Household	.159	.036	.209	4.371	.000

a. Dependent Variable: Expenditure on Fuelwood

Figure 10: Table 3 . 3 :

Year 2021 B

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