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Desertification and Soil Erosion: Dual Effects of Deforestation in JADA Local Government Area of Adamawa State, Nigeria.

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Abstract :Areas affected by gully erosion and logging were surveyed in the study area between February and November, 2012 with the aim to determine some effects of deforestation. Sampling of logged trees was conducted in six out of the nine districts of the local government, with more pronounced logging activities and gully erosion features. Data collected was based on random visible logged trees that suffered environmental degradation. Photographs of logged trees and gully ravaged areas were taken. Results showed that the total volume of soil lost to erosion was 51,713.24m^3, while a total of 305 trees were logged in the study area. As a result of this, roads, schools, health clinics and other infrastructures were lost to erosion in this area. Some ways of reducing these effects of deforestation have been suggested in this work.

Keywords: gully erosion, deforestation, logging, degradation and environment.

I Introduction : Nigeria's forest estate is estimated at about 10 million hectares, with about 20% in reserve. This forest estimate consists of vegetation types ranging from mangrove swamp along the southern coast through fresh water swamp, low level rain forest and savannah (Lucas, 1997). According to Longman and Jenik (1987), forests influence the rate of rainfall, since about 75% of rainfall evaporates directly or via the trees, thus, providing moisture for cloud formation and rain. Mikloda and Joshua (2004) reported that forests provide wood, fibre, fauna and also facilitate the effective protection of watershed and thus helps in preventing erosion. Deforestation is derived from forest which is a large area of land covered with trees, bushes, shrubs and herbs. It can also mean the entire functioning system of a tree dominated community, including a biotic substrate and atmospheric surroundings. Therefore, deforestation is the process of removal of forests by cutting down or burning trees to convert the land use for other purposes which can lead to desertification Ota (1984). Pierce (1992) described desertification as the collective expression of numerous forms of land degradation. In developing countries such as Nigeria, more than 80% of the population depends on fuel wood for supply of energy and other domestic purposes, such as cooking, heating and fish smoking (Smith, 1985: Goodman, 1986 and Umeh, 1986). By reducing the amount of forest area that would otherwise convert carbon dioxide to oxygen, deforestation can be linked to carbon emission and soil erosion. Similarly, Lucas (1997) observed that deforestation being practiced on a wide scale in Nigeria today constitutes some major environmental problems such as desertification, ecological and social constrains. Soladoye (1998) estimated the rate of deforestation in Nigeria to be between 300,000 – 400,000 ha/yr. Lucas and Olajide (2002) indicated that, though there may be reasons for why trees are felled on our environment, some factors that influence deforestation have been identified as manmade for purposes such as Agro- agricultural, power projects, housing, road construction or harvesting the trees for the production of building materials and for fuel without replanting the trees. Other reasons could be natural such as excessive flood, strong wind and storm, outbreak of pests and diseases, elephants and other wild animals that browse and break down branches of trees and uprooting some of them. Unlike in other parts of this country, where impact assessment of deforestation, flood, ecological and other natural disasters are carried out, this part of the country especially the study area is lacking in this regard. Hence there is a need to evaluate some of the effects of deforestation on our environment that is silently suffering from and to provide suggestions that may reduce this trend. Deforestation can lead to soil erosion because when trees are logged, the impact of rainfall is direct on the soil surface as the canopy of the trees that trap rain drops are no longer there (UNDP Report, 2007). This results into splash, rill, sheet, and subsequently gully erosions. The report agreed that the combined effects of deforestation have led to an increased desertification of the magnitude of 2.38km/yr due to human activities. According to World Bank report (2000) under review of resettlement and development, between 90 and 100 million people have been involuntary resettled over the past decade due to deforestation to pave ways for these infrastructures.

In Africa, land trees cleared for dams have forcibly relocated farmers, herds' men and even local inhabitants (The Awake Magazine, 2005). The magazine further warned that frequent deforestation destroys valuable agricultural alluvial soils. These facts have serious implications for runoff and surface erosion. Strong erosion reduces the fertility of soil and organic matter giving rise to low agricultural productivity and food security may be impaired due to desertification as a result of deforestation, physical loss, or change in the structure of soils and crop types (Pierce, 1992).

A report of Adamawa State Ministry of Agriculture in 1994 indicated that more than 15,000 hectares of land in the state suffered from serious related problems. A study of soil erosion due to deforestation in Biu local government area of Borno State, Nigeria showed that more than 1000 tones of soil have been lost to gully erosion (Ekwue and Tashiwa, 1993). Soil loss caused by erosion in Sade town of Bauchi State, Nigeria was estimated at 31,000 tones (Rattenbury, et al., 1988a). This erosion led to a wide scale loss of crops, livestock and the collapse of some buildings. The much talked about of global warming, desertification and other environmental problems are manifestations of deforestation (FAO/UNDP. 1992). In Adamawa State, forests have been subjected to severe deforestation resulting from indiscriminate extraction of wood for fuel and expansion of land for cultivation (Mikloda and Joshua, 2004).

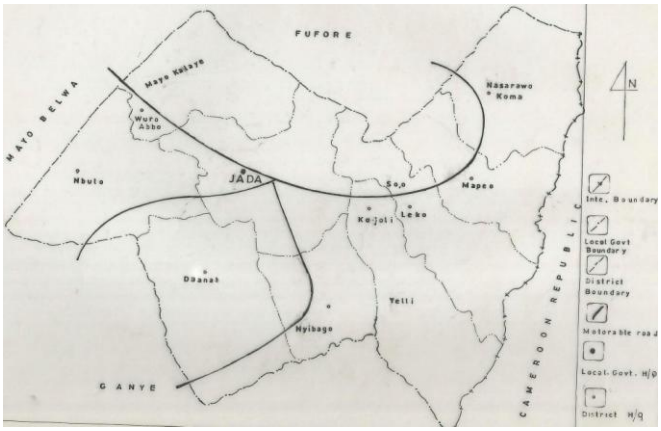

Fig 1: Map of JADA local Government Area Showing its District Areas

The climate is broadly divided into wet and dry seasons of the tropical type. The rainy season begins mostly in April and ends in November, while the dry season lasts between November and March. The average annual rainfall ranges from 885 to 1000mm, and the soil in this area fall in the category of lithosols i.e. clay and loam (AADP, 2006). The vegetation is mainly the Sudan type, which implies a grassland vegetation interspersed by short and tall trees mainly eucalyptus, *acacia albida*, shear butter (*Batyrospermum paradoxium)*, African capaiba (*Daniella oliveri)*, Mahogany (*Khaya Senegalensis)* and African locus bean trees *(Parkia clapertomiana)* (Burmamu, 2006).

Jada local government area of Adamawa State is one of the areas in the north-eastern part of Nigeria with serious deforestation and erosion problems, partly but significantly as a result of indiscriminate logging. Large farm lands and roads have been destroyed due to gullies. This paper presents the result of the effects of deforestation and gully erosion features in some selected district areas of Jada local government area of Adamawa State, and has provided suggestions to reduce the trend.

II Material and Methods Brief description of the study area:

Jada local government is one of the twenty one local governments located in the southern part of Adamawa State of Nigeria. It lies between latitudes $8^0 48'$ and $8^0 75'$N and longitudes $12^0 17'$ and $12^0 38'$E with a land mass of 2,890Km^2 (Adebayo and Tukur, 1992). Jada, the local government headquarters is about 96 Km from Yola, the state capital. It has a population of 168,473 people (NPC, 2006). The eastern of the local government shares an international boundary with the Republic of Cameroun. It also shares boundary with Taraba State, and some local governments of Adamawa State, such as Mayobelwa, Fufore and Ganye. The entire local government is made up of nine district areas, namely: Mbulo, Dashen, Yelli, Mapeo, Koma, Leko, Danaba, Mayo-kalaye and Jada (Fig. 1).

Method of Data Collection

The sampling of the felled trees was conducted in six out of the nine districts, namely: Mbulo, Danaba, Yelli, Mapeo, Leko and Koma. The choice of these districts was based on the rate and level of soil ravage done to their environments due to erosion problems as a result of logging and deforestation. A survey to determine the extent and causes of deforestation and soil erosion was carried out between February and November, 2012, so as to see the effects of the two seasons. The data collected was based on random visible logged trees from areas that suffered environmental degradation being a brain child of deforestation. Logged trees were sampled randomly and photographs were taken with digital camera, but the exact number of was not quantified

because logging was done almost on daily basis and indiscriminately. Similarly, records were not available with the local government, since the exploiters claimed to have obtained permission from relevant authorities. Personal observations on the environment and interviews with the exploiters were employed in order to assess the number of utilized and unutilized logged trees. The surveyed areas affected by gully erosion were identified, and the total soil loss in each gully erosion was estimated by measuring the length, width and the depth of the gullies. This was used to calculate the size of the gullies using a 50 meter steel tape and a metric ruler. Quadrants were demarcated with peg arrows measuring 500m x 500m using a steel measuring tape. A total of five quadrant samples were randomly collected in each district to give a total of thirty quadrants in all.

Method of Data Analysis

Simple tables of the types of trees logged particularly the English, botanical and vernacular names were analyzed. Volumes of soil lost due to gully erosion were calculated from the measurements taken. Figures and plates of erosion features were also analyzed. The economic importance of some of the trees logged was given descriptive discussion in order to evaluate the effects of deforestation in the study area.

$$P_{U} = \frac{L_U}{S} \times 100\ \% \quad \text{..... (1.1)}$$

$$P_{N} = \frac{L_N}{S} \times 100\ \% \quad \text{.....(1.2)}$$

Where, L_U is the sum of logged utilized trees per district, and L_N is the sum of logged not utilized trees per district, while S is the total number of trees logged per district.

Table 1: Sampling of total logged trees per district and percentages of logged utilized and logged

S/N	District areas	Total logged Utilized trees (L_U)	Total logged Not utilized trees (L_N)	Total no. number of Logged trees (S)	Percentage of logged Utilized trees (P_U)%	Percentage of logged not utilized trees (P_N)%
1	**Mbulo**	41	7	48	85.4	14.6
2	**Danaba**	39	8	47	83.0	17.0
3	**Yelli**	42	8	50	84	16.0
4	**Leko**	43	9	52	82.7	17.3
5	**Mapeo**	47	8	55	85.5	14.5
6	**Koma**	49	7	56	87.5	12.5

Total = 308

Not utilized trees

Total = 308

III Results and Discussion

Sampling, discussion and calculation of percentages of logged utilized and unutilized trees per district.

The data in Table 1 consists of logged utilized trees and number of logged trees but not utilized with their percentages per quadrant of 500mx 500m sampled per district. This logging activity started in a wide scale in the early 1990s and now is growing at an alarming rate. The percentage of the logged trees utilized and not utilized were calculated using equations 1.1 and 1.2 respectively (Ekwue and Aliyu, 1991).

From Table 1, the total number of trees logged per district ranged from 39 – 49, for the five quadrants, with Danaba district having the lowest of 39 total logged trees, while Koma district has the highest of 49 .Leko district has the lowest percentage of logged utilized trees with 82.7%, while Koma has the highest percentage of logged utilized trees with 87.5%. Koma district has the lowest percentage of logged not utilized trees with12.5%, while Leko has the highest percentage of logged not utilized trees with 17.3%. Koma district has the highest number of logged trees as well as the highest percentage of logged utilized, this might be connected with the fact that Koma district is at the extreme eastern part of the local government sharing common boundary with the

Republic of Cameroun and has more vast land. This makes the perpetrators to operate almost in isolation without been checked or easily noticed. The percentage of logged trees not utilized in each of the districts is significant because most of the perpetrators are not experts, and hence lack the technical capabilities to distinguish between trees that can make good timbers. Some of the trees logged from different parts of the study area are presented in plates (I – IV) and Table 2, with their direct economic importance to the inhabitants.

Plate 111: Mahogany (Khaya Senegalesis) being converted Plate 1V: Typical erosion from Yelli District

Into timber from Koma District

Plate 1: Logged Plate 1: Lo

Table 2: Some tree species commonly logged in the study area and their direct benefits to the inhabitants

Botanical name	English name	Hausa name	Igbo name	Yoruba name	Direct benefits
Bombax costatum	Silk tree	Gurjiya or bambta	--	--	Flower as food especially in soup preparation
Borassas aethiopum	Fan palm	Giginya	Ubili	Agbon-olodu	Fruit as food and broom from dry leaves
Batyrosperpum paradoxium	Shear butter tree	Kadanya	Osisi	Emi-emi	Fruit for oil, and bark cover for medicine and generation of gum
Ceiba pentandra	Silk cotton tree	Rimi	Akpu or akbo	Araba	Seed cotton for textile and tender leaves for food
Daniella oliveri	African capaiba balsam	Maje or kadaura	Abwa or ozobai	Omuya or iya	Back cover for medicine, perfume and the generation of gum

Erosion Menace in the Study Area: As a result of deforestation, the environment is subject to both water and wind erosion. Intensive and destructive nature of gully erosion has been noted in the study area, particularly Yelli, Leko, Mapeo and Koma districts. Visitors to the study area are always shocked by the destruction of homes, farmlands, roads, schools and other infrastructures in the gully ravaged parts of Jada local government area. Apart from the effects of gully erosion, there is variability of climate because deforestation has affected agriculture and livestock production. This variability may necessitate very expensive adaptive and adjustment measures, which an average farmer in that area can afford. The result of the detailed gully erosion in the study area is shown in Table 3.

Table 3: Presentation of land use, vegetation, slope and gully erosion parameters of the surveyed Area

Location of erosion	Present land use	Vegetation	Gully erosion parameters				Type of erosion
			Average length (m)	Average width (m)	Average depth (m)	Total average volume (m^3)	
Mbulo	Human settlement and arable	Few trees and grass	349	9.2	1.7	5,458.36	Gully
Danaba	Few human settlement and arable	Trees and shrubs	243	8.2	2.0	3,985.20	Gully
Yelli	Human settlement and arable	Few shrubs and trees	270	7.0	1.6	3,024.00	Gully
Leko	Few human settlement and arable	Few grass and trees	659	8.2	2.1	11,347.98	Gully
Mapeo	Human settlement and arable	Shrubs and trees	359	11.0	4.0	15,796.00	Gully

Total = 51,713.24m^3

From Table 3, measurements of the lengths, widths and depths of seven erosion features in each district were taken, and the average values were determined. The average volume of soil lost in the badly affected areas is in decreasing order of Mapeo, Koma and Leko districts with more gully erosion features than the remaining three districts. This is in good agreement with the data in Table 1,

where these three districts have the highest number of logged trees than the remaining three. Plates (i – iv) show some pictures taken from the study area with features of gully and sheet erosions. Table 3 also shows the volume of soil lost to gullies in the study area, which ranged from 3,024.00m^3 in Yelli district to 15,796.00m^3 in Mapeo district. The extent of gully erosion in these areas may be linked to desertification, mode of the formation of each feature, organic matter content, land use, topography, vegetation, and soil characteristics. In all, the overall average total soil lost to gully erosion in the study area from Table 3 was 51,713.24m^3. This can increase in the near future if not checked or controlled.

Suggestions

The following are some suggestions that if implemented would assist in conserving the forest and land thereby reducing the menace of soil erosion in the study area:

(i) To reduce further erosion, farmers in the study area should adopt erosion control measures such as the use of double cropping, crop rotation, conservation terracing, wind breaks, strip cropping and contour ploughing.

(ii) Government should be more proactive in constructing drainages to combat erosion and pave ways for water flows along the existing road sides.

(iii) Tree planting should be revisited and government should lead by example by planting trees on monthly, quarterly or yearly bases.

(iv) More legislative actions on prohibition of indiscriminate logging of trees, except where necessary such as for schools, health clinics and roads construction.

(v) Government should explore more ways of utilizing the abundant solar energy we have, and discourage its citizens on the total dependence on forest energy as fuel.

(vi) People should be encouraged to plant more economic trees and orchards to improve on availability of raw materials for our industries, and to boost the standard of diet in our societies, e.g. oranges, mangoes, banana, apple, guava, etc.

Conclusion

Due to the poor economic nature of Nigeria, the practice of deforestation would hardly stop completely because wood and charcoal fuels are the major sources of energy in the study area. This study has shown that at the rate at which trees are indiscriminately logged for timbers and other purposes, time will come when some particular species of trees would be wiped out and there will also be low production of food as some of the food items are obtained from these trees such as: honey, fruits, flowers and other soup ingredients. The menace of soil erosion is also alarming, and if not checked, the inhabitants would one day pay a high price economically, agriculturally and even environmentally before reclaiming it from devastation.

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