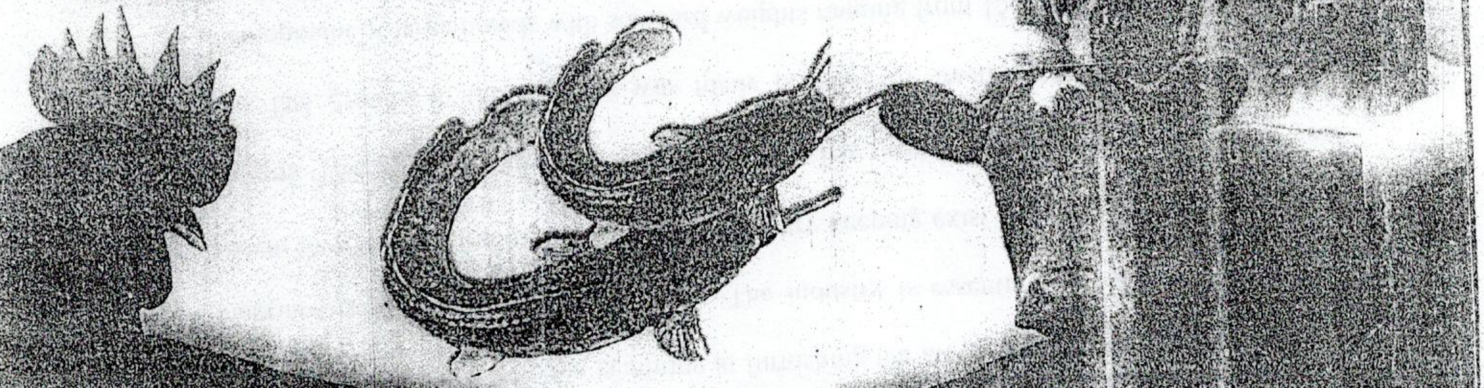
AGRICULTURAL SOCIETY OF NIGERIA (ASN)

PROCEEDINGS OF THE

44th Annual CONFERENCE "LAUTECH, 2010"

Theme:

RESTRATEGIZING NIGERIAN AGRICULTURE IN A RAPIDLY CHANGING CLIMATIC CONDITIONS FOR SUSTAINABLE FOOD SECURITY



Date: 18th - 22nd October, 2010

Venue: Ladoke Akintola University of Technology, Ogbomoso, Oyo State Nigeria.

Hardcopy reqd.

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PROCEEDINGS OF THE 44TH ANNUAL CONFERENCE OF THE AGRICULTURAL SOCIETY OF NIGERIA HELD AT THE LADOKE AKINTOLA UNIVERSITY OF TECHNOLOGY, OGBOMOSO.
18-22, OCTOBER, 2010.

Agricultural Society of Nigeria (ASN)

Publisher also of the Nigerian Agricultural Journal

ISBN 0300.368X
Published in 2010.

Printed in Nigeria by:
JOHNNY PRINTING WORKS
Beside Customary Court Okelerin, Ogbomoso.
08035244076.

SOIL DEGRADATION AS A PRELUDE TO LAND DEGRADATION AND ENVIRONMETAL REVERSES IN UGA, AGUATA, ANAMBRA STATE, NIGERIA

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Abstract

This study investigated the impact of soil erosion on land degradation and its environmental hazards in Uga, Southeastern Nigeria. Profile pits were sited on severely degraded (eroded) sites and less severely degraded sited. They were morphologically described and sampled. Soil samples were collected from the surface (0-50cm) of the erosion sites that were controlled. Some physical and chemical properties of the soils were determined. Morphologically, the soils were deep and well drained with no concretions or mottles. The colour variation ranged from brown (7.5YR 4/4) to dark reddish brown (7.5 R 3/3) for the profile pits. The soil varied in textured from fine loamy sand to sandy clay loam. The structure varied from hard to weak coarse crumb and friable. Chemically, they were strongly acidic, low in organic carbon and low in nutrient status. The pedons were classified as Arenic Kandiustults and correlated with Haplic Acrisols. The most prominent form of land degradation identified was soil erosion. Others included deforestation, bush burning, sand quarrying and contamination with palm oil wastes. Efforts at combating land degradation should be intensified by the Uga indigenes. Management practices such as use of organic amendments, minimum tillage and crop rotation could help in the conservation of the soil. This is to protect their land from environmental devastation and ensure food security for the future generations.

Introduction

Erosion and other land degradation processes are serious problems confronting Uga people in anambra State.

There is serious need for us to conserve our land against degradations like erosion and deforestation in order to enhance among other things food production and environmental sustainability. Our complacency to this has exposed us to the hazards of land degradation and we are almost being engulfed by it.

Land degradation which has been defined as the loss of utility or potential utility of land or the decline in soil quality caused through misuse by humans (Barrow, 1992). It is posing more threat to our future than military aggression. The major causes of land degradation are land misuse and poor land management. It could also be as a result of the climatic condition of Uga and the soil type of the area or due to bush burning, deforestation, quarrying, overgrazing, wrong building orientation and cultivation at the edges of erosion sites as observed at si[illegible] Uga town is devastated by gully erosion and o[illegible] degradative factors. Efforts made in the past to [illegible]mbat the problem even by the state government an[illegible] the village people could not make much meaning. There is need to investigate the causes of the problems of land degradation and other environmental hazards in Uga and make recommendations on how to ameliorate them in order to improve food security and sustain the environment. This study reports the case study of Uga land degradation and environmental hazards.

Materials and methods

The area under investigation lies within longitude 7^0 4'E and latitude 5^0 56'N. it is about 32km south of Awka, Anambra state capital. It lies on a slope that comes from east (Awalasi Uga) and North east (Oka) down to south (Umueze) and southeast (Umuoru) Uga. The study area falls within humid tropical zone.

Data on areas affected with erosion were collected and analyzed. The erosion-affected areas were considered in two aspects; eroded but controlled site and eroded but uncontrolled site, the uncontrolled site was considered in two aspects; severely eroded and less severely eroded.

Auger samples were collected from eroded but controlled site and two profile pits were dug on the other two eroded but uncontrolled sites. Samples were collected according to FAO profile description format (FAO, 1977). The samples were air dried and sieved to pass through 2mm sieve and the fine earth fraction so obtained was analyzed for physical and chemical properties using the normal methods as follows: Particle size distribution was determined by hydrometer method [illegible]uyoucos (19[illegible]). Bulk density was determined using undisturbed soil cores.

Total Porosity was calculated from the values of bulk density using the method described by Vomicil (1965). The soil pH was measured in a 1:2.5 soil water suspension ratio (McLean, 1982) available P by the Bray 2 method (Bray and Kurtz, 1945). Cation exchange capacity (CEC) was determined by the NH_4OAC displacement method and exchangeable acidity by titrimetric method after extraction with 1.0N KCl (McLean, 1982). Total exchangeable bases were by the complexometric titration method of Jackson (1962). Base saturation was calculated. Soil organic carbon was determined using the Walkley and Black (1945) method. Total nitrogen was determined by the micro Kjeldahl digestion procedure (Bremmer, 1965).

Results and Discussion:

Causes of the Degradation in the Area.

One of the causes identified in the area was indiscriminate building of houses which is as a result of land tenure system. Other causes were indiscriminate removal of vegetative covers, bush burning, deforestation and quarrying of sand, construction of markets, intensive row cropping and overgrazing. Also high population density or even over population increases the quest for fuel wood. The soil types of the area i.e. the parent material and the climatic factors also contributed to the hazards. In addition to erosion hazards, other hazards identified was pollution of the soil with palm oil waste and other domestic wastes. The impact of this pollution is mostly felt in wet season when it forms a suitable breeding ground for most vectors of disease. Generally it is noted that some of the hazards identified can occur at anytime of the year while some are prominent in the wet season such as improper disposal of waste materials while bush burning is prominent in the dry season.

Soil Morphology.

A summary of the morphological properties of both the severely eroded and less severely eroded but uncontrolled sites were presented in Table 1. The erosion had minimal effect on the morphology of the soils. The soils were derived from sand stones and shale, generally deep and well drained. The cause of the erosion was not mainly due to morphology but slope and the anthropogenic activities.

Soil characteristics

The particle size distribution indicated that the two profile pits and the auger samples have fine sand dominant over coarse sand. Textural classifications are Sandy Clay Loam, Sand Loam, and Loamy Sand. This could be attributed to the type of parent material of the area (Akamigbo and Asadu, 1986). The clay content of the soils is low, ranging from 8% -34% (Table 2). The upper horizons had lower clay content which could be attributed to the runoff on the surface which is caused by high rainfall and slope. The coarse sand was decreasing with depth in the first profile but was not so in the other samples. This could be attributed to the nature of lithology of the parent material. The samples have low silt content indicating the extent of weathering (Akamigbo, 1984). They also have higher quantity of fine sand which is due to the age of those areas as attested by their weathering index f.s/c.s (fine sand/coarse sand=73/16=4.56). In AP of UG/02 profile, the fine sand ranges from 40-73 while the coarse sand ranges from 14-36 and it is decreased with depth. The findings further confirm the observation of Obi and Asiegbu (1980) that the low clay and silt content of surface soil horizons in this area were attributed to the high detachability and transportability of these lighter soil materials. The bulk density values are relatively high. It ranged from $1.4g/cm^3$-$1.6g/cm^3$. The value obtained from the top soils of the severely eroded soil was lower than the bulk density values of the soil of less severely eroded site. This could be due to agricultural activities going on at the less severely eroded site and again as a result of soil and structure degradation.

Chemical properties

Table 3 shows that all the chemical properties were generally low in both sites and even in the auger samples. The values obtained from the less severely eroded site were higher than the ones obtained from the severely eroded site indicating that erosion has really affected the later more. The soil pH was generally extremely low ranged from extremely acidic to strongly acidic for all the soils. The organic carbon and the total nitrogen in the severely eroded profile pits and the auger samples in the area studied were very low and were decreasing with depth due to mineralization caused by high temperature, leaching, and nutrient depletion of arable farming. The Ap horizon of the UG/01 recorded relatively high organic matter content because the place was left fallow. The exchangeable bases and exchangeable acidity in the soils were low and could be attributed to the texture, structure and the parent materials respectively. The cation exchange capacities of the studied soils were low and may be due to clay composition of the area. Kang and Juo (1981) referred to such soils as low activity clay soils (LAC). Available phosphorus had moderate to high values but highest in the Ap horizon of UG/01 (Table 3). It must be because the place was left fallow. However, available phosphorus is usually low in the high acid soils which tend to fix phosphorus by forming insoluble Fe and aluminum phosphate (Unamba-Opara, 1990).

Soil Classification

Using the soil data obtained from both field study and laboratory analysis, the soils of the area were classified using the key to soil Taxanomy (Soil Survey Staff, 2003). The two profiles classify as Ultisols in the Ustults suborder. The soils have

Kandic horizon with a ustic moisture regime. They are Kandiustults because they do not have a clay decrease of 20% or more from the maximum clay content. They were classified as Arenic Kandiustults. They were correlated with the FAO/UNESCO classification system as Haplic Acrisols. They lack ferric properties, lack plinthite within 125cm of the surface and lack gleyic properties within 100cm of the surface.

Erosion Control Measures

So far efforts are in progress to see that the area is rescued from the incidence of erosion hazards. Local materials like bamboo trees, elephant grasses (*Pennisetum purpurem*), diversion ditches and sand bags are used to construct barriers in the area prone to erosion. Government efforts through the Task Force on soil Erosion Control have contributed to erosion control by constructing culverts and taking other measures to see that erosion is combated. Some sites have been controlled before but due to the type of soil and topography of the area aided by anthropogenic activities of man in the area, the gully is increasing despite all the efforts to control it.

Conclusion and Recommendation

Erosion was identified as the major land degradation agent in Uga town of Anambra State. There are differences in physical and chemical properties in the soils with severe degradation and less severe degradation. The soils of severe erosion recorded higher values of exchangeable acidity, %clay, %silt, heavy metals than the site with less severe degradation. The bulk density is lower than that of the less severe degradation. It must be born in mind that the soils are naturally poor in chemical attributes and degradation of land is prominent in Uga and the degradation potentials are high. If nothing is done to it now, one day the whole land may be lost to land degradation. To ensure continuous usage of the land and at the same time derive maximum returns from the land and preserve it for future use, sound conservation measures are very essential. So every Uga indigene should be encouraged to participate in the restoration of the land to avoid these stated hazards. It is therefore advised that rural agricultural policies on land use should be made and enforced to the people by both the government and the village heads so that there would be reduced misuse of the land.

References

Akamigbo F. O. R and Asadu. C. L. A. (1986). The influence of toposequence on some soil parameters in selected areas of Anambra state. South Eastern Nigeria. J. of Soil Science 6: 35-46.

Akamigbo, F. O. R (1984). The accuracy of field textures in the humid tropical environment. *Soil Survey and Land Evaluation. 4(3) 63-70.*

Barrow, C. J. 1992. Land Degradation. Cambridge Univ. Press, New York.

Bouyoucos, C. J.[1951]. Direction for making mechanical analysis by the hydrometer method. *Soil Sci.42;25-229.*

Bray, R. H. and L. T Kurtz (1945). Determination of total organic carbon and available forms of phosphorus in soils. Soil Sci. 59; 39-45.

Bremmer,J.M (1965); Total Nitrogen in C.A.Blackled methods of soil analysis partI. Am Soc. *Argron.9;1149-2278.*

FAO (1977). Guidline on profile description Rome.

Jackson, M. C. (1958) soils chemical analysis. An advance cause University of Wisconsin U. S. A.

Mclean, E. O. (1965). Aluminium. Methods of Soil analysis part 2. Ed. C. A. Black. Am. Soc. of Agronomy.

Soil Survey Staff, (2003). Keys to Soil Taxanomy. United States Department of Agriculture (USDA). 9th ed. P 263-285.

Unamba-Opara, I. (1990, 1988). Lecture discussion Department of Soil Science, University of Nigeria. Nsukka.

Vomicil, T.A. (1965). Porosity. In C. A. Black (ed.). Methods of Soil Analysis Part I. *American Soc. Of Agron. 9:299-314.*

Walkley, A.and I.A.Black (1934). Determination of organic carbon in soil. *Soil Sci.7; 29-38.*

Table 1. Summary of morphological properties of severely eroded and less severely eroded soils in Uga southeastern Nigeria.

Classification	Slope	Parent material		Drainage	Brief description
Severely eroded site					
Arenic Kandiustult	Slopping (12%)	Weathered stones and shale	sand	Well drained	Brown (7.5YR) to dull reddish brown dry. sandy loam to sandy clay loam, slightly plastic to slightly sticky with fibrous root and clear boundaries for the top layers; Orange (5YR6/6-2.5YR6/6)dry sandy clay loam; sticky and plastic, strong sub angular blocky with clear boundaries.
Less Severely eroded soil					
Arenic Kandiustult	Almost flat (2%)	Weathered stones and Shale	sand	Well drained	Dark, reddish brown (7.5R3/3) dry sandy loam, non sticky and loose with fibrous roots for the top layers: Reddish brown (2.5YR4/4) dry, sandy loam moderate sub angular blocky with clear boundaries

Table 2. Physical properties of representative profiles and auger samples

Horizon	Depth (cm)	Clay (%)	Silt (%)	%Total sand	Fine Sand	Coarse Sand	Textural classes	Bulk Density (g/cm^3)	Total Porosity (%)
Ap	0-24	16	7	77	41	36	SL		
AB	24-42	26	1	73	57	16	SCL	1.4	54
Bt_1	42-69	26	3	71	55	16	SCL		
Bt_2	69-128	34	1	65	51	14	SCL		
Bt_3	128-165	34	3	63	47	15	SCL		
Ap	0-13	8	3	89	[illegible]	[illegible]	Sand	1.6	39
AB	13-67	11	2	87	5[illegible]	[illegible]	LS		
Bt_1	67-120	12	1	87	55	32	SL		
Bt_2	120-200	17	1	82	52	29	SC		
A1	0-25	12	1	87	58	29	LS		
A2	25-50	14	1	85	53	31	LS		

Legend: A1 and A2: Auger point controlled sites, SL: Sandy loam, SCL: Sandy clay loam, LS: loamy sand, SC: Sandy Clay.

Table 3. The Chemical properties of the representative profiles and auger samples.

Hori	Depth (Cm)	pH	C(g/kg)	N(g/kg)	Av.P (mg/kg)	Exchangeable Bases (cmol/kg) Na^+	K^+	Ca^{2+}	Mg^{2+}	C.E.C (cmol/kg) ACEC	ECEC	B S(%)	Exch. Acidity(cmol/kg) AL^{3+}	H^+
Ap	0-24	4.0	2.01	0.12	53	0.01	0.06	1.6	.4	2.8	5.4	7[illegible]	.3	.2
AB	24-42	4.0	0.87	0.07	37	0.01	0.03	0.4	.2	2.2	3.44	2[illegible]	.2	.4
Bt_1	42-69	4.0	0.50	0.04	39	0.01	0.03	trace	.2	1.7	2.54	1[illegible]	.2	.4
Bt_2	69-128	4.1	0.25	0.02	47	0.01	0.01	trace	.6	1.8	2.92	3[illegible]	.1	.4
Bt_3	128-165	4.1	0.21	0.01	41	0.01	0.03	trace	.2	1.2	1.84	20	.2	.2
Ap	0-13	4.2	1.08	0.09	87	0.01	0.12	0.2	.4	1.8	2.83	40	.1	.2
AB	13-67	3.9	0.62	0.05	59	0.02	0.03	0.2	.2	1.8	2.62	2[illegible]	.2	.2
Bt_1	67-120	4.1	0.37	0.03	42	0.01	0.03	0.4	.2	2.0	3.04	32	.1	.3
Bt_2	120-200	4.0	1.16	0.01	76	0.01	0.02	0.4	.2	1.5	2.43	4[illegible]	.1	.2
A1	0-25	5.1	0.87	0.08	51	0.01	0.06	0.4	1.0	1.9	3.57	3[illegible]	.1	.1
A2	25-50	4.5	0.62	0.05	42	0.01	0.04	0.1	.2	1.6	2.25	2[illegible]	.1	.2