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Degradation of the Vegetation Cover in the White Nile State (Elgetaina Area)

Nuha Ahmed Mohammed[1] **and Ahmed Ali Salih**[1]
1Forestryand Gum Arabic Research Centre; **Agricultural Research Coorporation**

Abstract :
The study was carried out in , White Nile State (East of Elgetaina town) during 2004- 2006. The selected site was dominated by *Capparis decidua* shrubs and *Panicum tergidum* grasses.The main objectives of the study were to investigate the limitation for natural regeneration of vegetation cover by studying the variation in rainfall amount and distribution, evaluating the soil properties and assessing the soil seed bank. , the study aimed to suggest some measures to enhance the natural regeneration of the vegetation cover.The site was divided into four Blocks. Soil samples were taken from each Block, soil seed bank and soil chemical properties were determined. In addition, the vegetation density was estimated for each Block for trees, shrubs and grasses.Satellite imageries were used to monitor the change in the vegetation cover (Land uses and bare area maps).The results showed that the mean annual rainfall and distribution for the period 1987-2005, and soil seed bank has little effect on degradation of vegetation cover in the study area, and that the main cause of vegetation cover degradation is the deteriorated soil properties.The high sodicity/salinity reduced the seeds germination and the infiltration rate of the soil and most of rainfall is lost as runoff. Most of the study area is now bare (no vegetation). The study recommended use of water harvesting methods, soil reclamation with organic and inorganic materials and enrichment of soil seed bank for rehabilitation of the vegetation cover

Key words: soil reclamation. Sodicity,salinity,soil seed bank.

Introduction, scope and main objectives

Deficiency of precipitation, prolonged periods of heat, low relative humidity and high rates of evaporation characterize dry lands. Natural habitats and ecosystems management in the dry land regions are a population pressure issue with more than 900 million people in 100 countries dependant upon the resource base. The sahelian droughts of late 60s and early 70s and the famous drought of 1985 drew attention to the issue of natural resources management of the dry lands regions where productivity is typically inhibited by lack of rainfall and low fertility. The dry land environment of Africa poses formidable problems for sustainable development; among these are the unpredictable severe droughts, desiccation and land degradation or desertification (Darkoh, 1998). Hulme and Kelly (1993) stated that desertification is a result of human and animal pressure which leads to exploitation and intensified stresses on the dry land environment A remarkably high correlation seems to exist between human population intensities and degraded soils in the different aridity zones

The main degraded zones in Sudan are arid and semi-arid zones where 76% of the human population of Sudan lives (Ayoub, 1998). The soils of dry land have several properties in common but exhibit major differences between hyper arid and the dry sub humid regions. Dregne (1986) stated that the dry soils possess many unique properties that distinguish them from the soils of the humid region. The dry land soils have commonly low organic matter and nitrogen, of alkaline reaction, contain variable amounts of $CaCo_3$, and have weak to moderate development and variable depth. They also vary in their cabability of supplying nutrients according to their parent materials and the processes by which they were formed (Cooke, 1975). The dry lands are not capable of supplying the required amount of plant nutrients for high yields. Degradation of the dry land resources is caused primarily by the loss of vegetation cover, wind and

water erosion, Stalinization, sodification, soil crusting and compaction. All these degradation inhibit the natural fertility.

Degradation of natural vegetation leads to shortage of fuel wood, lowering organic matter, decline in soil fertility and deterioration of soil physical conditions. in Sudan an aerial photograph taken in 1975 compared with a map prepared in 1958, showed that desertification boundary had shifted southwards (El.Karuori,1986). Land-use, growing population, deforestation and overgrazing were considered as the causes (El-Karuori, 1986; Brenan and Kessler, 1995).

This study hypothesized that the degradation in of the vegetation cover in the White Nile State is related to variation in rainfall pattern and soil properties and seed viability

Methodology

1- Study area

This study was carried out in Central Sudan, East of Elgetaina City in the White Nile state (32º 15' North and 14º 45' East) during 2004-2006.

The climate is atypical tropical continental, characterized by warm dry winter and hot rainy summer. The mean Temperatures is 37ºC and 21ºC for summer and winter, respectively. Relative humidity is lowest in April (10%) and highest in August (67%). The mean daily evaporation is highest in April (20 mm) and lowest in August (10.8mm). This to be expected since higher temperatures coincide with lower R. H. in April, while in August, cooler and more humid conditions reduce evaporation. The wind at the study area blows in the dry season from the south-east direction at about 4.5m/s. Dust storms (Haboobs) are common during the summer season.

Brawn et al (1991) classified the soils of study area as White Nile clays with 60%-70% clay content and are rather uniform in texture and profile features

2- Soil sampling:

Five samples were taken from each block in the study area from two depths (0-30cm)-(30-60cm) during April 2004. Forty samples were taken from the whole area of study (4 blocks for two depths). Soil analysis was carried out at the center for land and water research (CLWR) of The Agricultural Research Corporation (ARC) at wad medani, Sudan. based on procedures specified by FAO (1970).

Results and discussion

The running mean of seventeen years (1987-2005) for rainfall in Edueim station showed there was a sharp decline in rainfall sience 1987 (Fig 1).. After prolonged drought this area was abandoned. The abandoned areas were exposed to erosion due to lack of vegetation cover and this led to desertification.

The average running mean of rainfall of period 1930-2005 for ED-dueim station showed the rainfall maximum in 1938-1942 and there was a sharp decline during 1958-1966 where the average of the rainfall was less than 200 mm. There was a sharp decline of rainfall during 1978-1998. The mean average of rainfall from 1998-2004 was constant and very low (300mm). This data indicated that this area is located in an area of high rainfall variability

Table 1 : location of the blocks in Elgetaina area and their vegetation

Block No.	Location	trees	shrubs	Species
1	14º 49`20,7 N 32º 26`35,4 E	2	3	*Capparis decidua* & *Acacia oerfota, Acacia tortilis subsp. radiana*
2	14º 49 17 N 32º 26`37 E	1	3	*Capparis decidua* & *Acacia oerfota, Acacia tortilis subsp. Radiana*
3	14º 49`00.3N 32º 26`54,9E	0	0	-
4	14º 48`43,3N 32º 27`13,5E	0	1	*Capparis decidua*

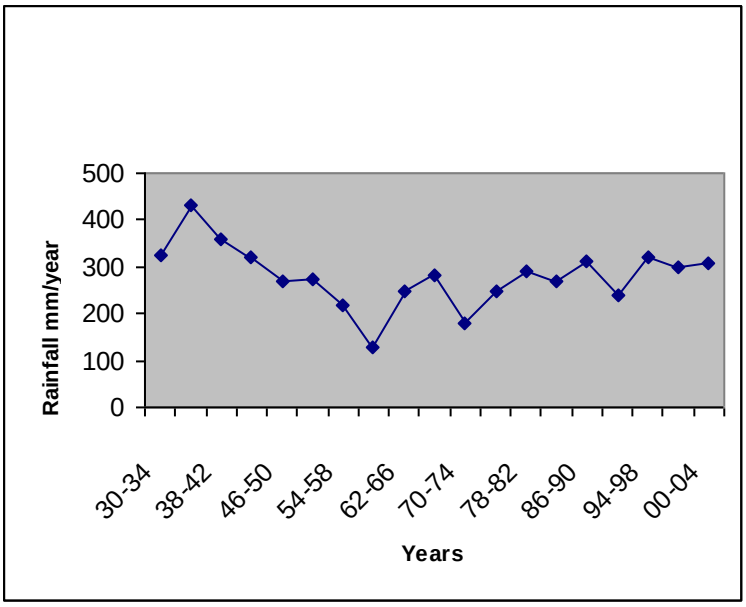

Fig. **Average rainfall for period 1930 – 2005 ED-deuim Station**

1- The Vegetation cover:-

The study area has a low woody vegetation cover only 10 trees in the whole study area were found and these are 5 shrubs of *Capparis decidua,* 3 trees of *Acacia tortilis* and 2 shrubs of *Acacia nubica* (Table1) Most parts of the study area is bare land especially in block 3. Vegetation consisted of the the following species *Cassia senna* and *Panicum tergidum*

with some sparse vegetation of *Chrozophora oblongifolia* (Tirba) which is highly desired by camels. And the ground vegetation was estimated at 20% in the whole the study area .

2- **Soil seed bank**

There were no viable seeds in the whole study area because there were no trees in this area and it contains some dead grass seeds (Table 2)

Table 2. Soil seed bank at the study site Seed/kg soil

Block No.	Seed/kg soil	Species
1	0	-
2	12	Panicum Sp.
3	0	-
4	0	-

3- Soil characteristics:-

Generally the soil at the study site is low in N and Organic carbon. Cl content is high especially in block 3. The $_{P}$H in Block 3 was higher than in Block 1 and Block 2, Block 4 has the lowest alkalinity in the whole area. In all four blocks we noticed that $CaCO_3$ was very high in all blocks, especially block 3. Electric conductivity (EC) and Exchangeable Sodium Percentage (ESP) increase with depth. The soil of block 3 and 4 is saline and sodic (EC> 4ds/m and ESP > 15)) (Table3). In these two blocks there were no trees and only some grasses and bushes of *Panicum tergidum* are present.

The high sodicity decreases the infiltration rate and inhibit the emergence of seeds. The high $_{P}$H inhibits P availability. These soils need to be reclaimed by leaching the soluble salts by good quality water and

addition of farm yard manure (FYM) and gypsum to reduce the sodicity level and to improve the physical properties of the soil.

The analysis indicates that the inherent fertility status of this soil is very low. It also has low water holding capacity and is susceptible to wind erosion. Due to the current droughts and misuse, the vegetation cover on this land is very low. The carrying capacity for livestock and biodiversity in vegetation are also low.

The study recommended reseeding of the area with salinity resistant trees for stabilizing the highly mobile sand dunes and use of water harvesting methods to conserve water for trees. Because of the observed soil variability, a detailed soil survey of the area is needed before any planting programme is recommended.

Table 3 . Soil chemical properties in (4 blocks)

Block	Depth (cm)	Exchangeable bases (Coml.+ /kg)					Soluble Cations and Anions (meq/L)				
		$Ca\ Co_3$	Na	O.C %	N %	PH paste	E.C (ds/m)	ESP%	Na	CL	HCO_3
1	0 – 30	1.28	1.93	0.06	0.02	7.76	1.40	6.6	8.55	5.7	2.25
	31 – 60	1.64	2.99	0.07	0.03	7.94	3.26	12.8	24.7	22.0	2.30
2	0 – 30	1.84	2.33	0.06	0.02	8.16	1.9	8.8	13.9	7.05	1.0
	31 – 60	1.52	2.24	0.07	0.02	8.28	1.55	8.6	11.4	2.3	1.15
3	0 – 30	5.08	12.06	0.10	0.04	8.36	8.45	38.4	74.5	61.0	4.2
	31 – 60	4.84	11.44	0.15	0.02	8.32	9.29	38.6	80.0	71.7	4.9
4	0 – 30	3.32	3.49	0.09	0.02	8.52	1.99	14.6	15.85	13.9	3.3
	31 – 60	3.36	7.08	0.05	0.02	8.56	4.41	24.8	38.4	35.0	3.2

Conclusions

the inherent fertility status of this soil is very low. It also has low water holding capacity and is susceptible to wind erosion. Due to the current droughts and misuse, the vegetation cover on this land is very low. The carrying capacity for livestock and biodiversity in vegetation are also low.

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Reference

Ayoub, A. T. (1998). Extent severity and causative factor of land degradation in Sudan. Journal of arid environmental, 38:397-400.

.Brawn, M.H., Burgstaller, A. M. Hamdoun and H. Walter (1991). Common weeds of central Sudan. GTZ. Eschborn.

Brenan, H and Kessler, J. J. (1995). Woody Plants in Agro Ecosystems of Semiarid Regions. Springer. Verlag. Berlin. Germany.

Cooke, G. W. (1975). Fertilizing for maximum yield. Green Britain: Granda Publishing.

Darkoh, M. B. K., (1998). The nature, causes and conservation of desertification in the dry lands of Africa. Land degradation development, g: 1 – 20.

Dregne, H.E. (1986). Magnitude and spread of the desertification processes. UNDP. USSR commission for UNEP. Arid land development approach and the combat against desertification. Moscow.

El Karuari, M. O. H., (1986). The impact of desertification on land productivity in Sudan. In F. El. Baz and Hassan. I. M. H. A (eds.) physics of desertification, Marlinus Njhooff, Dordrecht: 52 – 58.

Gaiballa and Farah (2003). Plan action proposal of desertification White Nile State (work shop of desertification, Sudan).

Halwagy, R. (1961). Studies on the succession of vegetation on some islands and sand bank in the Nile near Khartoum, Sudan vegetation – Acta Geobotanica 6, 4 : 217 – 234.

Hulme, M and Kely M. (1993). Explaining the link between desertification and climate change. Environment, 35 (6): 4 – 11.

Olsen, L., (1982). An integrated study of desertification, applications of remote sensing, GIS and Spatial Model in semi–arid Sudan. University of Lund. Sweden, Dept. of Geography. 170p.

Pungaire, F. I., Lazaro, R., (2000). Seed bank under story species composition in semi-arid environment: The effect of shrub age and rainfall. Annals of Botany 86: 807 – 813.

Verstraete, M. M., (1989). Influence of metrological hazards on desertification processes. In land management in arid and semi-arid areas. World metrological organization. WMO. Technical Note. No. 156, Geneva.