Some Factors Affecting Plant Attributes of the Range land of Babanosa area (Western Kordofan State, Sudan)

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Abstract- **This study was conducted at Babanousa area, which is located in the Southern part of the western Kordofan state, between latitudes (10° – 12°) North and longitudes (27° – 29°) East. It lies at the low rainfall woodland savannah zone. The area is estimated to be about 15,000,000 feddans. The overall objective of this study was to study the factors affecting plant attributes of Babanousa area. The methodology used in the study included botanical measurements for the assessment of range vegetation composition, density, relative frequency and soil vegetation cover. This information was used in the determination of range vegetation current condition. The study showed that the current condition of the range grass species of the area is largely affected by the current utilization of its plants. The normal practice in the area is the grazing of the same plant species, by the same class of livestock at the same time yearly. Such practice is bound to bring about the suppression of certain plant species in favour of others. This practice was resulted in the decrease of desirable plant species and increase of less desirable ones and the appearance of invader plant species.**

Keywords- plant attributes; range land; species composition; vegetation cover; plant density.

I. INTRODUCTION

The rangeland all over the world is subjected to intensive use due to increasing animals and human population, ecological change and increase in human demands and over economical activities [1]. Sudan is a large country with an area of 1.882.000 square kilometres this area is extended over different ecological zones including desert, semi-desert low rainfall savannah and high rainfall-savanah,in addition to mountain regions[2]. Range lands in Sudan are facing many problems that hinder their use and development. Some are user oriented whereas others are resource oriented. Most rangelands lie in fragile environments and facing frequent drought periods, seasonal bush fires, changing in species composition, increasing pressure on the range resource specially around water points, expanding cultivation, destruction of the local institutions and the gradual loss of the traditional knowledge, increase in animal population and low off-take, blockage of the livestock migration routes and lack of local community participation in the planning and execution of range programs [3].

According to [4] Babanousa area is part of *Combertum cordofanum – Dalbergia sp. – Albizzia sp*. Savannah woodland. [5] Recorded the following species:

- The tree and shrub species were *Combertum cordofanum* (Habeel), *Albizzia amara* (Arad), *Guiera senegalensis* (Khobish), *Dalbergia melanoxylon* (Babanus), *Sclerocarya birrea* (Humeid), *Balanites aegyptica* (Higlig), *Acacia melifera* (Kitir), *Acacia seyal* (Talih), *Comiphora pedunculata* (Gafal), *Lanea humilis* (Layon) and *Bauhinia sp*. (Kharbu). It was observed that *Sclerocara birrea* is associated with soft sand (loose sand), *Dalbergia melonxylon* on hard sand and *Acacia seyal* on clay soil. The other tree species are on both types of sand and *Balanites aegyptiaca* on clay and sand soils. *Bauhinia sp.* and *Lennea humilis* are on the fringe of rahads.

-The understory on the hard sand soil around Babanousa is dominated by *Zornia diphylla* (*Lusseig* or *sheleeni*) and *Eragrostis tremula* (Bano). On the soft sand the dominant species are *Andropogon sp* (Taf, Abo Rakhis), *Digitaria sp.* (Um Aag) and *Blepharis sp*. (Bigeil, Siha). There are also small areas of *Dactyloctenium aegyptium* (Abo Asabei), *Echinochloa colona* (Diffra), and *Panicum fasciulatum* (Kireib) on clayish soils.

On the none-cracking clay areas *Schoenefeldia gracilis* (Um feireedo, Danab Elnaga), and *Aristida sp*. are the dominant species. Nowadays, the vegetation cover consists in most parts of the area of the following types. *Guerra senegalnsis, Albizzia amara, Dalbergia melanoxylon, Combertum cordofanum, Commiphora pedunculata, Lennea humilis, Terminalia brownii, Calotropis procera, Acacia senegal, Ziziphus spp., Acacia*

melifera, Acacia nilotica, Balanites aegyptiaca, Adansonia digitata, Cassia tora, Sclerocarya birrea, Zornia diphylla, Eragrostis tremula, Cenchrus spp., Dactyloctenium aegyptium, Solanum dubium, Hibiscus sabdarrifa, Hibiscus esculantus, Helianthus annus, Leptodenia lancifolia, Sida cordifolia,Tamarindus indica, Combertum acculeatum, Guiera tenax, Maerua crassifolia, Ricinus communis, Boscia senegalesis.

II. MATERIALS AND METHODS

Vegetation was sampled for the assessment of the plant attributes.

A. Methods used in range vegetation measurements

The method used in this study was the 100 M transect tape and $\frac{3''}{4}$ loop method which was adopted by the Range Management and Pasture Administration (RPA). This method was used for the measurements of the range vegetation for the assessment and monitoring of the following parameters:-

- Percentage species composition.
- Total vegetation cover.
- Plant species frequency.
- Plant density.
- Range condition.

Equipment used:

- One meter tape (100M).
- $\frac{3''}{4}$ Loop.
- Recording sheets.

B.Number of measuring sample to be recorded

Ecologically it is rather difficult to measure or count the entire population, therefore the species area curve method is normally used for the determination of the number of samples to be taken. Species determined in each sample are usually recorded in the vertical axis. The numbers of samples taken are recorded in the horizontal axis of the curve. When the number of samples increased up to 20 samples no additional plant species was recorded. This point is called the "point of diminishing returns" after which no new species will be recorded with increase of sampling number. This is an indication that up to 20 samples is quite enough to encounter the whole population, and after which no new species will be expected to be recorded.

The measurements encountered the following:

Plant species % = $\frac{the\ total\ number\ of\ the\ plant\ appearance}{the\ total\ number\ of\ all\ readings}\ x\ 100$

Forage composition % =

$$\frac{the\ total\ number\ of\ the\ forage\ composition}{the\ total\ number\ of\ the\ all\ \ readings - forage\ composition}$$

Species relative frequency = $\frac{the\ total\ number\ of\ the\ species\ readings}{the\ total\ number\ of\ the\ all\ plant\ readings}\ x\ 100$

C.The determination of range condition

Range condition is defined as the general health of the range vegetation which is usually determined by the percentage composition of forage plant species within the overall vegetation composition. Range condition is determined according to the following classification [6].

Range condition classification:

% Forage species composition	Range condition classes
0-25	Poor
26-50	Fair
51-75	Good
76-100	Excellent

Source [6]

III. RESULTS AND DISCUSSION

A .Dominance:

In the year 2006 the four dominant species at Babaonousa area were *Zorina diphylla*, *Eragrostis spp, Echinochola colona*, and *Cassia tora* respectively. While in 2007 the four dominant species were *Zorina diphylla*, *Eragrostis spp*, *Cassia tora* and *Echinochola colona* respectively.

Zorina diphylla was the dominant species in the two seasons 2006 and 2007 respectively (Table 1), the dominance of *Zorina diphylla* in all seasons may be attributed to the clearance of several trees recently (which lay at the lines of petroleum process). [5] Stated that the dominance of *Zorina diphylla* is a sign of disturbance and absence of sound management and proper techniques.

Cassia tora was the fourth dominant species in 2006 and then it was third one in 2007. This may reflect the dynamic changes in the species composition of the area as a result of seasonal changes and the native animal's impacts on grazing lands. This agreed with [7] who stated that plant populations change under the reduced native animal's impact and increased grazing pressure of domestic animals especially in the wet season. Also the ranking of *Echinochloa colona* from the third dominant species to the fourth dominant species in season 2007, may be attributed to the selective grazing which led to removal of the desirable plant species in the area. As a result of this selection *Echinochloa colona* was subjected to heavey grazing while *Zorina diphylla* was in dangerous stage (Zornia diphylla causes bloat in the flowering period). [8] Stated that most of the vegetation changes are essentially man-induced. Grasses and herbs are undergoing a remarkable change due to over grazing. [9] in Gerih el Sarha settlement scheme found that the decrease of important forage plants in the scheme is due to palatability and selectivity as in the case of *Blepharis sp* (Bugeil) and *Aristida plumosa* (biyad) which are highly palatable and nutritive. [10] Observed the high grazing pressure upon *Blepharis linarifolia*. He related this palatability to the high protein content, especially during the wet season. [8] Mentioned that *Aristida plumosa*, which is very palatable and has very high nutritional value, has been completely removed. So, this case may be true for *Echinochloa colona*.

[9] Reported that the dominant species of Babanousa area were *Zorina diphylla*, *Eragrostis tremula* (Bannu), *Andropogan gayanyus* (Abu Rakhees), *Blepharis sp* (Bugeil), and *Brachiaria sp* (Um chir) which showed 62%, 15%, 12%, 7% and 4% of the plant composition respectively. [11] Reported that animals select the highest quality components of the available forage pool first. Some plant species are highly nutritious but available only in limited quantities while more readily available species are less nutritious. As the pool of highest quality plant is depleted, increasing quantities of the next highest quality component are consumed. The selection and consumption processes are integrated through space and time.

Table (1) the four dominant species for the two seasons (2006, 2007).

Order	2006	2007
1	*Zornia diphylla*	*Zornia diphylla*
2	*Eragrostis tremulla*	*Eragrostis tremulla*
3	*Echinochloa colona*	*Cassia tora*
4	*Cassia tora*	*Echinochloa colona*

B.Species composition percentage:

In 2006 the species composition percentage was 81.5%. While it was 74.8% in 2007, (Table 2). The reduction in the species composition percentage in 2007 despite the high rainfall amount in 2007 (656.5 mm) may indicated that the amount of the rainfall is not the only parameter which should be studied, but the distribution of this rainfall during autumn period is a very important issue. This agreed with [12] who stated that in west Eldueim although the amount of rainfall in 1999 was higher than in 1998 (431.5 mm to 374.9 mm) but species diversity in 98 was 15 kinds of species, which was higher than 99 (9 kinds of species). The same observation was mentioned by [13] who stated that rainfall amount and distribution have great influence on species composition.

The reduction of the species composition percentage may be also attributed to the effect of the new introduced kind of animals (sheep). Baggara tribes recently entered sheep as a second type of domestic animals. This agreed with [14] who mentioned that, Sudan has multiple climates that has its impact on the diversity of livestock and also agreed with [15] who stated that different classes of domestic stock affect plant communities in different ways depending on growth forms and acceptability of the predominant plants, so pasture land managers should be well advised to consider whether undesirable changes in plant species composition have occurred as a result of the present kinds of grazing animals or whether changes in the kinds and proportions of different types of grazing/browsing animals are needed to attain more equitable balance between the over story and understory plants.

Table (2) species composition percentage for the two seasons (2006, 2007).

Season	Percentage %
2006	81.5
2007	74.8

C.Forage composition percentage:

In 2006 the forage species composition was 74.2%. While it was 67% in 2007, (Table 3). The reduction in the forage composition percentage in 2007 may be due to the botanical change which happened as a result of fluctuation of rainfall in 2007, or it may be due to the intensity of grazing which happened yearly as a result of the increase in the number of the livestock and the decrease of the palatable species. This agreed with [9] who stated that most plants show a trend of change i.e. some have disappeared; some have become less frequent, while others have increased. A herb like *Blepharis linarifolia* has decreased to a critical level. Perennials, e.g. *Aristida plumosa* and *Chrysapogon sp* are becoming more infrequent in the vegetation cover. The annual *Monsonia senegalensis* has also like wise decreased. *Cernchrus biflorus* was increasing every year till 79/80, and then it dropped to 0.57% in 83/84. Some unpalatable perennial grasses have disappeared such as *Aristida pallida* (Um semeimah), or have become less, e.g. *Cymbopogon proximus*. Other species have shown an increase in the year 83/84 when compared with the year 72/73. E.g. *Brachiaria sp*., *Eragrostis tremula* and *Tribulus terrestris*.

[16] report on the effect of grazing on Indian rangelands, stated that increased grazing replaces Sehima-Dichanthium cover by Chrysopogon and Bothriochloa communities, followed by Heteropogon and finally by annuals, such as Aristida, Eragrostis and Melanocenhrus, the same trend that is replacement of rich grasses by coarser ones and finally the annuals. [15] Summarized the direct effects of grazing as:

- Suppression of certain of the more palatable perennial plants and encouragement of coarser less palatable species under heavy stocking pressure.
- Replacement of the more acceptable forage plants by less desirable when heavily overgrazed.

They also stated that stocking rate is the key element to successful livestock production. The use of improper stocking rates can reduce both the vigor of desirable forage species and animal performance.

Table (3) forage composition percentage for the two seasons (2006, 2007).

Season	Percentage %
2006	74.2
2007	67

D.Range condition class

The forage composition percentage in 2006 was74.2% while it was 67% in 2007, (Table 3), this indicate that the range condition is good in the two seasons, but it is going to be reduced. The reduction of the

percentage of the forage composition (which is used as an indicator to determine the range condition class) may indicate that the range is going to be deteriorated as a result of open grazing practices which are practiced by the herders. They enter the study area before the plants make seeds. This lead to decreasing the number of forage plants year by year and prevents the plants to adapt better to open sites. This agreed with [17] which reported that land degradation is a critical issue throughout the Sudan, including areas with the highest rainfall. Its various forms are deforestation, devegetation, species changes and loss of soil through erosion. Its principle causes are crop cultivation, overgrazing, cutting of trees for firewood and charcoal, and climate change.

Table (4) range condition class for the two seasons (2006, 2007).

Season	Forage composition %	Range condition class
2006	74.2	Good
2007	67	Good

E. Relative species frequency

In 2006 and 2007 *Zorina diphylla* showed the highest relative frequency 58.89% and 55.62% respectively, and for the same seasons *Eragrostis tremulla* stands as the second percentage in the relative frequency 21.45% and 19.91% respectively. While the third highest relative frequency in 2006 was *Echinochloa colona*, but in 2007 the third one was *Cassia tora*, (Table 5).The reduction of the relative frequency of *Zornia diphylla* and *Eragrostis tremulla* at season 2006 from 58.89% and 21.45% to 55.62% and 19.91% at season 2007 respectively, may be attributed to the fact that these species were found usually patchy in range sites, which may explain their sensitive reservation.

Table (5) relative species frequency for the two seasons (2006, 2007).

Scientific name	Local name	2006	2007
Zornia diphylla	Luseigh	58.89	55.62
Eragrostis tremulla	Bunnu	21.45	19.91
Echinochloa colona	Diffra	6.13	6.68
Cassia tora	Kawal	6.01	7.21
Aristida spp.	Gaw	4.29	2.94
Schonfelidia gracilis	Danab elnaga	1.22	0.26
Abutlon figarianum	Niada	1.22	1.06
Cassia mimosoides	Sukar naba	0.31	0.80
Dactyloctenium aegyptium	Abu Assabi	0.18	4.41
Cencherus spp.	Haskaneet	0.18	0.26
Acanthospermum hespidum	Hurab Hawsa	0.06	0.80

F.Plant density

In 2006 and 2007 *Zornia diphylla* showed the highest density among all plants 148 plants/m2 and 137 plants/m2 respectively, (Table 6). This high density may be attributed to the existence of sandy soil which is the best place for this kind of species or it may be due to the characteristics of the *Zornia diphylla* seed which can remain in the soil after the grazing process to increase the stock of the seed bank for the coming year in addition to the current year.

The reduction of *Zornia diphylla* density in 2007 (55.62%) from (58.89%) in 2006 may be attributed to heavy and permanent grazing which hinder the natural rehabilitation of grasses, as a result of open grazing practices. [9] Reported that this system (open grazing practices) leads to range land degradation.

Table (6) plant density for the two seasons (2006, 2007).

Year	Plant density / m2
2006	148
2007	137

*G.**Vegetation cover***

In 2006 the vegetation cover% was 75% and it was 70% in 2007, (Table 7). The reduction of vegetation cover may be due to the increase of the livestock and the water points which appeared in 2007 as a result of the heavy and poorly distributed rainfall. This agreed with [18] who related the reduction of plant cover

to sacrifice areas along livestock routes, around water points and homestead. [19]) stated that a change in vegetation cover happens as a result of an increase in grazing intensity. He also attributed the change to a result of varying animal combinations.

Table (7) Vegetation cover for the two seasons (2006, 2007).

Year	Vegetation cover percentage
2006	75
2007	70

IV. CONCLUSION & RECOMMENDATION

The study concluded that, although the range condition considered as good in the two seasons but it is going to be reduced. The study also revealed that babanousa range land would be subjected to deterioration as a result to open grazing practices and this was indicated by forge composition that reflected the range condition class. The study recommended that herders should enter the area with their livestock after its range plants reaches full maturity stage where they produce seeds to protect palatable species from decreasing.

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