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# **Original Research Article**

# Influence of Human Activities on Carrying Capacity of Grazing land in Semiarid area at Kilemindo Locality, North Darfur State, Sudan

Abdelrahman Ismail Adam<sup>1</sup>, Ismail Mohamed Fangama<sup>2\*</sup> and Abdelrahim Ismail Hamid<sup>3</sup>

<sup>1</sup>Department of Forestry and Range, Faculty of Natural Resources and Environmental Sciences, Elfashir University, Sudan

<sup>2</sup>Department of Botany & Environment, College of Forestry & Range Science, Sudan University of science & Technology (SUST), Sudan

<sup>3</sup>Forest National Corporation, ElFashir, North Darfur State, Sudan \*Corresponding author

#### ABSTRACT

#### Keywords

Biomass productivity, density, frequency, plant, and Total livestock unit (TLU) The study area is subjected to heavy deterioration through the population activities such as over grazing, cutting down of trees, hunting wildlife and repeated firing. These human practices affect many plants species and absence of the others. The change of plants condition compels the animals to prefer the palatable species in the area which affect the carrying capacity. The objective of the study is to investigate the carrying capacity of rangeland in Kilemindo Locality by testing the density of plants per m², frequency per m² and biomass productivity per hectare. The results show that, the highest density is 147, 64 and 76 plants per m² for the species of *Dactyloctenium aegyptium*, *Eragrostis diplachnoides* and *Aristida spp* respectively while the frequency shows 37.8 %, 37% and 17.4% for *Dactyloctenium aegyptium*, *Eragrostis diplachnoides*, *Schoenfeldia gracilis*. On the other hand the biomass productivity gives 713.3 kilogram per hectare and the carrying capacity shows very low amount which is equal to 3.8 ha /TLU /year.

#### Introduction

North Darfur State lies between latitudes  $12^{0}$ - $20^{\circ}$  North and longitudes  $24^{\circ}$ - $27^{\circ}$  East, kilemando locality is located in the middle of the State. The prevailing climate in the State is arid and semi-arid. The weather is hot in summer and cold in winter. The average minimum and maximum temperatures are  $17.7~c^{\circ}$  and  $34.7~c^{\circ}$  respectively. The average annual rainfall ranges from 75-287 mm (Meteorological station, 2013).

The study area is characterized by fluctuating rainfall from season to another and prevalence of the multiple types of plants, according to classification of (Harrison and Jackson, 1956). They classified plants according to the regions and climate such *Senna maka*, *Abu assabei*, *Nada.*, *Sarah*, *Higlieg*, *Ghibaish*, *laoat*, in addition to other plants. Rangeland resources include both tangible product such as grazable forage, wildlife, water, natural

beauty, recreational opportunities, mineral, supplies, areas for the ecological energy ofnatural systems study (Busby,1987). Vegetation is used as forage and cover for livestock and wildlife species, in addition to that, rangeland provide open space, water, wood fuels and numerous other products (Tuller, 1991). The use of rangeland is generally coupled with the use of other types of grazing land and most range livestock and many big game animals use multiple source of grazing capacity to meet their requirements (Valentine, 1990).

## **Density and frequency**

Density (D) is defined as the number of either individual species or a group of species of plants per area (Cooper, 1959) and is determined by counting the number of plants in quadrates. Frequency is the percentage of total quadrates containing at least one rooted individual of a given species. Relative frequency (R.D) of one species is percentage of total plant frequency. Biomass usually refers to the weight of organisms present at the time of measurement (Society for Range Management, 1989). Biomass of grassland above-ground vegetation refers to herbaceous material, commonly referred to as 'dry matter (DM) yield. Research workers and managers of grassland vegetation are interested in this to determine the amount of available forage for animals. Vegetation biomass is important also for assessment of grassland or rangeland condition (Mannetie, 2000). Carrying capacity is defined as the maximum stocking rate possible which is consistent with maintaining or improving vegetation or related resources. It may vary from year to year on the same area due to fluctuating forage production. Stocking rate is defined as the number of specific kinds and classes of animals grazing or utilizing a unit of land for a specified time period. It may be expressed as animal unit months or animal unit days per hectare (ha). The carrying capacity is determined on basis of total forage biomass production and amount of feed requirement per animal unit. Carrying capacity is usually determined by using the proper use factor (PUF) of 50% in which only one half of forage biomass produced is considered as available for grazing (Darrag, 1996).

#### **Problem**

The study area is influenced by practices came out by human such as over grazing, cutting down of trees, hunting and repeated firing, due to these practices the grazing area has deteriorated and diminished by means of less appearance of many plant species and absence of the others. Under this situation animals in the area mainly camels, goats and sheep were compelled to adapt to the new range condition through changing their preference to select their preferred plant species and definitely the carrying capacity is changed.

The objective of the study is to assess the carrying capacity through investigating the density, frequency and biomass productivity caused by the change of the environmental condition in the area.

#### **Materials and Methods**

# Measurement in the field Sampling design

Sampling was carried out by locating 2 km<sup>2</sup> plot in the two sites of open rangeland, South and North of Kilemindo. The study was conducted in 2013 during the late rainy season (seeds set stage). In each plot, four transects of 500 m length were constructed and these steps are carried out as follows:

- The loop method (Parker and Harris, 1959) was used to measure botanical composition of the range. Each one of the eight transects, plant species, litter, rock,

bare soil, and animal pellets were recorded at every 1m interval using 0.75" loop. Data were recorded in a specified sheet and the calculation was done as follows:

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- Plant composition %, bare soil %, litter % and camel pellets %, were as follows:
- Plant composition % = Total hits of plant × 100 Total number of all hits
- Bare soil % = Total hits of bare soil × 100 Total number of all hits
- Litter % =  $\frac{\text{Total hits of litter}}{\text{Total number of all hit}} \times 100$
- Camel pellets  $\% = \underline{\text{otal hits of camel pellets}} \times 100$ Total number of all hits
- Density = The number of plants rooted within each quadrate
- Frequency = The percentage of total quadrates that contain at least one rooted individual of a given species.
- Fourty quadrates from the two samples plot were used to measure density and frequency.
- The carrying capacity was calculated according to the daily requirement of a Tropical Livestock Unit (TLU) which is equivalent to (7.5 kg/day) as reported by (Mustafaet al, 2000).
- Carrying capacity can be determined as hectare/ animal unit/ year (ha/Au/Y) according to (FAO, 1980). Carrying capacity was calculated as follows:-
- Carrying capacity = the desirable production / requirement of TLU
- Biomass estimation

At each of the transects, 5 quadrates' of one m<sup>2</sup> were placed at 100 m intervals, giving a total number of 40 quadrates. Samples were cut and air dried in the field, labeled and then oven dried at 75°C for 48 hours and their dry weight recorded.

#### **Result and discussion**

# Plant density (Plant /m<sup>2</sup>) and Relative density (%)

Plant density in the area was estimated by 377 plants/m<sup>2</sup> e.g. Dactyloctenium aegyptium, Eragrostis diplachnoides and Aristida spp. is high relative density being 37.8%, 19.4% and 17.4% respectively.

### Plant frequency and relative frequency (%)

Plant frequency and relative frequency (%) is presented in table (2), the heist frequency persent include, Dactyloctenium aegyptium (82.5%), Eragrostis diplachnoides (57.5%), Schoenfeldia gracilis (47.5%), (37.5%),Aristida spp Brachiria erucifrmis (32.5%) and Echinochloa colona (30%). When Plants with highest relative frequency in the area were Dactyloctenium aegyptium 16.3%), Eragrostis diplachnoides (10.74%), Schoenfeldia gracilis (9%),Aristida spp(7.74%), Brachiria erucifrmis (6%).

#### **Vegetation cover**

The measurement of plant cover in the study area in season 2013 was 80.3 % while in season 2014 it shows 67.9 % of the total area. This difference may be due to the crowd of animals in the area resulting from the conflict between Rezygat and Malia which compelled Malia to move North. The increase in farm areas by the rural people to cultivate Millet crop which is their staple crop has led to reduction of vegetation cover in the study area.

Table.1 Plant density and relative density of seeds set stage

No	Latin name	Local name	$D./m^2$	R. D
1	Alycicarpus glumaceus	Um sibeha	1.3	0.2
2	Aristida spp	Gaw	76	17.4
3	Dactyloctenium aegyptium	Korieb	147	37.8
4	Fimbristyls dichotomy	Umfisyfesa	00	0.0
5	Eragrostis tremula	Bano	4	0.7
6	Farsetia longisiliqua	Aboadefir	00	1.0
7	Corchorus olitorius	Molukhia	1	0.4
8	Mollugo noduavlis	Sim elagrab	00	1.0
9	Polygala erioptera	Marikh	1	0,0
10	Schoenfeldia gracilis	Danabelnaga	22	7.0
11	Alusicarpu yaginalis	Umngigirh	00	0.0
12	Eragrostis diplachnoides	Mohoya	64	19.4
13		Aerkh elhalmey	00	0.0
14	Echinochloa colona	Defra	37	10
15	Indigofra aspera	Leesan tair	1	0.0
16	Tribulus terrestris	Derassa	00	0.1
17	Syperus rotundus	seida	4	1.1
18	Ipomoea sinesisvar	Hamtout	1	0.1
19	Oxygonum atriplicifolium	Um hamit	1	0.0
20	Parkin Sonia aculata	Sesaban	00	0.0
21	Brachiria erucifrmis	Umdaferteen	8	2.5
22	Tripogon minmus	Fart arnab	1	0.4
23	Justicia kotschyi	Nana	5	1.6
24	Tephrosia uniflora	Arkana	00	0.0
25	Zornia diphylla	Sheliny	00	0.0
26	Aristida adscensionis	Um hiraibu	3	0.7
27	Senchrus biflorus	Haskanit	00	0.0
28	Cassia italica	snmka	00	0.0
29	Urochloa trichopus	Hochst	00	0.1
Total			377	100%

Table.2 Plant frequency (%) and relative frequency (%) at seeds set stage

No.	Latin name	Local name	F.	R. F
1	Alycicarpus glumaceus	Um sabiha	27.5	6
2	Aristida spp	Gaw	37.5	7.7
3	Dactyloctenium aegyptium	koreib	82.5	16.0
4	Fimbristyls dichotoma	Um Fisiysiat	2.5	0.9
5	Eragrorstis tremula	bano	27.5	6
6	Farsetia longisiliqua	Abo adefir	12.5	2.7
7	Corchorus olitorius	Molukhia	20	3.7
8	Mollugo noduavlis	seam elagrab	10	2.1
9	Polygala eriotear	Marikh	5	1.8
10	Schoenfeldia gracilis	Danad elnage	47.5	9.0
11	Alysicarpus glumaceus	Um ngigirh	7.5	1.6
12	Eragrostis diplachnoides	Mohoya	57.5	10.8
13		Earg elhalmy	2.5	0.9
14	Echinochloa colona	Defra	30	5.7
15	Indigofra aspera	Leesan eltair	2.5	0.9
16	Tribulus terrestris	Derassa	10	1.9
17	Syperus rotundus	Seida	12.5	2.4
18	Ipomoea sinesisvar	Hantout	12.5	2.3
19	Oxygonum atriplicifolium	Um hamit	5	1.0
20	Parkin Sonia aculata	Sesaban	2.5	0.6
21	Brachiria erucifrmis	Umdfearteen	32.5	6.0
22	Tripogon minmus	Fart arnab	27.5	5.0
23	Justicia kotschyi	Nana	22.5	2.0
24	Tephrosia uniflora	Arkana	5	0.9
25	Zornia diphylla	Sheleny	2.5	0.4
26	Aristida adscensionis	Um hiraibu	2.5	0.4
27	Cenchrus biflorus	Hasknit	2.5	0.4
28	Cassia italic	Snamka	2.5	0.4
29	Urochloa trichopus	Hochst	2.5	0.4
Total				100

Table.3 Composition of herbaceous plant species at seed set stage

No	Latin names	Vern names	P%
1	Dactyloctenium aegyptium	Koreib	27.8
2	Aristida spp.	Gaw	10
3	Echinochloa colona	Defra	10.5
4	Eragrostis tremula	Bano	1.7
5	Alycicarpus glumaceus?	Umsabiha	3
6	Alysicarpusglumaceus ? Same	Um ngigira	0.3
7	Schoenfeldia gracilis	Danab elnaga	11
8	Mollugo noduavlis	Seam elagrab	2.2
9	Eragrostis diplachnoides	Mahoya	9
10	Cyperus rotundus	Seida	2.5
11	Tripogon minmus	Fartarnab	4
12	Tribulus terrestris	Derassa	2.6
13	Solanum incanum	Gebien	0.8
14	Justicia kotschyi	Nana	4.4
15	Ipomoea sinesis	Hantout	1.1
16	Corchorus olitorius	Molukhia	1.4
17	Indigofera aspera	Leesan tair	0.07
18	Farsetia longisiliqua	aboadefir	0.7
19	Cenchrus biflorus	Haskanet	2
20	Unidentified	C4??	0.07
21	Tephrosia sp.	Herasha	0.9
22	Aristida adscensionis	Um hiraibu	0.4
23	Brachiria eruciformis	Um daferteen	3.38
24	Urochloa trichopus	Hochst	1.3
25	Tephrosia uniflora	Arkana	0.14
26	Zornia diphylla	Sheleni	0.34
27	Trianthema portulacastrum	Turba	0.15
28	Zalya pentandra	Raba	0.08

Table.4 Biomass productivity and Carrying capacity at seeds set stage

Mean productivity/g/ m <sup>2</sup>	Productivity/ g / m <sup>2</sup>	C.C / TLU /ha /year	TLU / ha
71.33	713.30	3.80	0.27

#### **Plant composition %**

Table 3 Grasses constitute 75.7 while forbs only 24.4 in the study area. The species of highest relative composition were Dactyloctenium aegyptium(27.8%), Schoenfeldia gracilis(11%), Echinochloa colona (10.5%), Aristida spp (10%) and Eragrostis diplachnoides is 9% these results refer to the preference index of the type of animals in the area.

#### **Biomass Productivity (kg/hectare)**

Biomass productivity at seed set stage in the study area is presented in table 4 for the season 2013 alone it was 713.3 kg/ha.

#### **Carrying capacity**

The results show that the carrying capacity at seed set stage in the study area is only 0.27 TLU/h that means one animal unit

needs 3.8 hectare during the year. The previous results of density and frequency presented the dominant species such as grass while the forbs appearing with low density this is because of over grazing on forbs, one of the characteristic of grass is determined by hallow stems which minimize the weight than the forage or forbs.

Kilemindo Range area was rich with grasses but poor of forage, although the carrying capacity is low due to absence of preferred species in many places therefore, the range area needs especial care and attention to recover the land by some important plants which are preferred by different types of animal in the area.

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