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Assessment of Rangelands in Protected and Grazed areas at Zalingei area, Central Darfur State, Sudan

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Abstract

The study was conducted at Zalingei areas, Central Darfur State, Sudan. During rainy season in 2018 to assess the vegetation attributes in the protected and grazed sites at rangelands. The vegetation attributes which were measured by Parker Loop Method included plant composition%, plant relative composition%. Quadrat Method was used to determine frequency% and biomass production. Carrying Capacity was calculated depend on biomass production. The standard equations were used to analyse the data of vegetation attributes which were mentioned in part (2). The protected site was showed higher values of plant litters and bare soil respectively (24.83 and 23.16%) than grazed site (19.5% and 15.16%). The dominant species in the protected site most of them belong to grasses, included Aristida fanculata, Eragrostis spp, Aristida mutablis, Scheonfeldia gracilis and Zornia glochidiata and the dominant species in the grazed area included Aristida fanculataI, Zornia glochidiata, Oldenlandia senegalensis, Dactyloctenium aegyptium and Scheonfeldia gracilis, the dominant species in the protected area most of them are grasses. In the grazed area most of dominant species were forbs and considered unpalatable for livestock in the study area. The research recommended the protection of rangelands has benefits to rest plants from grazing process, particularly at early rainy season. The study was conducted at Zalingei areas, Central Darfur State, Sudan. During rainy season in 2018 to assess the vegetation attributes in the protected and grazed sites at rangelands. The vegetation attributes which were measured by Parker Loop Method included plant composition%, plant relative composition%. Quadrat Method was used to determine frequency% and biomass production. Carrying Capacity was calculated depend on biomass production. The standard equations were used to analyse the data of vegetation attributes which were mentioned in part (2). The protected site was showed higher values of plant litters and bare soil respectively (24.83 and 23.16%) than grazed site (19.5% and 15.16%). The dominant species in the protected site most of them belong to grasses, included *Aristida fanculata, Eragrostis spp, Aristida mutablis, Scheonfeldia gracilis* and *Zornia glochidiata* and the dominant species in the grazed area included *Aristida fanculataI, Zornia glochidiata, Oldenlandia senegalensis, Dactyloctenium aegyptium and Scheonfeldia gracilis*, the dominant species in the protected area most of them are grasses. In the grazed area most of dominant species were forbs and considered unpalatable for livestock in the study area. The research recommended the protection of rangelands has benefits to rest plants from grazing process, particularly at early rainy season.

Keywords: Plant litters, bare soil, plant composition, frequency, relative frequency, dominant species

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Introduction

Flexibility of animal movement is progressively hampered by increased population pressure and loss of corridors between wet and dry season grazing areas. Stock is increasingly concentrated the entire year on the same lands, breaking the ecologically sound cycle of alternating use of wet and dry season grazing areas, leading to over-use of dry season grazing land and, inevitably, to human suffering [1]. Plant consumption by herbivores introduces an additional feeding level between the primary producers and decomposers, but the question is how grazing influences energy flow and nutrient cycling within ecological systems. An ecological dilemma the percentage of annual above-ground primary production utilized by herbivores varies greatly, but estimated generally range between 20 to 50% [2]. Although much higher levels of utilization can occur in excess of 90%, they are generally restricted to specific regions or years. An even smaller portion of total annual primary production is utilized by domestic herbivores, because approximately 60 to 90% occurs below-ground in grassland systems [3]. Rangelands are highly susceptible to the impacts of climate change in response to limited water availability and higher air and soil temperatures [4]. Impacts on rangeland vegetation include reduced growth rates, lower photosynthetic rates, impaired mineral absorption, low tissue regeneration and increased concentrations of secondary metabolites such as ginsenosides and polyphones [5].

Rangelands are the home to millions of people, most of who rely solely on the ecological services that rangelands provide. The significance of rangelands as a resource base falls into several broad categories: for grazing animals, livestock and wildlife; for biodiversity conservation: as a source of medicinal plants and foods; for carbon sequestration; as a reservoir of irreplaceable biodiversity and as a bastion of customs and tradition that have endured for centuries. Therefore, this study aims to assess

plant characteristics (plant composition, frequency, ground cover, productivity) in the protected and open grazing sites in preparation for use of fencing system in management of natural rangeland.

Materials and Methods

The study area: Zalingei locality, lies between latitude 12° 30' - 13° 30"N and longitude 30° 23' - 45° 23"E [6]. The study is carried out at Zalingei area which located between latitude 12° 42' 576" N (South point) and 13° 08' 055" N (North point) and between longitude 23° 39' 761" E (East point) and 23° 25' 835" E (West point), with altitude varies from 890 m to 1121 m above the sea level. Characterized by varying temperatures between 26-38c°, and the average annual rain about 800 mm and relative humidity up to 83% in the rainy season (Figure 1).

Sampling procedures

The data of the research gathered from two sites each one ½ km^2 first site was protected from grazing operation, and second site open for grazing presented Three transect length 100m were layout in each site and Three quadrats distributed along each transect to come up nine quadrat of site and 18 quadrat for all study area.

Measurements of vegetation attributes

Plant composition

Parker loop method [7] was used. A total of 100 hits per transect were taken, then distribution of the species, litters, bare soil and rocks along each transect were identified. The following equations were used to calculate per cent of certain parameters such as (Plants composition%, relative plants species composition%, litter%, bare soil% and rocks %)

$$\text{Plant composition\%} = \frac{\text{Total hits on plants}}{\text{Totalof all hits}} \times 100 \quad (1)$$

$$\text{Relative plant composition\%} = \frac{\text{Total hits on each species}}{\text{Total hits on all plants species}} \times 100 \quad (2)$$

$$\text{Percentage of each parameter\% (litter, baresoil, rocks)} = \frac{\text{Total hits on each parameter}}{\text{Total of all hits}} \times 100 \ldots\ldots (3)$$

Frequency

Three quadrats per line transect at interval of 100 m from 500m length that give Nine quadrat per site and (18) quadrat in the study area. To estimate plant distribution.

Plant frequency was calculated by counting species, which occur within each quadrat and recorded their names only. The following equation was used to calculate frequency [8].

$$\text{Frequancy} = \frac{\text{Number of quadrats with plants species occurrence}}{\text{Total number of all quadrats}} \times 100 \ldots\ldots\ldots\ldots (4)$$

Plant cover

According to [9]. Plant cover percentage usually estimated by looking at the quadrat from the above and estimate approximately the part covered by plants for each quadrat and recorded in form of plant cover %. The total cover for all quadrats determined total cover for each site, which is divided by the number of quadrats taken in each site to obtain one average. The following equation was used to calculate plants cover%.

$$\text{Plants cover percentage} = \frac{\text{Total estimations}}{\text{Total number of quadrats}} \times 100 \ldots\ldots\ldots\ldots\ldots (5)$$

Biomass production and carrying capacity

Sampling was done by locating a1/2 km^2 plots in both sites open rangeland and protected rangeland. In each plot, three transects of 500m length were constructed, at each of the transect, three quadrates of one m^2 were selected, giving a total number of 18 quadrats. Samples were cut in grazing level 3cm, labelled and then oven dried at105C° for 24 hours and their dry weight recorded [10]. Then the dry matter (ton per hectare) was used following formulas.

$$\text{Biomass production gm/m}^2 = \frac{\text{Total weight of dry matter of plants}}{\text{Total number of Quadrats}} \quad (6)$$

$$\text{Biomass production ton/ha} = \frac{\text{Biomass gm/m}^2 \times 10000}{1000 \times 1000\text{gm}} \quad (7)$$

The carrying capacity was calculated according to the daily

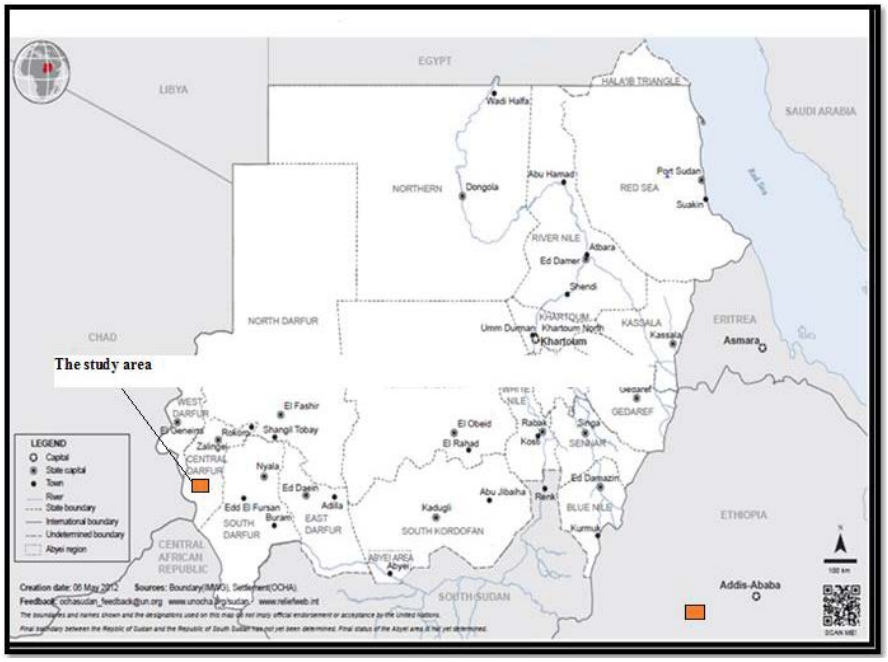

Figure 1. *Showed the study area.*

requirement of a Tropical Livestock Unit (TLU) 2.5 – 3% of their body weight. And proper use factor is (0.5) which is equivalent to (7.5 kg/day) as reported by [11]. Carrying capacity was calculated as follows:

$$\text{Carrying Capacity} = \frac{\text{Available forage production}}{\text{Total animal unit consumption (AU/Year)}} \dots\dots\dots (8)$$

Results and Discussion

Parker loop measurements (plant composition%, Litters%, Bare soil% and Rocks %)

Plant composition in the two sites recorded similar values in protected area was 14.51% and in grazed area 42.68%. Protected area recorded higher plant litters per cent (24.83%) than grazed area (19.5%), which might due to repeated grazing in the grazed area on short time within rainy season in addition to early grazing. The value of bare soil in the protected area was higher (23.16%) than in grazed area (15.16%) that due to high plant composition in this site and rocks per cent was high in grazed area (22.66%) and in protected area (10.5%) (Table 1).

Relative Plant Composition in the two sites

In the protected area the species recorded high plant composition per cent were included *Aristida mutablis* (26.89%), *Aristida fanculata* (14.82%) and *Eragrostis spp (*12.43%) and other species appeared in small per cent illustrated in (Table 2). The species in the grazed area included *Aristida fanculata* (67.54%), *Eragrostis spp* (13.66%) and *Aristida mutablis* (8.58%) and other species recorded in (Table 2). There no variation between the two sites in the relative plant composition per cent.

Frequency and Relative Frequency in the two sites

The species *Aristida fanculata* was recorded highest frequency in both sites protected site and grazed site (77.8 and 100%) respectively, *Eragrostis spp* (66.7%) in protected area and *Zornia glochidiata* (88.9%) in grazed area, *Aristida mutablis*, *Dactyloctenium aegyptium* were recorded same value (44.4%) in the two sites (Table 3).

Five dominant species in the two sites

The protected area was dominated with *Aristida fanculata , Eragrostis spp, Aristida mutablis, Scheonfeldia gracilis* and *Zornia glochidiata* and the dominant species in the grazed area included *Aristida fanculataI*, *Zornia glochidiata*, *Oldenlandia senegalensis*, *Dactyloctenium aegyptium* and *Scheonfeldia gracilis,* the dominant species in the protected area most of them are grasses, that might due to protection of area which encourage plants to sets seeds for a long time. In the grazed area most of dominant species belong to forbs and considered unpalatable for livestock in the study area, that due to early grazing and intensive grazing (Table 4).

Table1. *Percent cover for two range sites.*

Parameters	Protected	Grazed
Plant composition %	41.51	42.68
Litters %	24.83	19.5
Bare soil %	23.16	15.16
Rocks %	10.5	22.66
Total	100	100

Table 2. *Relative Plant Composition (%) at the two Range sites during season 2018.*

No	Scientific name	Local name	PC/ Protected site	PC%/ Grazed site	Habits
1	*Aristida abisinis*	Gaw abid	0.39	0.37	Grass
2	*Aristida mutablis*	Gaw azrag	26.89	8.58	Grass
3	*Schizachyrium exile*	Gaw ahmer	14.82	67.54	Grass
4	*Hetropogon contortus*	Abuherab	2	0	Forbs
5	*Eragrostis tremula*	Banw	12.43	13.66	Grass
6	*Justicia schimperi*	Umderademat	0.79	0.37	Forbs
7	*Senna obtusifolia*	Kawal	3.61	1.55	Forbs
8	*Oldenlandia senegalensis*	Tamer el far	4.4	0.77	Forbs
9	*Seasabania seasaban*	Sorabi	2	0.37	Forbs
10	*Dactyloctenium aegyptium*	Abuasabi	10.43	0.77	Grass
11	*Oxygonum atriplicifolium*	Um hamed	0.39	0	Forbs
12	*Ipomoea belpharosepla*	Hantoot	1.2	0	Forbs
13	*Sesbania arabic*	Sesban	2.4	0	Forbs
14	*Zornia glochidiata*	Sheliniy	2.4	1.55	Grass
15	*Indigofera hochstetteri*	Sharaya	1.59	0	Forbs
16	*Schoenfeldia gracilis*	Danabelnaga	1.2	1.17	Grass
17	*Justica kotschyi*	Nana	1.79	1.37	Forbs
18	*Corchorus olitorius*	Molukhia	0.39	0	Forbs
19	*Chloris gayana*	Afanelkhadeem	1.2	0	Grass
20	*Pennisetum pedicellatum*	Umdofofo	2	1.55	Grass
21	*Cenchrus biflofrus*	Haskaneet	0.39	0	Grass
22	*Alycicarpus vaginalis*	Kasbera	0.39	0	Forbs
23	*Aristida adscensionis*	Um hribo	4.82	0	Grass
24	*Vigna sun-hum*	Taktag	0.39	0.37	Forbs
25	*Oldenlandia herbacea*	Gragoub	0.39	0	Forbs
26	*Polycarpea corymbosa*	Ras elshibe	1.59	0	Forbs
27	*Xanthium brasilicum*	Ramtok	0	0.37	Forbs
28	*Abutilon angulatum*	Mgshat elregal	0	0.37	Forbs
Total			100	100	

Biomass production in the two sites

The biomass production was recorded low values in both sites protected and grazed area (870 and 491.16kg/ha) respectively, that could be due to intensive, early grazing in the area and harvesting for grasses by people in the area to provide forage for their livestock in the dry season and that effects on carrying capacity (Table 5).

Conclusion and Recommendations

The study calculated that is protected site was recorded higher values of plant litters than grazed site and the most dominant species in this site were annual grasses, while in grazed site the species were forbs and most of them unpalatable for livestock in the study area. The study recommended that the application

Table 3. *Plant Frequency and Relative Frequency in study area.*

No	Scientific name	Local name	Protected area		Grazed area		Habits
			Frequency %	Relative Freq%	Frequency %	Relative Freq%	
1	*Aristida abisinas*	Gaw abid	22.2	3.7	11.1	1.75	Grass
2	*Aristida mutablis*	Gaw azrag	44.4	7.4	22.2	3.57	Grass
3	*Schizachyrium exile*	Gaw ahmer	77.8	12.98	100	16.08	Grass
4	*Hetropogon contortus*	Abuherab	22.2	3.7	0	0	Forbs
5	*Eragrostis tremula*	Banw	66.7	11.12	33.3	5.36	Grass
6	*Senna obtusifolia*	Kawal	22.2	3.7	33.3	5.36	Forbs
7	*Oldenlandia senegalensis*	Tamrelfar	33.3	5.55	44.4	7.14	Forbs
8	*Sesbania seasaban*	Sorib	22.2	3.7	33.3	5.36	Forbs
9	*Dactyloctenium aegyptium*	Abu asabi	44.4	7.4	44.4	7.14	Grass
10	*Oxygonum atriplicifolium*	Um hammed	11.1	1.85	0	0	Forbs
11	*Ipomoea belpharosepla*	Hantoot	22.2	3.7	22.2	3.57	Forbs
12	*Seasabania arabic*	Seasaban	11.1	1.85	0	0	Forbs
13	*Zornia glochidiata*	Shillini	33.3	5.55	88.9	14.3	Grass
14	*Indigofera hochstetteri*	Sharaya	11.1	1.85	11.1	1.775	Forbs
15	*Schoenfeldia gracilis*	Danabelnaga	44.4	7.4	44.4	7.14	Grass
16	*Justica kotschyi*	Nana	11.1	1.85	22.2	3.57	Forbs
17	*Corchorus olitorius*	Molukhia	0	0	11.1	1.75	Forbs
18	*Pennisetum pedicellatum*	Umdofofo	0	0	11.1	1.75	Grass
19	*Cenchrus biflofrus*	Haskaneet	11.1	1.85	0	0	Grass
20	*Vigna sun-hum*	Tagtag	22.2	3.7	0	0	Forbs
21	*Oldenlandia herbacea*	Gragoub	22.2	3.7	0	0	Forbs
22	*Polycarpea corymbosa*	Ras elshibe	11.1	1.85	22.2	3.57	Forbs
23	*Commicarpus africanus*	Lesage	22.2	3.7	11.1	1.75	Forbs
24	*Stylosanthes fruticosa*	Natasha	11.1	1.85	0	0	Forbs
25	*Blepharis linariifolia*	Beg hail	0	0	22.2	3.57	Forbs
26	*Senna occidentalis*	Aboefeen	0	0	11.1	1.75	Forbs
27	*Sida cordofolia*	Nada	0	0	11.1	1.75	Forbs
28	*Dicanthium annulatum*	Um melaha	0	0	11.1	1.75	Grass
Total			599.6	100	621.8	100	

Table 4. *Five dominant species in the two sites.*

No	Sites			
	Protected	Habits	Grazed	Habits
1	*Aristida fanculata*	**Grass**	*Aristida fanculataI*	**Grass**
2	*Eragrostis spp*	**Grass**	*Zornia glochidiata*	**Forbs**
3	*Aristida mutablis*	**Grass**	*Oldenlandia senegalensis*	**Forbs**
4	*Scheonfeldia gracilis*	**Grass**	*Dactyloctenium aegyptium*	**Grass**
5	*Zornia glochidiata*	**Forbs**	*Scheonfeldia gracilis*	**Grass**

Table 5. *Biomass production at the two sites.*

Parameters	Sites	
	Protected area	Grazed area
Biomass gm/m^2	87.49	49.12
Biomass kg/m^2	0.087	0.049
Biomass kg/ha	870	491.16

of protection for rangelands before actual grazing (rest) leads plants to re growth in fast time and increasing the biomass production and lead the plants to complete growth.

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