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Research Article

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ABSTRACT

This study was conducted in Um "Nabag" (15km north of "Bara"), "Dilling" (160km south of "Elobeid") and "Eldemokya" (30km east of "Elobeid").
The objective was to assess the effect of grazing level on vegetation cover and frequency, and to assess its effect on biomass production and shoot/root ratio.
The results showed different levels of grazing intensity at different sites as indicated by cover and shoot/ root ratio. More intensive grazing levels were found at Bara in the north, early and late in the rainy season but in Dilling it was not found in the late in the rainy season for both seasons (2008 and 2009) which indicated longer stay of herders in "Bara" area as a rainy season residence.
The results also showed that, there was a decrease in cover percentage increase in bare soil with increased grazing intensity since it reached 70% and 67% for "Bara" and "Demokeya" at level II(>50%<75% grazed) grazing, indicating high possibility of erosion hazard and reflecting the impact of using rainy season residence intensively, subjecting the area to soil erosion hazards.
There was drastic decrease in root/shoot ratio with increasing grazing intensity decreasing from 1:6 to 1:10 in (2008) from non grazed to level (I) (>50% grazed) grazing, and from 1:3 to 1:4 in (2009) from non grazed to level (I) grazing for "Bara" between early and late time of use.

Keywords: Intensity of grazing level, vegetation cover, Shoot/Root ratio, litter, bare soil.

INTRODUCTION

Therefore, with the prevailing systems of production, the negative impact on the land and the environment would be expected to continue. Since most of the animal wealth is concentrated in the hands of transhumant and nomads, it is difficult to alleviate the pressure on land by attempting to reduce the number of animals. These constraints may be reflected in severe deterioration in both quality and quantity of rangelands and consequently reduced livestock productivity. Therefore detailed evaluation of vegetation is necessary to describe the current status of rangelands in semi-desert and low rainfall savanna, comparing these measurements over time to detect the change that has happened to rangeland, using ground measurements and remote sensing techniques. Such monitoring would enable setting up strategies and measures aiming at alleviating constraints and improving productivity.

Transhumant migration seasonally following grazing routes; approximately 60% of the livestock in Kordofan is engaged in migration to the drier range lands of the north for major part of the growing season, the movement is natural response to high clays during the rainy season

MATERIALS AND METHODS

General: This study was conducted in three areas namely "Bara", "Demokeya" and "Dilling," as these areas represented different geographical locations in relation to agropasorlist movement and consequently represented different timing and intensity of use.
Sampling design: Three range sites were selected in each of the three geographical areas, within each site an area of 1kmx1km plot was marked based on Relief (Greig- Smith 1979 and Barbour et al 1987) each containing three smaller circular plots of a radius of 200m, marked based on the minimum area principle.

Degree of grazing intensity: The degree of grazing intensity was determined using method similar to what was used by Saltaz et Al, (1999). In each quadrate percentage of vegetation cover , litter and bare soil were

recorded, then the intensity of grazing was assessed as level I if it estimated <50%, level II if it is >50% and <75% level III if >75% and >100% level IV if it reached 100% grazing

Data analysis: Data for vegetation measurement were assessed using standard range measurements equations, while grazing intensity assessed based on Saltaz and Methal (1999). Other indicator such as Ried and Love (1951) for soil erosion hazard was also used.

RESULTS AND DISCUSSION

Plant Cover

Results of season 2008 and 2009 indicated that there are clear negative correlation between percentage of vegetation cover and litter on one hand and the level of grazing intensity. For season 2008 the correlation between cover and grazing intensity were -0.54, -0.75 and -0.87 for Bara, Demokeya and Dilling. On the other hand, the correlation between litter and grazing intensity were -0.48, -0.67 and -0.62 for the same sites respectively.

Results for season 2009 indicated that the correlation between plant cover and grazing ntensity were similar in Bara (r = -0.92) and Demokeya (r = -0.95). On the other hand, correlation of litter was -0.87 and -0.43 for the two sites respectively.

At Dilling site the correlation between cover and litter in one hand and grazing intensity was moderately negative (-0.70 and -0.69 respectively).

In season 2008 at Bara and according to Table (1), there was clear decline in cover and slight increase in litter between non grazed quadrates and level (I) grazing quadrates, where the total cover percentage increased with the values of 56% with non grazed quadrates to 49% at level (I) grazing quadrates while the total litter decline with the percentage of 9% with non grazed quadrates to 10% at level (I) grazing quadrates. Similar results were obtained between non grazed quadrates and level (II) grazing quadrates, where total cover percentage was 56% for non grazed quadrate to 14% level (II) while the litter percentage was 9% in non grazed quadrate to 16% at level (II), according to (Ried and Love 1951), bare soil of (50%) percentage or more is an indication for possibility of erosion hazards. Bare soil percentages in Bara at level II and level III recorded 70% and 82.5% respectively.

In Demokeya site, there was decline in cover and increase in litter between non grazed quadrates and level (I) grazing quadrates where the total cover percentage decline from 34% with non grazed quadrates to 17% at level (I) grazing quadrates, while the total litter increased from 8% with non grazed quadrates to 12% at level (I) grazing quadrates.

In Dilling, decline in cover biomass and increase in litter between non grazed quadrates and level (I) grazing quadrates where the total cover percentage decline from 62% with non grazed quadrates to 25% at level (I) grazing quadrates while the total litter increased with the percentage of 7% of non grazing quadrates to20% in level (I) grazing quadrates.

The litter value in non grazed quadrates was more than litter values at level (I) and also higher than the litter value in level (II). This could be attributed to more animal trampling and more grazing imposed within more grazed quadrates.

Level (IV) (100% grazed)

When comparing season 2009 as with season 2008, nearly similar results were obtained [table (1) and table (2)]. There was clear decline in cover and litter between non grazed quadrates and level (I) grazing quadrates in Bara where the total cover percentage decline with the percentage of 45% with non grazed quadrates to 23% at level (I) grazing quadrates. The total litter increased with percentage of 9% with non grazed quadrates to 10% at level (I) grazing quadrates. Table (2)

Table (1) Intensity of grazing level, plants cover, litter and bare soil percentages in season (2008)

Site	Parameter	No grazing	Level (I)	Level (II)	Level (III)	Level (IV)	Corr. (r)
Bara	Cover	56%	49%	14%	16%	40%	-0.54
	Litter	9%	10%	16%	1.5%	5%	-0.48
	B.S	35%	41%	70%	82.5%	55%	
Demokeya	Cover	34%	17%	24%	25%	0	-0.75
	Litter	8%	12%	9%	9%	0	-0.67
	B.S	58%	72%	67%	66%	0	
Dilling	Cover	62%	25%	0	0	0	-0.87
	Litter	7%	20%	0	0	0	-0.62
	B.S	31%	55%	0	0	0	

Level (I) (<50% grazed)
Level (II) (>50 %< 75% grazed)
Level (III)(>75%<100 grazed)
Level (IV) (100% grazed)

Table (2) Intensity of grazing level plants cover, litter and bare soil percentages in season (2009)

Site	Parameter	No grazing	Level (I)	Level (II)	Level (III)	Level (IV)	Corr. (r)
Bara	Cover	45%	23%	21%	20%	0	-0.92
	Litter	9%	10%	9%	5%	0	-0.87
	B.S	46%	67%	70%	82.5%	0	
Demokeya	Cover	46%	39%	26%	25%	0	-0.95
	Litter	9%	7%	11%	12%	0	-0.43
	B.S	45%	55%	63%	63%	0	
Dilling	Cover	61%	60%	0	45%	0	-0.70
	Litter	7%	5%	0	5%	0	-0.69
	B.S	32%	35%	0	50%	0	

Level (I) (<50% grazed)
Level (II) (>50 %< 75% grazed)
Level (III) (>75 %< 100 grazed)
Level (IV) (100% grazed)

Shoot/Root ratio

A well developed root system is very important in the early stages of the crop growth. Not only does it set a good root system for the plant to intercept water and nutrients but also create an environment for beneficial microorganisms to multiply. Poor soil structure causes water logging and anaerobic conditions and suppresses root development. Low levels of base actions like calcium, magnesium and potassium, bring about low pH or high acid levels, suppressing root development.

In season 2008, and as shown in Table (3), there was clear decline in shoot biomass and root biomass between non grazed quadrates and level (I) grazing quadrates early in the season in Bara, where the shoot weight decreased with the percentage of 33.9%, and the root decline with the percentage of 59.2% resulted in shoot/root ratio of 6:1 with no grazing to 10:1 at level (I) grazing. Late in the season, there was decrease in shoot biomass and root biomass between non grazed quadrates and level (I) grazing quadrates was 14:1 with no grazed to 13:1 with level (I) grazing. The same results were obtained at Demokeya site where the shoot weight decreased with the percentage of 72%, while the root decreased with the percentage of 74.6%. The shoot/root ratio was 3:1 at no grazed quadrates and 3.5:1 in level (I) grazed quadrate.

In early season (2009), in Bara and according to Table (4), there was clear decrease in shoot biomass and root biomass between non grazed quadrates and level (I) grazing quadrates, where the shoot weight decreased with the percentage of 35%, while the root decreased with the percentage of 85% resulted in shoot/root ratio 25:1 with no grazed to 17:1 at level (I). In Demokeya, early in the season the decrease in shoot biomass and root biomass between non grazed quadrates and level (I) grazing quadrates was 92%, while the root decrease with the percentage of 96.8% resulted in shoot/root ratio 5:1 with no grazed and 2:1 at level (I). The same results between non grazed quadrates and level (II) grazing quadrates late in the season were obtained, the shoot weight decrease with the percentage of 24%, while the root decrease with the percentage of 69.4% resulted in shoot/root ratio of 4:1 with no grazed to 3:1 at level (II). In Demokeya, late in the season there was decrease in shoot biomass and root biomass between non grazed quadrates and level (I) grazing quadrates

where the shoot weight decrease with the percentage of 73.7%, and the root decline with the percentage of 74.5% resulted in shoot/root ratio 4:1 with no grazed no grazing and 3:1 at level (I) late in the rainy season.

Table (3) shoot/root ratio at the different grazing level for biomass/m2 (oven dried) in Season 2008

Grazing level		Bara			Dilling			Demokeya		
		shoot	root	Shoot/root ratio	Shoot	root	Shoot/root ratio	shoot	root	Shoot/root ratio
No grazing	early	66	11.23	6:1	160.3	27.6	6:1	772	252	3:1
	late	498.8	37.4	14:1	5774.34	397.96	15:1	1492	996	1:1
1	early	43.16	4.58	10:1	82.66	8.29	9:1	216	64	4:1
	late	221.8	17.9	13:1	0	0	0	392	253	2:1
2	early	0	0	0	0	0	0	194	60	3:1
	late	0	0	0	0	0	0	38	18	2:1
3	early	10.10	3.83	3:1	30.5	4.22	7:1	14	16	1:1
	late	0	0	0	0	0	0	0	0	0
4	early	0	0	0	0	0	0	0	0	0
	late	0	0	0	0	0	0	0	0	0

Level (I) (<50% grazed) Level (II) (>50 %< 75% grazed) Level (III) (>75 %< 100 grazed) Level (IV) (100% grazed)

Table (4) shoot/root ratio at the different grazing levels for biomass/m2 (oven dried) in season 2009

Grazing level		Bara			Dilling			Demokeya		
		shoot	root	Shoot/root ratio	Shoot	root	Shoot/root ratio	shoot	root	Shoot/root ratio
No grazing	early	175.05	6.78	25:1	1418.25	1088.9	2:1	610	122	5:1
	late	2.44	1.51	2:1	2035.72	1010.17	2:1	384.42	107.47	4:1
1	early	236.95	13.59	17:1	0	0	0	44.98	24.26	2:1
	late	276.88	121.66	2:1	254.78	134.86	2:1	478.26	182.13	3:1
2	early	0	0	0	0	0	0	7.33	3.89	2:1
	late	43.61	26.81	2:1	0	0	0	64.79	20.95	3:1
3	early	0	0	0	0	0	0	41.16	14.42	3:1
	late	0	0	0	0	0	0	142.24	54.33	3:1
4	early	22.33	1.14	20:1	0	0	0	0	0	0
	late	0	0	0	0	0	0	0	0	0

Level (I) (<50% grazed) Level (II) (>50 %< 75% grazed) Level (III) (>75 %< 100 grazed) Level (IV) (100% grazed

CONCLUSION

The study concluded that, levels of grazing can be used as indicators for plant cover and biomass as proved in the area of the study.

Grazing intensity of level (II) and more may have significant effect on plant growth and shoot/root ratio.

RECOMMENDATION

The study recommended that grazing level can be used as a practical means to assess utilization level as expressed by growth performance indicators including cover and root/shoot ratio. Grazing intensity more than level (II) is expected to result in negative impact on rangeland plants growth performance.

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