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The impacts of high grazing pressure on plants species diversity with focusing on native forbs species – case study of Dilling locality – south Kordofan State - Sudan

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Abstract

The study was conducted at EL Dilling locality grazing land at South Kordofan State. The objective of this study is to assess the impacts of high grazing pressure on plants species diversity and also focused on the common forbs species diversity in three different grazing sites. The rangeland was divided into three sites according to utilization degree. Three water points were selected randomly from 24 permanents water points. Three grazed sites were also selected randomly, while the un-grazed site was selected in the middle of two sites. The Parker loop method (Parker and Hirris, 1959) have been used, to measure relative plants composition and ground cover of the rangeland.48 transects were delineated using 100 meter tape and a ¾ loop placed at ground level at one meter intervals. Also the quadrate method (Wilm *et al*, 1944) was used to determine individual forbs plant frequency in three different grazing sites. The manual calculated using standard range measurements equations, and the plants species diversity for two years at three different sites was observed. The results showed significant variation in plant relative composition over the three sites. The study showed that the very sensitive forbs that considered being sensitive for grazing practice was very rare in both around water point and grazing sites. Also the results showed that there were high variations in plants diversity within the three sites. The study concludes that high grazing pressure could change plants species composition and plants diversity.

Key words: plant composition, Plants frequency, plants diversity, forbs, palatable plants, unpalatable plants

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Introduction

It is widely acknowledged the livestock have a major impact on the rangeland vegetation composition and stability of grasslands and shrubs vegetation, if overexploitation by grazing animals, the response of plants to the intensity and frequency of livestock impacts in relation to environmental condition and the animals factors, which affects not only the intensity and frequency, but also the distributions of that impact. In most African countries, rangeland livestock production is a form of extensive grazing systems practiced by nomads of the arid and semi- arid regions, considering the demand for foodstuffs due to the growing human population, increasing livestock productivity gains importance particularly under harsh environmental condition in arid and semi – arid areas, (Kamau, 2004). Rangelands form an immense natural resource and the major of feed for national herd in Sudan. The various types of grazing land vary from open grasslands to seasonal water sources, flood plains, river banks, woodlands, hills and mountain slopes (Zaroug, 2006).

In South Kordofan pastoralist was the traditional mode of rangeland resources utilization, but the society is experiencing profound change throughout the last decades. These changes are visible through the regression of animal mobility and sedenreisation of the population, rangelands are subject to increasing pressure leading to their degradation. (Nefzaoui, 2004).Degradation of natural resources is the most serious problem facing the rangeland in the country. Animals are kept on the rangeland eight months. Also the prevailing drought conditions, involving shortage of forage and drinking water in most areas of rangeland, livestock are fed for most on open grazing land through the year. This system is based on the traditional opportunistic mobility, which balances availability of feed and water with aversion of wet-disease in infected areas. Livestock in depend mainly on rangeland vegetation. (Fashir, 2008).

The impact of grazing by domestic stock on plant communities has received considerable attention. Very heavy grazing results in a decline in the number of species; changes in vegetation also have an impact on soil properties, including soil fauna. (Howery and Sprinkle, 2006).

Grazing has also changed the abundance and distribution of grasses. Many species are only affected by very heavy grazing and some species are sensitive to grazing over a range land (Landsberg *et al* 1997). There is broad agreement that improper grazing can negatively impact various rangeland ecosystem functions and degrade ecosystem services (Belsky et al. 1999; Jackson and Bartolome 2007), specifically on annual rangeland. Rangelands are incredibly

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dynamic ecosystems. Drastic changes can be observed among seasons within a year and among years and decades. There are many factors that cause rangelands to change over time one of them is grazing. These factors change the plants diversity on rangeland (University of Idaho, 2011). Grazing is a natural ecological process that occurs on all rangelands. . Grazing can buffer changes in plant communities and species richness, even in the face of other environmental drivers such as climatic warming. (James, et al, 2014) Animals preferring some plants over others depending of existing plants communities. When herbivores focus their grazing attention on one plant, or group of plants, the un-grazed plants can express themselves sometime creating dramatic contrasts. Rangeland center university of Idaho (2011), reports that, Sheep grazing in Montana preferred the yellow forbs in this mountain and almost completely removed them from where they grazed. In the other side some plants are more tolerance to grazing process and other are not, Jaddalla, (1994), report that some forbs are very sensitive to grazing. In this study we assess the impacts of grazing pressure on plant species diversity and also focused on the common and rare forbs species diversity in three different grazing sites. We thought these types of study could be very importance in indentifying the open grazing management practices, are most consistent with the conservations of plants diversity in whole country.

To investigate the effects of grazing variability and grazing pressure, we compared species diversity for two years at three different sites, in desert-steppe and steppe areas

Materials and Methods

Study area:

The study was conducted in EL Dilling locality rangeland at South Kordofan State which lies about 165km² South East EL Obied town during the years 2010 – 2011. The area lies approximately between latitudes 29°:00-32°:00East and longitudes10°:00 12°: 00North. It covers an area about135, 000Km². The average elevation is 600m above sea level, (SKRDP-NKRDP, 2002). The climate of Dilling locality is semi- arid, rainfall is about 300mm – 800mm, the temperatures range from 42C° to 24C° in May and 31C° to 13c° in January(IFAD,2006).

Sampling:

The rangeland in study area were divided into three sites according to utilization degree (a round water points, grazed sites and un-grazed site), three water points were selected randomly from 24 permanents water points. Three grazed sites were also selected randomly, while the un-grazed

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site was selected in middle of two sites. For vegetation measurement the Parker loop method (Parker and Hirris, 1959) have been used to measure relative plants composition, transects were delineated using 100 meter tape and a ¾ loop placed at ground level at one meter intervals. Record was made of whatever was encountered in the loop (plants, litter, bare soil and rock), plants species were recorded based on life root crown covering 0.5 loop size each plant species were recorded by their scientific name used record sheet. In addition to quadrate method (Wilm et al, 1944) double sample procedure were used to determine the dominated palatable and unpalatable plant frequency were observed. Sampling was concluded by end of rainy season within two years using 1×1m quadrate on each of three study sites 72 quadrates within each sites were conducted.

Plants relative composition

The relative plants composition refer to the contribution of each individual plants species of the total plants percent when used parker loop method (Parker and Harri,1959). Measured observation along transect line will be usually plants species, litter, bare ground, rock and animals drop or belts. To calculate the relative plants species composition the following formula were used:-

$$\text{Relative plants composition} = \frac{total\ hits\ of\ each\ plants\ specieces}{total\ hits\ of\ all\ plants} \times \%100$$

Frequency:

Frequency is the percentage of total quadrates that contain at least one rooted individual of a given species. It is determined by recorded the species names which appear in quadrates. The frequencies were calculated by using the following formula:

$$\text{Species frequency} = \frac{The\ number\ of\ quadrate\ contaning\ the\ individual\ species}{The\ total\ number\ of\ quadrate\ taken} \times \%100$$

Data analysis

The plants species attributes data were organized tabulated and analyzed using standard range measurements equations and the plants species diversity for two years at three different sites was observed.

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ERESULTS & DISCUSSION

Botanical composition:

The result in table (1) shows the variation between a botanical compositions (%) in three sites within two seasons when use Parkar loop method. The plants composition showed a gradual change as one moved from the watering points to the grazing areas. The results revealed differences in plants diversity in three sites, that 22 plants species were found in grazed site and 18 plants species were found in around water points, while in un- grazed site, the vegetation condition is seemed to be healthy, where 27 different plants species have been found during vegetation measurement in two seasons. Table (1) also shows clear indicators of a high pressure of animals a round water points and grazed sites, have negative impacts of rangeland plants species composition, plans diversity, increased bare ground percent specially a round water points. The highest marked of some palatable grass species in grazed sites was not mean healthy range condition, because most of these grass are single stemmed with less foliage. While in un-grazed sites much defoliation was found. In addition to high frequent marked. The variation in plants species frequency around water points and grazed sites shows rather non significant differences. The same plants species were found in both sites and proximately same frequency marked, but in un-grazed plants species were rather different and marked highest frequency.

The result shows the clear indicator that grazing pressure has negative impacts on plants diversity especially on forbs species which seem to be very sensitive to heavy grazing practices. Moreover, high grazing pressure can lead to greater species diversity, Holechk, (2004). Repot that extensive grazing decline the abundance of palatable plants, changes in ground cover, palatable plants and ground cover have clearly been affected by the sustained and widespread increase in grazing pressure that has developed around artificial sources of water. The results also showed that the plant diversity in both around water points and grazing sites were dominated by grass types, this may be due to that the most palatable forbs species are not given enough rest to survive and invaders forbs plants like *Cassia tura, Acanthospermum hespidu and*

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Oldenlandia herbacea are developed, however, we belief that extensive livestock grazing practices in open rangeland could leads to the disappearance of the most palatable forbs species where they will be replaced by other herbaceous plants.

Table (1) the variation between average individual botanical compositions (%) in three sites within two seasons

Botanical lateen name	Botanical types	R. W.P site		Grazing site		Un-grazing site	
		Year 2010	Year 2011	Year 2010	Year 2011	Year 2010	Year 2011
Oldenlandia herbacea	Forbs	7	3.3	3	1.1	1.4	1
Pennisetum pedicellatum	Grass	2.1	1.5	5	3	2.1	2.1
Eragrostis tremula	Grass	25	20.7	27.7	19.2	9	8.2
Aristida mutablis	Grass	12	8.7	8.5	5	11.3	7.3
Indigofra spp	Forbs	3	2.1	1	2.1	3.4	00
Schonfeidia gracilis	Grass	17.9	13.9	40.5	33.1	5.9	6.6
Jasminum nitidum	Forbs	0.0	00	0.4	00	00	00
Zornia glochidiata	Forbs	3	1.9	1.5	4.7	00	00
Dactylactinum aegyptioum	Grass	7	4.8	3.5	11.6	6.1	4.9
Cassia tora	Forbs	13	16.1	3.9	0.9	0.0	0.0
Acanthospermum hespidum	Forbs	1	3.3	5.9	3	0.0	0.0
Blepharis linariifolia	Forbs	0.0	00	0.3	00	0.0	0.0
Euphorbia hirtal	Forbs	00	0.6	0.1	00	0.0	0.0
Marettia philaeana	Forbs	3.2	6.3	0.3	0.1	00	0.6
Setaria pallidea fusea	Grass	1	2.1	0.9	1.6	4.2	3
Hygrophylla spinosa	Forbs	0.5	0.0	0.1	0.0	0.0	0.0
Impomea kordofana	Forbs	0.5	0.5	0.1	0.2	12.3	8

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Echinocola colonum	Grass	1.1	7.5	0.3	7.4	4.1	3.5
Chloris gyana	Grass	0.0	3.9	3.9	5.3	0.0	2.5
Amaranthus grecans	Forbs	0.0	1.3	0.1	0.3	0.0	0.0
Justicia kotschyi	Forbs	0.0	0.0	0.4	1.7	0.0	0.0
Corchorus ditorius	Forbs	1	0.5	0.0	0.0	1	2.4
Xanthium brosilicum	Forbs	0.5	1.5	0.0	0.0	00	00
Ocimum basilicum	Forbs	0.5	00	0.0	0.0	4	2.4
Tribulus terrestris	Forbs	0.0	0.6	0.0	0.0	00	00
Sorghum purpureosercim	Grass	0.0	0.0	0.0	0.0	4	6
Symbopogan nevratus	Grass	0.0	0.0	0.0	0.0	11.5	14.7
Hyparrhenia confinis	Grass	0.0	0.0	0.0	0.0	1.5	4.1
Demodium dichotomum	Forbs	0.0	0.0	0.0	0.0	2.6	4
Rhynchosia minima	Forbs	0.0	0.0	0.0	0.0	3	5.9
Asteraceae hyperhernia ofrun	Forbs	0.0	0.0	0.0	0.0	0.5	0.3
Cucumia dispaceors	Forbs	0.0	0.0	0.0	0.0	0.5	1.1
Loranthus spp	Forbs	0.0	0.0	0.0	0.0	0.5	00
Sesbania Arabic	Forbs	0.0	0.0	0.0	0.0	0.5	2.1
Sorghum halepense	Grass	0.0	0.0	0.0	0.0	0.5	00
Ipomoea coptica	Forbs	0.0	0.0	0.0	0.0	0.5	2.1
Farsetia grandiflora	Forbs	0.0	0.0	0.0	0.0	0.5	00
Andropogon gayanyus	Grass	0.0	0.0	0.0	0.0	5.6	4.2
buffalo grass	Grass	0.0	0.0	0.0	0.0	4.4	3.6
TOTAL		**100 %**	**100 %**	**100%**	**100%**	**100%**	**100%**

RWP= a round water points

Table (2): variation of average palatable forbs Plant frequency per cent that observed at different range sites over two seasons when used quadrate methods

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Botanical lateen name	**Botanical type**	**R.W.P sites**	**Grazed sites**	**Un-grazed sites**
Impomia sPP	Forbs	0.7	0.7	50
Asteraceae hyperhernia ofrun	Forbs	0.0	0.0	6.25
Demodium dichotomum	Forbs	0.0	0.0	18.75
Blepheris linoriifolia	Forbs	0.0	1.4	0.0
Sorghum purpureosercim	grass	0.0	0.0	14.6
Andropogon gayanyus	grass	0.0	2.8	12.5
buffalo grass	grass	0.0	0.0	22.9
Sesbania Arabic	Forbs	0.0	0.0	6.25
Waltheria indica	Forbs	0.0	0.0	10.6
Rhynchosia minima	Forbs	0.0	0.0	20.8

RWP= a round water points

Table (3): variation of average unpalatable forbs Plant frequency per cent that observed at different range sites over two seasons when used quadrate methods

Botanical lateen name	**Botanical type**	**R.W.P sites**	**Grazed sites**	**Un-grazed sites**
Cassia tura	Forbs	9.6	2.4	0.0
Oldenlandia herbacea	Forbs	5.2	2	1.1
Euphorbia hirtal	Forbs	0.0	0.2	0.0
Xanthium brosilicum	Forbs	1	0.0	0.0
Jasminum nitidum	Forbs	0.0	0.2	0.0
Acanthospermum hespidum	Forbs	2.2	4.5	0.0
Amaranthus grecans	Forbs	0.7	0.2	0.0
Marettia philaeana	Forbs	4.8	0.2	0.0

RWP= a round water points

The result in table (2) shows frequency variation at different range sites over two seasons. The result indicates that, the most plants species found around water points were grass type with unpalatable forbs such as *Cassia tura, Oldenlandia herbacea, Euphorbia hirtal, , Xanthium brosilicum, Marettia philaeana, Jasminum nitidum, , Acanthospermum hespidum, Amaranthus grecans, Marettia philaeana* the same forbs plants were found in grazed sites as indicated by

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table (3). There was a reduction in palatable forbs plants species frequency in both around water points and grazed sites. These may attribute to extensive and high grazing pressure. In fact the plant species especially palatable forbs plants were subjected to intensive selection by grazing animals. Moreover, much forbs species like *Demodium dichotomum, Asteraceae hyperhernia ofrun, Impomea kordofana, Ipomoea coptica* and *Rhynchosia minima* were considered to be very sensitive to animals grazing. On the other hand the native tall grass species like *Sorghum purpureosercim, Symbopogan nevratus, Andropogon gayanyus,* and *Pennisetum pedicellatum* were disappeared around water point and grazing sites but represented high with frequency in un-grazed site as indicated in table (2). These may be due to extensive grazing that influence the plants species diversity association among plants species through changing in habitat conditions and may be attributed to differences response of species population. Although plant cover has been shown in many studies to be sensitive to the increased grazing pressures near water points, simple trends are often obscured by interactions among palatable and unpalatable species of forbs and shrubs. (Lanta, 2009). The high grazing pressure results in a decline in the number of forbs species, a reduction in abundance of the remaining species and dominance by a few grass species see plate (1). Moreover, the species close to the water point, with substantial disruption to the soil surface, and unpalatable species dominated see blade (2), the plants diversity in grazing site of study area were decreased, these areas has increased in grass species only as in plate (3), by result of grazing pressure. But in un-grazed sites the palatable within both grass and forbs were more divers see plate (4) and (5)

Plate (1)

Plate (2)

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Plate (1) the high grazing pressure results in a decline in the number of forbs species, a reduction in abundance of the remaining species and dominance by a few grass species. Plate (2) shows the unpalatable forbs species around water point of study area, all palatable plants were consumed just unpalatable plants like *cassia tura, and canthospermum hespidum* are leaved.

Plate (3) the poor plants diversity in grazing site of study area, these areas has increased in grass species and forbs plants species were very rare, by result of grazing.

Plate (4 and 5) the plants density in un-grazed sites of study area, this area is healthy and more plants number per meter square and more plants diversity were found.

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