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# Impacts Assessment of Open Grazing System on Vegetation Attributes and Biomass Productivity, El Dilling Lacolity - South Kordofan State - Sudan

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**Abstract:** The study was conducted at EL Dilling locality rangeland at South Kordofan State which lies about 165km south east EL Obied town during the years 2010 – 2011. The aim of this study was to assess the impacts of open grazing system on vegetation attributes and biomass productivity. The rangeland was divided into three sites according to utilization degree. Three water points were selected randomly from 25 permanents water points. Three grazed sites were also selected randomly, while the ungrazed site was selected in the middle of two sites. For vegetation measurements 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. In addition to the quadrate method (Wilm *et al,* 1944) double sample procedure was used to determine relative plants density, plant frequency and biomass productivity. The SAS statistical package and manual calculated formula were used for analysis of the data obtained from vegetation measurements. The results showed very high significant differences in ground cover and significant variation in plant relative composition over the three sites. The study showed that the very sensitive forbs that considered being sensitive for grazing procedure was found in ungrazed site. Also the results showed that there were high variation in plants density and plants frequency between the three sites, in addition to very high significant differences in biomass productivity between the three sites. The study concluded that the open grazing system has affected plants growth, degreased soil stability, changed plants type and decreased rangeland productivity.

**Key words:** plant composition, Plants frequency, Plants density, Ground cover

## Introduction

Rangelands play a major role in supplying human population with animal products in the entire land region in the world. Rangelands account for 16% of world food production compared to 77% for cropland (Holechek, 2004). In many parts of Africa, nomadic herders consider cattle a source of wealth. Maintaining large numbers of non-productive animals by nomadic cultures has led to rangeland deterioration. Large increases in both nomad and livestock populations, as a result of interventions from western culture in Africa, necessitate a change in the practice of keeping non-producing livestock as a form of wealth. (Holechek, 2004)

The range land all over the world is subjected to intensive use due to increasing animal and human population, ecological change, and increase in human demands and over economical activities. These factors cause severe rangeland deterioration (Abdalla, 2008). The livestock cattle, sheep and goat owned by pastoralists are the main consumers of rangeland plants, and grazing is considered a natural influence in rangeland environment. Livestock rising in south Kordofan practiced two systems. The first one is the village – based adapted by the settled communities whereby livestock is kept throughout the year grazing near settlements. The second type is an open range seasonal grazing system followed by nomads and semi- nomads, and

livestock is driven to distant rangeland. The pastoralist nomads are increasingly responding in large by changing the nomadic way of life, through sedentraization in large areas in Dilling locality. The concentralion of people raises some problems like rangeland environment degradation in northern parts in particular that concentration resulted by insecurity situation in southern parts. Therefore, traditional open grazing system implies excessive pressure on rangeland by animals and expansions of marginal farming which accelerate environmental degradation, (Abdullah. 1982 and Zaroug, 2006). In Sudan over thousands years grazing has been one of the major land use activities in southern Kordofan, and continue to remain and important use. Range land grazed heavily by animals since no rule to recognize grazing practices, caused rangeland deterioration. Livestock have a major impact on rangeland vegetation composition and stability of grassland, through over exploitation. Desired plants could be changed by other undesired plants species (Cordon, 2007). Grazing has been one of the major land use activities in southern Kordofan State, and continuous to remain important use. Grazing poorly managed land has led to large scale soil loss. Currently, many rangelands show signs of degradation, the over grazing condition resulted in reduction of rangeland environment degradation. in term of vegetation cover, plants composition, desirable plants density, increase unpalatable plants species and destroyed the soil stability. Furthermore, the high population migrates from south parts to north as a result of security situation during the civil war. This pressure resulted in soil degradation, reduction in grazing capacity, replacement of desirable forage plants with other unpalatable, compaction of soil by livestock, decreased soil fertility due to loss of plant cover, high loss of soil during periods of torrential rain, decreased absorption of rainfall by soil and destroyed the vegetation diversity, which lead to environmental degradation, conversion of range land to waste land and constricted human food and animal production in particularly. This study will assess the impacts of open grazing system on vegetation attributes and biomass productivity.

## Materials and Methods

The study was conducted in EL Dilling locality rangeland at South Kordofan State which lies about 165km² South East ELObied town during the years 2010 – 2011. The area lies approximately between latitudes29°:00-32°:00East and longitudes10°:00 12°: 00North. It covers an area about135, 000 Km². 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 rangelands in El Dilling locality were divided into three sites according to utilization degree (a round water points, grazed sites and ungrazed site). Three water points were selected randomly from 24 permanents water points. Three grazed sites were also selected randomly, while the ungrazed 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 and ground cover of the rangeland, 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 relative

plants density, plant frequency and biomass productivity.

**Plants composition and plants reslative composition**

Species composition refer to total plants observed from total number of hits, while 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 vegetation attribute the following the formulas are used:-

Plants composition =

$$\frac{total\ hits\ of\ all\ plants\ specieces}{total\ hits} \times \%100$$

Relative plants composition =

$$\frac{total\ hits\ of\ each\ plants\ specieces}{total\ hits\ of\ all\ plants} \times \%100$$

Percent of bare soil =

$$\frac{Total\ hits\ of\ bare\ soil}{tatal\ hits} \times \%100$$

Percent of plants litter =

$$\frac{Total\ hits\ of\ litter}{total\ hits} \times \%100$$

**Biomass productivity**

The annual production above ground biomass is an indicator of the energy captured by plants, and it is availability for consumption given correct rangeland condition. While compaction layer in near surface layer of the dense soil caused by repeated impacts on grazing animals.

The above ground biomass data collected in the field are used to test the impacts of open grazing system on rangeland productivity in three sites (a round water points, grazed site and un-grazed site), using he double sampling method (Wilm *et al*, 1944) sampling was concluded in October within two years using 1×1m quadrate on each of three study sites 72 quadrates within each sites were conducted. The above ground biomass is measured with harvest technique in which standing crop sample were clipped above 2.5cm to ground level, the plants material collected into paper bags. All samples were oven dried at 104fc for 48 hours before weighing. Range productivity calculated by using the following formula:

$$\text{Range productivity per /m} = \frac{average\ biomass/m^2 \times 10000 \times 0.5}{100000} = ton/ha/\text{ years}$$

**Frecquency**

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:

Species frequency =

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

**Plants density and plants relalives density**

Density is a total number of plants species per unit area expressed as (plant/unit) it is

determined by counting all plants rooted in quadrates. While the relative plants density is a number of individual plants species per/unit area, in these study 1 × 1 meter square is used to determined plants density. The densitywere calculated by using the following formulas

Average plants density /meter square =

$$\frac{Total\ number\ of\ plants\ species\ in\ all\ quadrate}{Total\ number\ of\ quadrates}$$

Relative plants density /meter =

$$\frac{Total\ number\ of\ individual\ plants\ species}{Total\ number\ of\ quadrate}$$

**Ground cover**

Ground cover is a key indicate rangeland health, it is the vegetation (living and dead) biological crusts and stone that is in contact with soil surface (Steward *et al*, 2011), it is calculated by counted all components without include bare soil.

**Statistical analysis**

Statistical analysis (ANOVA) was performed using the A paired t-test (SAS, 1988) to compare differences in vegetation attribute in three sites and the differences between the means were compared.

**Results and Discussion**

**Bare soil**

The result in table (1) indicates a variation of bare soil in three sites. The deterioration around water points was very high 41% in season 2010 and 53 % in season 2011 followed by grazed area that recorded 26.8% in season 2010 and 30.7% season 2011, while bare soil in un-grazed site was very low and recorded 0.5% in season 2010 and 1.2% in season 2011. The high significant increase($P<0.01$) of bare soil around water points is attributed to high temperature and evaporation rates because bare ground is hotter and drier, and more subjected to temperature extremes and less likely to perm germination of new plants. It may also be attributed to poor habitat for microorganisms and insects that enhance nutrient cycling, on the other hand; there was a distinct decrease in grazing pressure with increase distance from the water.

**Litter:**

The result in table (1) shows variation of litter in the three sites. The reduction around water points was very high 34.1% in season 2010 and 17.2 % in season 2011 followed by grazed area 31.6% in season 2010 and 30.3 % season 2011, while litter in un-grazed site was low only 9% in season 2010 and 10.1% in season 2011. The high significant differences ($P<0.01$) in litter may be due to overgrazed plants that reduced the amount of surface plant materials and roots, and result in less food for soil organisms. No doubt that as biological activity decreases a downward spiral of the important functions of soil organism's results in a lower content of organic matter and impedes nutrient cycling, water infiltration, and water storage. Furthermore, heavy grazing also can reduce the abundance of nitrogen-fixing plants, causing a decrease in the supply of nitrogen for the entire plant community evaluating the important role soils play within ecosystems.

**Plants composition and relative composition**

The result in table (1) indicates a variation in range plants composition in the three sites. Deterioration a round water point was very high 24.8% in season 2010 and 30.6 % in season 2011 followed by grazed area that recorded 41.6 % in season 2010 and 40 % season 2011, while range plants composition in un grazed site was high and recorded 90 % in season 2010 and 88.8 % in season 2011. The highly significant variation ($P<0.001$) in plants composition may be due to high

grazing pressure by animals. The rangeland grazed heavily by animals since no rule to recognize grazing practices, this may cause plants composition deterioration. Moreover, the high animal's number around water points may limit plant regrowth potential by causing soil surface compaction. The result in table (2) shows the variation in plant relative composition for the three sites marked significant differences in term of individual plants composition. The increases of unpalatable plants species in both grazed sites and around water points was observed. These plants were; *Canthiums brazilicum,Aacia tura Oldenlandia herbacea, Zornia glochidiata, Euphorbia hirtal, Zaleya pentandra ,Xanthium brosilicum Marettia philaeana, Jasminum nitidum* and *Acanthospermum hespidum.* This may reflect the dynamic changes in the species composition as result of native animals' impacts on grazed sites and around water points when compared with ungrazed sites. Moreover the unpalatable plants often invade the areas around water points this was very clear within the rainy season and dry season grazing at Dilling locality where many areas are devoid of vegetation, and there is a notice change in understoryed vegetation. Also the reduction in more palatable plants species around water points and geazed area such *asBlepharis linariifolia, Asteraceae hyperhernia ofrun, Chloris gyana, Sorghum rpureosercim, Symbopogan nervatus, Demodium ichotomum, Asteraceae hyperhernia ofrun* and *Impomea kordofana*, may be due to extensive use of grazing land by animals. Hence the palatable plants such as *Blepheris linoriifolia* was reported to be very sensitive to grazing (Jaddalla, 1994) with some forbs such as *Impomia cordofana,* (taber), *Asteraceae hype-rhernia ofrun Abumorwa, Demodium ichoto-mum* (Abu areda) and completely disappeared from the area within 500m around water points. This sensitive species was found in un-grazed site.

The result in table (2) gives a clear picture about the a high number of animals around water points and grazed sites and the negative impacts on rangeland environment in term of plants species composition, plans diversity, increased bare ground percent especially around water points.

**Table (1) the variation in plants composition, bare soil and litter around water points, grazing site and ungrazing sites in two seasons**

| Parameter measured | R. W.P sites | | Grazed sites | | Un-grazed sites | | |
|---|---|---|---|---|---|---|---|
| | season 2010 | season 2011 | Season 2010 | Season 2011 | Season 2010 | Season 2011 | Sig |
| Bare soil (%) | 41 | 53 | 26.8 | 30.7 | 0.5 | 1.2 | * |
| Litter (%) | 34.1 | 17.2 | 31.6 | 30.3 | 9 | 10.1 | - |
| T.P.compositon(%) | 24.8 | 30.2 | 41.6 | 40 | 90 | 88.8 | *** |
| Total (%) | 100 | 100 | 100 | 100 | 100 | 100 | |

RWP= round water points

*=p<0.1 - ***=p<0.001- T.P = total plants

**Table (2) the variation in relatives' botanical composition in the three sites**

| *Scientific name* | Botanical types | Relative botanical composition % R.W.P sites Season 2010 | R.W.P sites Season 2011 | Grazed sites Season 2010 | Grazed sites Season 2011 | ungrazed sites Season 2010 | ungrazed sites Season 2011 |
|---|---|---|---|---|---|---|---|
| *Sesbania arabic* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 2 |
| *Corchorus ditorius* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 0.05 | 2.5 |
| *Cassia mimosoides* | Grass | 0.09 | 0.0 | 0.0 | 0.0 | 0.09 | 0.5 |
| *Impomea kordofana* | Forbs | 00 | 0.0 | 0.0 | 0.0 | 3.3 | 2.5 |
| *Indigofra spp* | Forbs | 0.6 | 0.05 | 0.2 | 0.5 | 4.8 | 8.3 |
| *Demodium ichotomum* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 1 |
| *Pinnestum romosum* | Grass | 00 | 0.03 | 0.0 | 0.03 | 0.05 | 0.0 |
| *Setaria pallidea fusea* | Grass | 0.1 | 1.5 | 0.6 | 1.5 | 5.4 | 4.2 |
| *Cucummie dispaceors* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 0.05 | 1.9 |
| *Cymbopogan nervatus* | Grass | 0.0 | 0.0 | 0.0 | 0.6 | 11.8 | 7.1 |
| *Oldenlandia herbacea* | Forbs | 10.5 | 8.9 | 2.4 | 2.2 | 2.7 | 1.7 |
| *Rhynchosia minima* | Forbs | 00 | 0.0 | 0.0 | 0.0 | 0.2 | 0.07 |
| *Farsetia grandiflora* | Forbs | 00 | 0.0 | 0.0 | 0.0 | 0.08 | 0.0 |
| *Pennisetum edicellatum* | Grass | 5.9 | 2.3 | 6.5 | 4.3 | 0.3 | 2.2 |
| *Asteraceae hyperhernia ofrun* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.5 |
| *buffalo grass* | Grass | 0.0 | 0.0 | 0.0 | 0.0 | 0.02 | 3.1 |
| *Sorghum urpureosercim* | Grass | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | 5.6 |
| *Justicia kotschyi* | Forbs | 0.1 | 0.03 | 0.0 | 0.1 | 0.03 | 0.0 |
| *Aristida mutablis* | Grass | 14 | 18.1 | 7.4 | 13.8 | 32.2 | 27.1 |
| *Hyparrhenia confinis* | Grass | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 6.9 |
| *Ipomoea coptica* | forbs | 0.0 | 0.0 | 0.0 | 0.0 | 0.02 | 0.8 |
| *Marraa oblongfalia* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 0.05 | 0.0 |
| *Ocimum basilicum* | Forbs | 0.03 | 1 | 0,05 | 2.3 | 2.7 | 2.1 |
| *Eragrostis tremula* | Grass | 14.1 | 12.5 | 8 | 13.2 | 10.1 | 7.6 |
| *Eragrostis pilosa* | Grass | 00 | 0.09 | 8.8 | 4 | 4.8 | 3.5 |
| *Schonfeidia gracilis* | Grass | 34.9 | 30.6 | 60.1 | 40.9 | 9.2 | 5.1 |
| *Echinocola colonum* | Grass | 0.1 | 2.1 | 0.1 | - | 0.8 | 0.3 |
| *Dactyloctinum gyptioum* | Grass | 8.2 | 10 | 0.8 | 9.4 | 3 | 4.3 |
| *Polygala eriotera* | Forbs | 0.0 | 0.0 | 0.07 | 0.0 | 0.0 | 0.0 |
| *Blepharis linariifolia* | Forbs | 0.0 | 0.0 | .01 | 0.0 | 0.0 | 0.0 |
| *Acanthospermum hespidum* | Forbs | 0.03 | 5.4 | 0.7 | 0.03 | 0.0 | 0.0 |
| *Zornia glochidiata* | Forbs | 3.7 | 3 | 1.5 | 3.1 | 0.0 | 0.0 |
| *Euphorbia hirtal* | Forbs | 0.09 | 0.0 | 0.4 | 0.1 | 0.0 | 0.0 |
| *Cassia tora* | Forbs | 3.2 | 6.3 | 1.2 | 1.4 | 0.0 | 0.0 |
| *Tribulus terrestris* | Forbs | 00 | 0.7 | 0.03 | 0.0 | 0.0 | 0.0 |
| *Cassia mimosoides* | Forbs | 0.0 | 0.0 | 0.03 | 0.0 | 0.0 | 0.0 |
| *Chloris gyana* | Grass | 0.03 | 0.2 | 0.3 | 2.9 | 0.0 | 0.0 |
| *Marettia philaeana* | Forbs | 0.5 | 1.4 | 0.05 | 0.03 | 0.0 | 0.0 |
| *Corchorus ditorius* | Forbs | 0.3 | 0.1 | 0.05 | 0.0 | 0.0 | 0.0 |
| *Jasminum nitidum* | Forbs | 0.3 | 0.03 | 0.03 | 0.0 | 0.0 | 0.0 |
| *Hygrophylla spinosa* | Forbs | 0.2 | 0.0 | 0.03 | 0.0 | 0.0 | 0.0 |
| *Portulaca oleracea* | Forbs | 00 | 0.0 | 0.03 | 0.0 | 0.0 | 0.0 |
| *Amaranthus grecans* | Forbs | 00 | 0.0 | 0.03 | 0.0 | 0.0 | 0.0 |
| *Xanthium brosilicum* | Forbs | 0.03 | 1 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Zaleya pentandra* | Forbs | 0.03 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***total*** | | **100** | **100** | **100** | **100** | **100** | **100** |

**Plants density and relative density:**

The results in table (3) showed the very high significant differences ($p<0.001$).Variation in plants density in the three sites showed that deterioration around water points was also high and only 48 plants /m had been found in season 2010 and 50 plants /m in season 2011 followed by grazed area that recorded 60 plants per/m in season 2010 and 67 plants per/m in season 2011. The range condition in un-grazed site was healthy in term of plants density that recorded 298 plants per/m in season 2010 and 243 plants per/m in season 2011as shown in table (3). The lowest records around water points may be due to heavy grazing that consumed plants parts, and treading on the ground with animal hoofs caused soil compaction and decreased infiltration rate especially around water points, destroyed the upper layer of soil by animal hoofs which degreased soil aggregate. Also the result in table (4) showed great differences in relatives density within the three sites in term of plants /m². The result indicates that, most palatable plants recorded lowest number or completely disappearance in both grazed site and those around water points. Around water points, the overuse has affected plant density and this is clearly noticed within natural depressions where the most palatable plants like *(Impomia cordofana*, *Asteraceae hyperhernia ofrun*, *Demodium ichotomum*, *Blepheris linoriifolia Sorghum purpureosercim and Andropogon gayanyus*) were of rareoccurrence. But the unpalatable relative plants density such as *Canthiums brazilicum, Aacia tura, Oldenlandia herbacea Zornia glochidiata, Euphorbia hirtal, Zaleya pentandra ,Xanthium brosilicum ,Marettia philaeana, Jasminum nitidum* and *Acanthospermum hespidum* recorded very high number in two sites. While the first class palatable forbs and grasses that consider to be very sensitive to grazing were found in ungrazed sites. This may be due to the type of plants species, some plants species are more tolerant to animal grazing and other are not. Moreover, the decrease in the relative plants density may be attributed to many factors including human induced activities, severe drought, and poor rangeland resources management. Misuse activities such as heavy grazing and over cutting of trees in large areas, in addition to over population of both pastoralist's families and their animals, have contributed to reduction of relative density of plants species. The same result were reported by Abdalla(2008) who stated that, the shortage of water in some potential areas led livestock owners enforced to accumulate on the fragile areas around water points causing land degradation. The disappearance some desirable plants species may be due to the animal pressure on rangeland in wet season (rainy season). The early grazing can lead to loss of plants genetic (seed bank).

**Ground cover:**

The term ground cover means all components that cover the ground. Not to include bare soil, it is the vegetation (living and dead) biological crusts and stone that is in contact with soil surface (Steward *et al,* 2011). The result in table (3) shows variation of ground cover in the three sites, the decreases around water points was very high 20% in season 2010 and 25 % in season 2011. Followed by grazed area 30% in season 2010 and 37 % season 2011, while range ground cover in un-grazed site was very high that 85% in season 2010 and 86.7% in season 2011, when compared with two sites. According to result in table (3) there is significant variation ($P<0.01$) between the three sites, the result indicates that the vegetation cover in grazed and around water points suffers from increase in livestock numbers, that exceed the rain season grazing land (Makharif). And over grazing is become wide spreads, these may led to rapid striping of the vegetation cover. Ayoub (1998) reported that over grazing caused about (46.9) of the soil degradation.

on the other hand, the low record of ground cover around water points may attributed to high pressure of grazing animals, and the area surrounding the water points was devoid of vegetation even if the exact range capacity (sacrifice area). The reduction in ground cover around water points and grazed sites, when compared with un-grazed sites indicate the impacts of open grazing system on rangeland environment.

**Unpalatable plants:**

The result in table (3) indicates a variation between unpalatable plants species in three sites. The unpalatable plants species around water points was marked highest percentage 18% in season 2010 and 30% in season 2011 followed by grazed area that marked 11% in season 2010 and 14% in season 2011. While the unpalatable plants in un-grazed sites seem to be very rare that recorded 5% in season 2010 and 7% in season 2011. These result may attributed to fact that the animals select only palatable plants species when they graze, and the invaded plants like *Aacia tura, and canthospermum hespidum* were dominated specially round water points.

**Table (3) shows the variation in plants density, ground cover and unpalatable plants (%) in around water point, grazed and ungrazed sites in two seasons**

| Parameter measured | R. W.P site | | Grazed site | | Un-grazed site | | Sig |
|---|---|---|---|---|---|---|---|
| | Season 2010 | season 2011 | season 2010 | season 2011 | season 2010 | season 2011 | |
| Plants density p/m² | 48 | 50 | 60 | 67 | 298 | 243 | ** |
| Ground cover (%) | 20 | 25 | 30 | 37 | 85 | 86.7 | *** |
| Unpalatable plants (%) | 18 | 31 | 11 | 14 | 5 | 7 | * |

RWP= round water points

**=p<0.01 - ***=p<0.001

**Table (4) the variation between average plants density per /m² in three sites within two seasons**

| *Botanical lateen name* | Botanical types | R. W.P sites | | Grazed sites | | Un-grazed sites | |
|---|---|---|---|---|---|---|---|
| | | season 2010 | season 2011 | season 2010 | season 2011 | season 2010 | season 2011 |
| *Pennisetum pedicellatum* | Grass | 2.9 | 2.3 | 3.9 | 2.6 | 21.3 | 19.8 |
| *Echinocola colonum* | Grass | 0.04 | 0.01 | 0.08 | 0.3 | 29.7 | 24 |
| *Polycarpea corymbosa* | Forbs | 5.1 | 3.9 | 1.5 | 1.2 | 2.9 | 6.3 |
| *Schonfeidia gracilis* | Grass | 16.9 | 18.1 | 41.1 | 45.5 | 12.1 | 16.1 |
| *Aristida spp* | Grass | 00 | 0.03 | 5.4 | 1.9 | 11.9 | 17.1 |
| *Setaria pallidea fusea* | Grass | 0.6 | 1.5 | 0.4 | 0.5 | 17.0.1 | 13.3 |
| *Polygala eriotera* | Forbs | 00 | 00 | 0.04 | 00 | 00 | 00 |
| *Eragrostis tremula* | Grass | 8.3 | 6.4 | 4.9 | 4.3 | 19.1 | 18.2 |
| *Blepharis linariifolia* | Forbs | 00 | 00 | 0.1 | 00 | 00 | 00 |
| *Indigofra spp* | Forbs | 0.3 | 0.5 | 0.1 | 1.4 | 1.9 | 7.6 |
| *Acanthospermumhespidum* | Forbs | 0.01 | 1.3 | 0.4 | 2.9 | 00 | 00 |
| *Zornia glochidiata* | Forbs | 1.8 | 0.06 | 0.9 | 0.1 | 00 | 1 |
| *Euphorbia hirtal* | Forbs | 0.04 | 00 | 0.2 | 0.01 | 00 | 1.9 |
| *Cassia tora* | Forbs | 2.6 | 3.7 | 0.7 | 1.8 | 00 | 00 |
| *Tribulus terrestris* | Forbs | 00 | 1.1 | 0.01 | 0.01 | 00 | 0.5 |
| *Cassia mimosoides* | 00 | 00 | 00 | 0.01 | 0.09 | 00 | 0.3 |
| *Chloris gyana* | Grass | 0.01 | 1 | 0.2 | 1.5 | 24.8 | 19.3 |
| *Marettia philaeana* | Forbs | 1.2 | 0.7 | 0.03 | 1.3 | 00 | 00 |
| *Corchorus ditorius* | Forbs | 0.2 | 00 | 0.03 | 00 | 3.1 | 2.9 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Dactylactinum aegyptioum* | Grass | 3.9 | 2.5 | 0.5 | 0.9 | 16.1 | 11.2 |
| *Jasminum nitidum* | Forbs | 0.1 | 00 | 0.01 | 00 | 00 | 00 |
| *Ocimum basilicum* | Forbs | 0.01 | 00 | 0.03 | 0.7 | 6.3 | 4.5 |
| *Hygrophylla spinosa* | Forbs | 0.1 | 0.9 | 0.01 | 0.03 | 00 | 0.03 |
| *Portulaca oleracea* | Forbs | 00 | 00 | 0.01 | 00 | 00 | 00 |
| *Amaranthus grecans* | Forbs | 00 | 0.01 | 00 | 0.01 | 00 | 00 |
| *Sesbania arabic* | Forbs | 00 | 00 | 00 | 00 | 8.2 | 6.2 |
| *Abelmaschus esculentus* | Forbs | 00 | 00 | 00 | 00 | 0.06 | 00 |
| *Andropogon gayanyus* | Grass | 0.4 | 00 | 00 | 00 | 15.9 | 12 |
| *Impomea kordofana* | Forbs | 00 | 00 | 00 | 00 | 12.6 | 11.9 |
| *Demodium dichotomum* | Forbs | 00 | 00 | 00 | 00 | 10.2 | 9.3 |
| *Pinnestum romosum* | Grass | 00 | 00 | 00 | 00 | 0.06 | 5.5 |
| *Cymbopogan nervatus* | Grass | 00 | 0.5 | 00 | 00 | 50.3 | 14.1 |
| *Clitoria ternate* | Forbs | 00 | 00 | 00 | 00 | 0.06 | 1.6 |
| *Rhynchosia minima* | Forbs | 00 | 00 | 00 | 00 | 6.5 | 9 |
| *Farsetia grandiflora* | Forbs | 00 | 0.3 | 00 | 00 | 0.08 | 00 |
| *Asteraceae hyperhernia ofrun* | Forbs | 00 | 00 | 00 | 00 | 3.4 | 0.3 |
| *Buffalo grass* | Grass | 00 | 00 | 00 | 00 | 1.9 | 0.7 |
| *Sorghum purpureosercim* | Grass | 00 | 00 | 00 | 00 | 12.1 | 10.5 |
| *Justicia kotschyi* | Forbs | 0.06 | 0.03 | 00 | 00 | 0.03 | 0.06 |
| *Aristida mutablis* | Grass | 4 | 3.9 | 00 | 00 | 15.2 | 13.2 |
| *Hyparrhenia confinis* | Grass | 00 | 0.05 | 00 | 00 | 10.3 | 00 |
| *Abutilon spp* | | 00 | 00 | 00 | 00 | 1.9 | 00 |
| *Ocimum basilicum* | Forbs | 00 | 00 | 00 | 00 | 0.01 | 00 |
| *Zaleya pentandra* | Forbs | 00 | 1.2 | 00 | 00 | 0.5 | 00 |
| *Total* | | 48 p/m | 50 p/m | 60 p/m | 67 p/m | 298 p/m | 243 p/m |

RWP= around water points

**Frequency:**

The result in table (5) shows frequency variation at different range sites over to season. The result indicated that, most plants species found around water points were *Pennisetum pedicellatum, Indigofra spp, Aristida mutablis, Oldenlandia herbacea, Schonfeidia gracilis, Eragrostis tremula, and Dactylactinum aegyptioum* in the two seasons. The same plants were found in grazed sites as indicated by table (5). There was a reduction in plants species frequency in both around water points and grazed sites. This may be attributed to heavy and high grazing pressure. In fact the plant species especially palatable plants were subjected to intensive selection by grazing animals. The highest marked of some palatable plants species around water points and grazed sites was a healthy range condition, because most of these species are single stemmed and have much foliage. While in ungrazed 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 site plants species were rather different and marked highest frequency. Moreover, much forb 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 nev-ratus, Andropogon gayanyus,* and *Pennisetum pedicellatum* disappeared and showed high frequency in un-grazed site. This may be due to heavy grazing that influence the plants species association among plants species through changing in habitat conditions and

may attributed to differences response of species population.

**Table (5): Plant frequency % at different range sites over two seasons**

| Scientific name | Botanical types | Species Frequency % R.W.P | | Grazed sites | | Ungrazed site | |
|---|---|---|---|---|---|---|---|
| | | Season 2010 | Season 2011 | Season 2010 | Season 2011 | Season 2010 | Season 2011 |
| *Pinnestum romosum* | Grass | 0.0 | 0.0 | 0.0 | 1.4 | 8.3 | 4.2 |
| *Ammania auriculata* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 4-2 | 0.0 |
| *Pennisetumpedicellatum* | Grass | 18.1 | 16.7 | 23.6 | 20.8 | 12.5 | 8.3 |
| *Sesbania arabic* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 8.3 | 4.2 |
| *Abelmaschus esculentus* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 8.3 |
| *Demodium dichotomum* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 20.8 | 16.7 |
| *Clitoria ternate* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 |
| *Waltheria indica* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 16.7 |
| *Rhynchosia minima* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 20.8 | 20.8 |
| *Ocimum basilicum* | Forbs | 1.4 | 1.4 | 0.0 | 0.0 | 12.5 | 8.3 |
| *Justicia kotschyi* | Forbs | 2.8 | 1.4 | 0.0 | 1.4 | 4.2 | 0.0 |
| *Aristida mutablis* | Grass | 25 | 34.7 | 20.8 | 20.8 | 37.5 | 45.8 |
| *Indigofra spp* | Forbs | 8.3 | 0.0 | 5.6 | 4.2 | 33.3 | 41.7 |
| *Impomea kordofana* | Forbs | 0.0 | 1.4 | 0.0 | 1.4 | 62.5 | 37.5 |
| *Farsetia grandiflora* | Forbs | 0.0 | 0.0 | 0.0 | 1.4 | 8.3 | 4.2 |
| *Sorghumpurpureosercim* | Grass | 0.0 | 0.0 | 0.0 | 0.0 | 16.7 | 12.5 |
| *Polycarpea corymbosa* | Forbs | 36.1 | 24.6 | 23.6 | 18.1 | 45.8 | 41.7 |
| *Setaria pallidea fusea* | Grass | 5.6 | 0.0 | 9.7 | 8.3 | 41. | 16.7 |
| *Hyparrhenia confinis* | Grass | 0.0 | 0.0 | 0.0 | 0.0 | 4.2 | 0.0 |
| *Symbopogan nevratus* | Grass | 0.0 | 16.7 | 0.0 | 0.0 | 16.7 | 37.5 |
| *Andropogon gayanyus* | Grass | 0.0 | 0.0 | 1.4 | 4.2 | 8.3 | 16.7 |
| *buffalo grass* | Grass | 0.0 | 0.0 | 0.0 | 0.0 | 37.5 | 8.3 |
| *Eragrostis turgada* | Grass | 0.0 | 0.0 | 1.4 | 0.0 | 16.7 | 33.3 |
| *Asteraceae hyperhernia ofrun* | Forbs | 0.0 | 0.0 | 0.0 | 0.0 | 8.3 | 4.2 |
| *Schonfeidia gracilis* | Grass | 22.2 | 34.7 | 58.3 | 34.7 | 37.5 | 41.7 |
| *Dactylactinum aegyptioum* | Grass | 34.7 | 16.7 | 12.5 | 18.1 | 16.7 | 20.8 |
| *Echinocola colonum* | Grass | 2.8 | 1.4 | 1.4 | 4.2 | 8.3 | 4.2 |
| *Polygala eriotera* | Forbs | 0.0 | 0.0 | 4.2 | 0.0 | 0.0 | 0.0 |
| *Blepharis linariifolia* | Forbs | 0.0 | 0.0 | 2.8 | 0.0 | 0.0 | 0.0 |
| *Tribulus terrestris* | Forbs | 0.0 | 1.4 | 1.4 | 4.2 | 0.0 | 0.0 |
| *Acanthospermum hespidum* | Forbs | 1.4 | 8.3 | 6.9 | 5.6 | 0.0 | 0.0 |
| *Zornia glochidiata* | Forbs | 13.9 | 5.6 | 11.1 | 18.1 | 0.0 | 0.0 |
| *Euphorbia hirtal* | Forbs | 2.8 | 1.4 | 6.9 | 11.1 | 0.0 | 0.0 |
| *Cassia tora* | Forbs | 16.7 | 18.1 | 12.5 | 0.0 | 0.0 | 0.0 |
| *Cassia mimosoides* | Forbs | 0.0 | 0.0 | 1.4 | 0.0 | 0.0 | 0.0 |
| *Eragrostis tremula* | Grass | 51.4 | 34.7 | 29.2 | 18.1 | 16.7 | 34.7 |
| *Corchorus ditorius* | Forbs | 5.6 | 2.8 | 2.8 | 1.4 | 0.0 | 0.0 |
| *Marettia philaeana* | Forbs | 8.3 | 0.0 | 2.8 | 1.4 | 0.0 | 0.0 |
| *Chloris gyana* | Forbs | 1.4 | 0.0 | 9.7 | 8.3 | 4.2 | 4.2 |
| *Hygrophylla spinosa* | Forbs | 6.9 | 0.0 | 1.4 | 2.8 | 0.0 | 0.0 |
| *Portulaca oleracea* | Forbs | 0.0 | 0.0 | 1.4 | 0.0 | 0.0 | 0.0 |
| *Amaranthus grecans* | Forbs | 0.0 | 1.4 | 1.4 | 0.0 | 0.0 | 0.0 |
| *Xanthium brosilicum* | Forbs | 1.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *Jasminum nitidum* | Forbs | 2.8 | 1.4 | 2.8 | 1.4 | 0.0 | 0.0 |
| *Zaleya pentandra* | Forbs | 1.4 | 0.0 | 1.4 | 0.0 | 0.0 | 0.0 |

RWP= round water points

**Biomass:**

The annual production of biomass is an indicator of the energy captured by plants, and it is the availability for consumption given correct rangeland condition. While compaction layer in near soil surface is caused by repeated impacts on grazing animals.

In the study area, compaction becomes a serious problem as shown in table (6). The biomass production was low around water points in term of dry mater and was only 0.25 ton/ ha in season 2010 and 0.20 ton/ha in season 2011. recorded this followed by grazed site which recorded 0.30 ton/ ha in season 2010 and 0.26 ton/ha in season 2011, while in un grazed site, the biomass production was very high 2.19 ton/ha in season 2010 and 2.8 ton/ha in season 2011 as recorded. This may be due to high pressure by the grazing animals especially around water points that begin to limit plants growth, water infiltration and nutrient cycling process. These reduce the biomass production as shown in table (6). There was a very high significant difference ($P<0.001$) in biomass production in term of dry mater production especially around water points and grazed sites. The biomass production was low in both around water points and grazed sites. These may be attributed to the fully utilized range by the grazing animals when compared to the un-grazed site.

**Table (6) the dry mater production per ton hector in the three sites of the study sites**

| | Production per ton hector | |
|---|---|---|
| Study sites | Season 2010 | Season 2011 |
| Ungrazed sites | 2.19 | 2.8 |
| Grazed sites | 0.30 | 0.26 |
| RWP | 0.25 | 0.20 |

RWP= round water points
**Sig=*****

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# تقييم أثار نظام الرعي المفتوح على سمات الغطاء النباتي وإنتاجية الكتلة الحية – محلية الدلنج ولاية جنوب كردفان – السودان

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**المستخلص:**

أجريت الدراسة في ولاية جنوب كردفان بمحلية الدلنج التي تقع على بعد 165 كيلو متر جنوب غرب مدينة الابيض في الفترة من 2010 – 2012. هدفت الدرسة لتقييم أثار نظام الرعي المفتوح على إتجاهات وحالة النمو لنباتات المراعي وتاثيرها على إنتاجيتها من العلف. قسم المرعى في محلية الدلنج إلى ثلاثة أقسام على حسب درجة الإستغلال. أختيرت ثلاثة نقاط مياه بطريقة عشوائية من جملة 25 نقطة مياه بمحلية الدلنج, وكزلك تم إختيار ثلاثة مناطق رعوية بطريقة عشوائية و اما المنطقة المحمية فأختيرت في موقع وسط بين المنطقتين. تم إستخدام طريقة اللوب (باركار وهيري, 1959) لقياس المؤشرات النباتية في المرعى. وأيضا تم إستخدام طريقة الكوادرات (وليم,1944) لقياس التغطية الارضية و تردد النباتات والنسبة المئوية للنباتات بالإضافة إلى تقدير الإنتاجية العلفية للمرعى. أظهرت النتائج فروقات معنوية عالية جدا في التغطية الارضية بين ثلاثة مناطق مختلفة. كما أظهرت الدراسة فروقات معنوية في التركيبة النباتية , وجد أن النباتات غير المرغوبة تنتشر بصورة كبيرة في المناطق حول نقاط المياه والمناطق المرعية , بينما تقل في المنطقة المقفولة. وجدت أيضا فروقات معنوية كبيرة جدا في الكثافة النسبية وتردد النباتات بالمقارنة مع الثلاثة مناطق, كما وجدت فروقات كبيرة جدا في الانتاجية العلفية للمرعي بين الثلاثة مناطق تحت الدراسة. خلصت الدراسة على أن نظام الرعى المفتوح له أثر واضح على نمو النباتات الرعوية وتدهورها. كما أنه أثرعلى التركيبة النباتية وقلل من الإنتاجية العلفية للمرعى.