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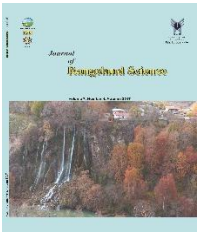

Research and Full Length Article:

The Impact of Continuous Grazing on Natural Rangeland in Alazzazah area- Blue Nile State, Sudan

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Received on: 23/08/2016
Accepted on: 04/12/2016

Abstract. This study was conducted in Alzzazah area which lies approximately 25 km East of El-Dmazein city, the capital of the Blue Nile State, Sudan. This study was carried out at the end of the autumn 2015. The aim of the study was to evaluate the impacts of continuous grazing on the rangeland of the study area. To determine this effect, two range sites were selected to represent the rangeland in the study area; a grazed one and a protected one by enclosure. At each site, eight line transects were systematicly distributed. Parker loop method was used to determine botanical composition and ground cover. Quadrate method was applied to determine plant density, frequency, biomass production and carrying capacity. The obtained data were organized and analyzed using standard range management equations and SAS statistical package. The result showed that the continuous grazing increased the bare soil percentage and decreased the vegetation cover. Also, it had negative impacts on botanical composition, biomass productivity and range carrying capacity. It was concluded that continuous grazing has a negative impact; it led to change the botanical composition of range plants of undesirable species with low nutritive value. So it can be considered as one of the main factors responsible of rangeland degradation in the study area.

Key words: Grazed and ungrazed area, Transects, Density, Botanical composition, Carrying capacity

Introduction

Rangeland covered vast areas of the globe and is considered a major source of cheap feed for livestock and wildlife habitat. The rangeland plays a vital role in providing human with the goods and services, (Holechek *et al.,* 2010). It considers as renewable natural resources if managed scientifically, they give multiple products according to their energy, innovation. Therefore, must be exploited by this energy to maintain them and sustain for future generations. To achieve this situation we need a sound management plan adopts the principle of sustainability and integration of natural resources in a manner, preserve and protect it for the reasons for the different degradation causes. In Sudan rangeland occupies an area of 31.5 million hectares and provides about 70% of the total animal feed requirement for national herd (El Wakeel, 2013).

Alazzazah area rangeland of range promising because of its diverse plant resources can be hereditary assets utilized in the improvement and rehabilitation practices in degraded rangeland. But recently the rangeland in this area suffered to intensive utilization as a result of wars in the state and the legacy of the great migrations of displacement in the study area. Increase the pressure on rangeland resources because of timber cutting and traditional rain-fed agriculture at the expense on the rangeland and the extensive use of range resources due to increasing numbers of different herds.

Continuous grazing followed in the area without being bound by the right time to enter the animals and prepared in accordance with the production of energy behind the big problems in the area. This practice led to change of plant structure and the disappearance of desirable species and the emergence of bare soil spots as a result of continuous grazing, and the dominance of harmful plants, which led to low-quality rangeland and low produced. The open grazing system is a dominant system in rangeland in Sudan practice for a long time, but in recent times as a result of increasing numbers of the population has increased the numbers of livestock, and the rangeland decreased due to the expansion of agriculture and some population activities.

Alkemade *et al.* (2013) reported that the environmental impacts of livestock will increasingly be associated with cropland expansion and crop production intensification. As a result of this situation, it has become the open grazing a big problem for range resources, due to the increased load on the pastoral herds, resulting in low productivity of the rangeland and the disappearance of desired plants and increases the invasive plants. The main objective of this study was to evaluate the impact of the continuous open grazing system on the vegetation attributes of Alzzazah area.

Materials and Methods

This study was conducted in Alazzazah area which lies approximately 25 km East of El-Dmazein city, the capital of the Blue Nile State, in the Southeastern part of Sudan between the longitudes 35-3º and 33-5º East, and latitudes 12-30º and 9-30º North.

To study the impact of continuing grazing on rangelands attributes: two range sites were selected; the first site was open grazing. The second site was the protected rangeland, which was fenced by Range and Pasture Administration for protection from grazing. In each range site, an area that best represents the site was selected based on Releve' method (Barbour *et al.,* 1987), then the starting point was chosen randomly and established eight line transects systematically,each of 100 m length with interval 50 m between each other. Five quadrates each of one $1m^2$ were distributed at regular 20 m intervals. The vegetation sampling was carried out during the growing seasons of 2015.

The Parker loop method (Parker, 1951), was used to determine the species composition and ground cover of the rangeland. Along 100 m transect a ¾-inch loop placed at ground level at 1m intervals.

The quadrate of 1m² size, (Wlim et al., 1944) was used to determine density1, frequency2, biomass productivity and range carrying capacity.

Plant density was determines by counting all plants rooted in quadrate.

The frequency was determined by listing all plant species appeared in quadrate and calculated by using the following formula (Muir and McClaran, 1997) (Equation 1):

$$\text{Frequency}\% = \frac{\text{Number of the occurrence of the species}}{\text{Total number of samples}} \times 100$$

(Eq. 1)

For biomass production, direct harvesting method was used, harvested all plant materials in a given quadrate above ground level, oven dried in105ºC and weighted. The following formula used to determine range productivity (Equation 2):

$$\text{Range productivity (Ton/ha/yr)} = \frac{\text{Average biomass (g/m}^2) \times 10000 \times 0.5}{1000000}$$

(Eq. 2)

0.5= Proper used factor (Stoddard and Box, 1975).

Carrying capacity was determined by the data acquired of the range survey. The base of the carrying capacity determination is the Tropical Animal Unit (TAU) which was consumed about 2.5% of its live weight. The standard live weight of the TAU about 250 Kg. According to this weight one TAU can consume 2.7 tons dry matter per year. Form this case the carrying capacity can determine by this formula, (Muir and McClaran, 1997) (Equation 3).

$$\text{Carrying capacity (animal units/ha/yr)} = \frac{\text{Forage production(kg/ha/yr)}}{\text{TAU consumption a year}}$$

(Eq. 3)

For Data Analysis, the plant species attribute data were organized tabulated and analyzed using standard range measurements equations. SAS statistical software V6.04 was used to analysis the results that have been obtained from this study; paired t test was used to compare between the two range sites and to identify the impact of the continuous grazing system on the rangeland.

Results and Discussion

Ground covers

The results are obtained in Table 1 explained clear indicator of open, gazing by increasing the bare soil in the grazed area 35% compared to the protected area 25%. The vegetation cover shown was about 26% in the grazed area while in the protected area was 41%. The high bare soil percentage in the grazed site may be because of increased livestock number that decreases the available vegetation cover. This result indicated that the open grazing system had a negative impact on vegetation cover and soil conservation. The continuity of grazing may lead to deterioration in the area as a result of overgrazing, this result was on line with Fashir *et al*. (2012) who found that the open grazing system has affected plant growth and decreased soil stability. Abdelrahim and Abdalla (2015) stated that the overgrazing was considered as the main factor responsible for the low vegetation cover. It was found that there is an increase in the proportion of plant litters in the grazed site compared with the protected site was 39% and 34%, respectively. This result may be due to animal grazing behaviors; it can eat parts of plants and leave the other parts which falling on the soil surface, in addition to other parts of the plant crushed during animal grazing.

Table 1. Ground cover of the study area

Attributes	Grazed area%	Protected area%
Bare soil	35	25
Litters	39	34
Plant cover	26	41

[1] Density is the number of individual plants per area

[2] Frequency refers to the appearance of plant species in study samples

Species composition

According to the results presented in the Table 2, illustrate that the vegetation of the grazed site was dominated by *Hyparrhenia pseudo cymboria* which constitutes about 56% of the total plants. This species is considered undesirable for domestic animals. The dominance of such types is also considered a strong indicator of the deterioration of this range site. While the dominant plant species on the protected site was *Brachiaria obtusiflora* about 55% of the total plant species in this area, it's considered as a high palatable and more desirable plant. Also the forage plant composition affected by the open grazing in the area, it recorded low percent in the grazed site 36% compared with 96% in the protected site. It could be concluded that continues grazing can change the vegetation composition of area by increasing the contribution of undesirable species. This result agreed with Fashir *et al.* (2016) reported that high grazing pressure could change plants species composition and plant diversity. These results showed a clear negative impact of open grazing on plant diversity, botanical composition and forage plant species, which will reflect negatively on the range condition.

Table 2. Species composition of the study area

Species name	Grazed area%	Ungrazed area%
Brachiaria obtusiflora	-	55
Clitorea ternatae	-	29
Dinebra retroflexa	-	8
Ipomoea spp.	4	2
Phragmites spp.	4	2
Corchorus fascicularis	-	2
Justica anselciana	-	2
Hyparrhenia pseudo cymboria	56	-
Echinochloa colona	28	-
Cassia tora	4	-
Rhynchosia minima	4	-
Forage plant composition	36	96

Density and frequency

Results in the Table 3 indicated that the total plant density of the grazed site was only 4 plant/m², this density is considered very few, if compared with plant density on the protected site, which amounted to 20 plants/m², it found high significant differences a mong the range sites, ($P \leq 0.001$). From this result, we concluded that the negative impact of open grazing on total plant density in the study area. This result is in line with Mohammed *et al*. (2010), who stated that higher plant density obtained in protected site due to absence of grazing and lower plant density in the grazed area due to the plant consumption by livestock grazing. The higher species density in the grazed site was recorded for *Hyparrhenia pseudo cymboria* and *Echinochloa colona* about 2plant/m² for each other, while the species density in the protected site where *Clitorea ternatea* and *Brachiaria obtusiflora*, which recorded about 9plant/m². Findings in Table 3 show frequencies of the dominant species in the grazed and protected sites. *Hyparrhenia pseudo cymboria*, scored the highest frequency in the grazed site, while *Clitorea ternatea*, *Brachiaria obtusiflora* and *Dinebra retroflexa* recorded the highest frequencies 100%, 94% and 58% respectively in the protected site. These results also show the impact of open grazing on the distribution of plant species in natural rangeland, through better distribution of plants in the protected site compared with the non-existence in the grazed site. The open grazing systems practiced in this area with the high grazing intensity led to change the vegetation diversity. Ning *et al.* (2014) reported that grazing may change the community structure and

floral composition of the rangeland. Also Hickman *et al.* (2004) stated that the large grazing intensities and the other abiotic factors affected to the plant community composition and species diversity.

Table 3. Species density and frequency of the study area

Species name	Grazed area		Ungrazed area	
	Density (plant/m²)	Frequency %	Density (plant/m²)	Frequency %
Clitorea ternatea	-	-	9	100
Brachiaria obtusiflora	-	-	9	94
Dinebra retroflexa		13	2	58
Echinochloa colona	2	31	-	-
Hyparrhenia pseudo cymboria	2	47	-	-
Total	4	-	20	-
Std Error of densities		2.42**		

** = significant differences at 1% probability level

Biomass production and carrying capacity

Results presented in the Table 4 shows those highly significant differences in biomass production between the two range sites, ($P \leq 0.001$). The biomass produced from the grazed area was less than that one produced from protected area, 70 and 260 kg/ha/year, respectively. This effect applies a range carrying capacity, because it comes from the biomass production. The carrying capacity of the grazed site about 0.3/AU/Hectare/Year, compared with the carrying capacity of the protected site 0.1AU/ ha/yr. Clearly, the continuous open grazing system affected negatively on the biomass productivity and grazing carrying capacity in the study area. This result agreed with **(**Zarekia *et al*., 2013; Gao *et al.*, 2007) who stated that the continuous grazing and grazing intensity had a negative impact on biomass production, it decreased the aboveground biomass in the rangeland.

Table 4. Biomass Production and Carrying Capacity

Attributes	Grazed area	Ungrazed area	Std Dev	Std Error	Probability
Biomass production (kg/ha/yr)	70	260	65.16	6.96	0.0001***
Carrying capacity (AU/ha/yr)	0.30	0.10			

*** = significant differences at 1% probability level

Conclusion

It could be concluded that:

- Continuous grazing had negative effects on rangeland vegetation attributes of the study area. It increases bare soil percentages and decreases plant density, frequency, and cover. Significant negative effects of grazing are the change the vegetation composition of undesirable species with low nutritive value. So it can be considered as one of the main factors responsible of rangeland degradation in the study area.
- Open grazing and intensive grazing had also affected negatively rangeland productivity and carrying capacity.

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بررسی فشار چرای مداوم بر مراتع طبیعی در منطقه آلزازا از ایالت نیل آبی کشور سودان

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تاریخ دریافت: ۱۳۹۵/۰۶/۰۲
تاریخ پذیرش: ۱۳۹۵/۰۹/۱۴

چکیده. این مطالعه در منطقه آلزازا که در حدود ۲۵ کیلومتری شرق شهر ال- دمازین پایتخت نیل آبی است در پایان پاییز سال ۲۰۱۵ انجام شد. هدف از این مطالعه بررسی اثرات فشار چرای مداوم در مراتع منطقه مورد مطالعه بود. برای تعیین این اثر، دو منطقه کلیدی وسیع به نمونه از مراتع در منطقه مورد مطالعه انتخاب شدند. یکی از مناطق تحت چرا و منطقه دیگر بعنوان شاهد با استفاده از حصار در قرق قرار داشت. در هر منطقه، هشت ترانسکت خطی به طور سیستماتیک مستقر شد. روش حلقه پارکر برای تعیین ترکیب گیاه‌شناسی و پوشش زمین استفاده شد. روش کوادرات برای تعیین تراکم بوته، فراوانی، تولید زیست توده و ظرفیت مرتع استفاده شد. اطلاعات به دست آمده سازماندهی شده و با استفاده از معادلات استاندارد مدیریت مرتع و برنامه آماری SAS مورد تجزیه و تحلیل قرار گرفت. نتیجه نشان داد که چرای مداوم باعث افزایش درصد خاک لخت و کاهش پوشش گیاهی می‌شود. همچنین، اثرات منفی بر ترکیب گیاه شناسی، میزان زیست توده، تولید علوفه و ظرفیت مرتع دارد. همچنین نتایج نشان داد چرای پیوسته تاثیر منفی بر مراتع دارد به طوری که منجر به تغییر ترکیب گیاهی از گونه‌های مرغوب به سمت گونه‌های گیاهی نامرغوب و با ارزش غذایی پایین می‌شود. بنابراین می‌توان آن را به عنوان یکی از عوامل اصلی تخریب مراتع در منطقه مورد مطالعه در نظر گرفت.

کلمات کلیدی: منطقه قرق و تحت چرا، ترانسکت، تراکم، ترکیب گیاه شناسی، ظرفیت مرتع