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The Effect of Rangeland Protection and Reseeding on Vegetation Attributes at Alazzazah Area, Blue Nile State, Sudan

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Abstract: The study was carried out at Alazzazah area rangeland in Blue Nile State during the rainy season of 2015. The main objective of this study was to evaluate the effect of protecting and reseeding on vegetation attributes on rangeland. It was selected two range sites for vegetation measurements in the area, one representing the protected site by enclosure and the other site in the open grazing area. The line transects, Parker loop and quadrate of 1m² size were used to determine the rangeland vegetation attributes. The data obtained were analyzed by using the SAS statistical program, paired t test. The study found that the protection and reseeding had a positive effect on the rangeland vegetation attributes. Results revealed that the plant cover, total plant density and biomass production of the protected site were significantly higher than an open range site. It could be concluded that protection and reseeding are an effective rangelands improvement practice for the low rainfall savannah ecosystem. Based on the present study, rangeland protection and reseeding are highly recommended to increase their productivity and control rangeland deterioration.

Key words: bare soil, species composition, cover, density, Alazzazah area and rangeland

1. Introduction

Rangeland occupies large areas within the different plant environments and ecological zones of Sudan, it covers about 46% of the total area of the country. The importance of natural rangeland its contribution to the feeding of the livestock estimated around 80% of the total feed requirements of the national herd [1]. They are important habitats for wild flora and fauna as well as for domestic livestock [2].

Recently rangeland resources has deteriorated significantly due to exploitation and timber cutting and conventional farming in the rangeland which led to the loss of the ability to sustain production, and reflected the deterioration in the vegetation cover and the disappearance of many of the forage plants with high palatability and good nutritive value for grazing animals, leading to the eco-system disorder and the breakdown of traditional pastoral livestock production systems that depends on them, and as an end result of this deterioration increased poverty among pastoral communities.

Rangeland management an active role in the sustainability of rangeland as a renewable resource, it deals with the human, plant, animal and soil together. So that it stays good vegetation and appropriately distributes and keeps the soil from erosion. To accomplish this role management numerous activities to raise the efficiency of rangeland and improve the productivity of both quantity and quality, including the protection and various means of improving programs, reseeding, water harvesting and spreading and the distribution of animals properly across the rangeland according to their carrying capacity. Rangeland improvement is any action that is intended to raise the

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rangeland condition, or raise the efficiency of the exploitation of rangeland. It depends directly on species competition and vegetation succession of basic environmental rules. This is done by creating an opportunity for desired plants in order to grow and expand, and limit the spread of invasive plants and reduce their competition.

Rangelands in Blue Nile State face many problems; these include increasing the population growth as a result of migration and displacement from war zones, leading to increase demand for rangeland products and caused overexploitation of the resources. That results expansion of rain-fed agriculture and to increase the pressure on rangeland, making them susceptible to the growth of invasive plants and decrease the palatable and forage species. These constraints may be reflected in severe deterioration in both quality and quantity of rangelands. Therefore, The range and pasture administration adopted some management practices in the study area to improve rangelands in the area by providing natural feed resources to the grazing herds and to provide seed bank. The main objective of this study was to evaluate the effect of protection and reseeding on vegetation attributes on rangeland in Alzzazah area, Blue Nile State, Sudan.

2. Research Methodology

2.1 Study Area

This study was carried out in Alazzazah area which lies about 25 km west of El-Dmseein city, the capital of the Blue Nile State. It was located in the southeastern part of Sudan between the longitudes 35-3 and 33-5 in the east, and a linear 12-30 width and 9-30 in the north. Alazzazah rangeland is representing the main type of natural rangeland in the State.

2.2 Methods

It was an initial survey of the area to learn about the natural rangeland and plant communities, so as to facilitate the process of selecting range sites to represent the rangeland in the area. To study the effect of protection and reseeding on rangelands attributes, two range sites were selected in the study area. The first site was protected rangeland as part of the natural rangeland was fenced by Range and Pasture Administration for protection from grazing. The second site was an open grazing area. Protection and reseeding have been done as management tools in rehabilitating and improving rangeland resources of the study area. The types of plant species which broadcasted into a protected site were Barchiaria obtusiflora (grass) and Clitorea ternatae (Forb).

The area that represents these sites were selected based on Releve' method [3]. Eight transects were distributed in each range site (protected site and grazed site) systematically with interval 50 meters between them. Five quadrates each of one 1m² were laid at regular 20 m intervals along each transect, the total quadrates in each site 40. The vegetation sampling was carried out during the growing season of 2015.

2.3 Vegetation Attributes Measurements

The vegetation attributes are useful and an important consideration in range management planning [4]. Many methods were used to determine the rangeland vegetation attributes in the study area are as the following.

2.4 Vegetation Composition and Ground Cover

Parker loop method [5], was used to determine the ground cover and vegetation composition of the study area. The measurements were taken along each transect using a 100 meter tape and a ¾-inch loop placed at ground level at 1 meter intervals to obtain 100 observations. Plant species, bare soil, litters... etc. were recorded in specific sheet, the following formula was used to calculate the vegetation attributes:

$$\text{Vegetation composition} = \frac{Total\ hits\ of\ each\ species}{Total\ hits\ of\ all\ species} \times 100\%$$

$$\text{Percent of bare soil} = \frac{Total\ hits\ on\ bare\ soil}{100} \times 100\%$$

$$\text{Percent of plant litter} = \frac{Total\ hits\ in\ plant\ litter}{100} \times 100\%$$

2.5 Density

Density can be a good indicator that because it is clears of less variable from year to year than measures of cover and biomass [6]. Density is the number of individual plants per area, it determines by counting all plants rooted in a given quadrate, it expresses as plant/m².

2.6 Biomass or Weight

Direct harvest method was used to determine the biomass production of the study area. According to Holechek et al. (2010) [7], this method is more reliable to determine aboveground biomass. Harvest all plant material above ground in a given quadrate, oven dried and weighted.

2.7 Analysis

SAS statistical software was used to analysis the results that have been obtained from this study, paired t test was used to compare between the averages of ground cover, plant density and biomass productivity of the protected and open range sites.

3. Results and Discussions

3.1 Ground Cover and Botanical Composition of Rangeland in the Study Area

The ground cover of rangeland plays a vital role of soil protection against the surface erosion. Ground coverage includes all the elements that have seen on the surface of rangeland such as bare soil, litters and vegetation cover.

The results in Table 1 indicated that there are significant differences ($p \leq 0.03$) between the two range sites in the percentage of bare soil. The bare soil percentage was low on the protected site compared with the unprotected one. In that manner Fashir et al. (2012) [8] found that the bare soil, increase in the grazed compares with the un-grazed area. The high bare soil percentage in the unprotected site may be as a result of increased livestock number in that decreases the vegetation cover and may also due to other human activities such as cultivation. This result indicates the positive effect of protection and reseeding on vegetation by decreasing bare soil percentage.

Table 1 Ground covers in protected and open range sites.

Attributes	Protected site	Open site	Mean	Std Dev	Std Error	Probability (T)
Bare soil	25%	33%	-19.37	21.48	7.59	0.03
Litters	32.4	38.5	-1.42	15.10	5.71	0.8
Vegetation cover	42.6	28.5	28.12	30.58	5.81	0.0001

There are highly significant differences in vegetation cover between the protected and grazed sites ($p \leq 0.0001$), this result reflects the respondent of the rangeland vegetation to the practices of range management applied in the range sites such as reseeding and protection. Protection from grazing increased the plant cover of the protected site. This result agreed with Dasci et al. (2010) [9] reported that the significant differences among treatments in vegetation cover in enclosed and grazed sites. The other component of the ground cover as the litters found not affected by the range practices in the protected range site because of it increase in both range sites due to the animal grazing in the open range site in order to accumulation of plant residues in the protected range site.

The results obtained from Table 2 explained protected site were dominated by two species which were broadcasted into the protected range site, as botanical composition. It recorded high percentage of about 54.76% and 28.57% for Barchiaria obtusiflora and Clitorea ternatae respectively, these species more palatable for grazing animal. While the vegetation in open range site was dominated by Hyparrhenia Pseudo Cymboria, which constitutes more than 50% of the total plant composition in the site. This species was unpalatable for the domestic animals. Similar findings were reported by Baghestani Meybodi et al. (2006) [10], stated that under enclosure effects, palatable species expand more in the area and cover percentage, density and forage production of undesirable species in

Table 2 Species composition (%) of protected and open range sites.

Species name	Protected range site	Open range site
Barchiaria obtusiflora	54.76	-
Clitoreaternatae	28.57	-
Dinebrarelroflexa	7.14	-
Ipomoea spp	2.38	4
Phragmitesspp	2.38	4
Corchorusfasicularis	2.38	-
Justicaanselciana	2.38	-
Hyparrhenniapseudocymboria	-	56
Echinochloacolona	-	28
Cassia tora	-	4
Rhynchosia minima	-	4
Forage plant composition	95.24	36

the grazed area was more than that of the enclosure. It was found that the forage plant composition higher on the protected site compared to the open grazing site, which was represented 95.24% and 36% respectively. This result agreed with Abdelkreim & Fadalla (2013) [11].

3.2 Plant Density:

Density can give valuable indicators in an inventory and monitoring program, because it remains quite steady from year to year [4]. Results presented in Table 3 clearly demonstrate a positive impact of reseeding and protection on total plant density. The total plant density of the protected site was significantly ($P < 0.001$) higher than the unprotected one. Protection from grazing increased the total plant density of the protected site. This result shows increasing the capacity of the protected rangeland to protect the soil from erosion, it agreed with Adelsalam et al. (2012) [6], stated that the increase of plant density makes the rangeland more protection against wind and water erosion.

3.3 Biomass Productivity

The results obtained from Table 4 indicated that there is a highly significant difference ($p \leq 0.0001$)

Table 3 Total plant density of protected and open range sites.

Attribute	Protected site	Open site	Mean	Std Dev	Std Error	Probability (T)
Density	20	4	12.75	6.86	2.42	0.001

Table 4 Biomass productivity of protected and open range sites.

Attribute	Protected site	Open site	Mean	Std Dev	Std Error	Probability (T)
Biomass	115.36	43.65	71.71	65.16	6.96	0.0001

between the two range sites in biomass productions. This is in line with Alokour et al. (2014) [12] who found that a high significant difference between the protected locations and the non-protected ones in biomass production. The protected range site recorded high biomass production about 115 gm/m² compared with 43 gm/m² come from the open grazing site. This result explained the ability of the protective and reseeding to raise the ecological potentiality of the growth process of the photosynthesis and reflect the rangeland health and ecological condition.

4. Conclusion

It could be concluded that: Protection and reseeding had a positive effect on rangeland vegetation attributes of Alazzazah area. It decreases bare soil percentages and increase vegetation cover, plant density and biomass production.

- Protection from grazing can change the vegetation composition of the Alazzazah area by increasing the contribution of palatable species such as Barchiaria obtusiflora and Clitoreaternatae.
- Protection and reseeding are an effective rangelands improvement practice for the low rainfall savannah ecosystem.

5. Recommendations

Through what our findings, we recommend:

(1) Increase protected and reseeded areas of natural rangeland.

(2) Expand the experiment to other range sites to adopt the protective process and reseeding activities.

(3) Rangeland protection and reseeding are highly recommended to increase productivity and control rangeland deterioration and desertification.

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