



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 11, November 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

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Effect of Intensive Grazing on Rangeland Resources at Al-Roza Enclosure, West Kordofan, Sudan

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ABSTRACT: The present study was conducted at West Kordofan State, El-Khuwai area. It aimed to investigate the effect of intensive grazing on rangeland resources at Al-Roza enclosure at Alkhuwai. The study assessed the range trend between two periods where the rangeland site was enclosed in the first and open in the second, a random point was chosen in the enclosure and then nine line transects of length 100 meters were established. Measurements were taken systematically along these transects. The Parker loop method was used for determining the ground cover and botanical composition of rangeland and quadrat method was used for determining plant density, frequency, biomass and carrying capacity. The study found that intensive grazing affected negatively the plant cover and changed the plant composition, which led to an increase in the undesired plants in the rangeland such as *Sidacordifolia*. The study concluded that the intensive grazing led to rangeland resources deterioration in Al-Roza enclosure. The intensive grazing led to change in botanical composition of the enclosure, through domination of unpalatable species like *Sidacordifolia*. The study recommended fencing the enclosure again, and determining the optimum time for animal grazing in it. Understanding the ecological consequences of grazing intensity provides useful information for assessing current grazing management scenarios and taking timely adaptation measures to maintain grassland capacity in the long-term system.

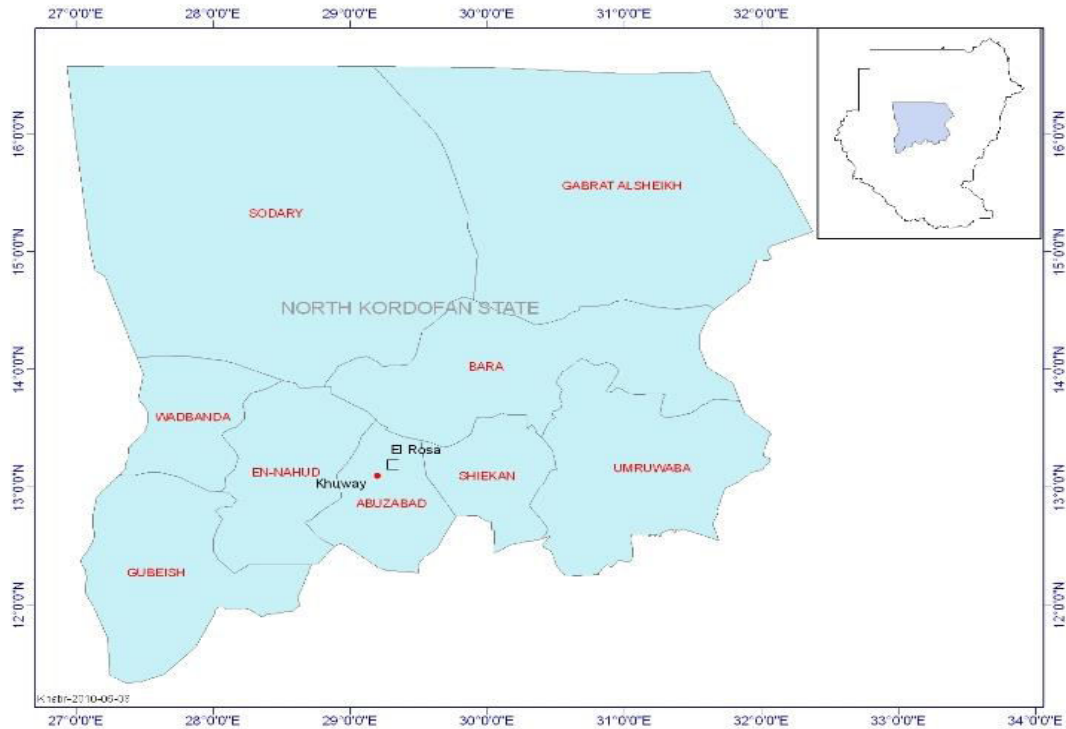
KEYWORDS: Al-Roza, enclosure, ground cover, botanical composition.

I. INTRODUCTION

Rangelands cover about 70% of the world's land surface and play a vital role in providing goods and services for humankind [1]. Rangelands in Sudan covered about 35.6%, [2] cited by [3] of the total area and it provides more than 80% of animal feed requirements. Rangelands play an important role in soil and watershed protection and biodiversity conservation. Sudan's rangelands have recently been severely degraded, particularly in arid and semi-arid areas and their area decreased after the independence of Southern Sudan, [4]. Heavy grazing and poor management in the rangeland of arid and semi-arid area lead to poor productivity and carrying capacity, [5]. The arid conditions which characterized Alkhuwai area have led to the practice of grazing and animal husbandry as a major mode of livelihood for most of the region's population, where pastoralists practice nomadic and semi-nomadic husbandry. Alkhuwai area is important rangelands in Sudan, and as a result of the intensive use of these rangelands a deterioration of rangeland resources occurred, which led to the opening of Al-Roza enclosure for grazing animals. The intensive grazing of the reserve area by animals has led to the degradation of range plants and ground cover. The aim of this study was to investigate the effect of intensive grazing and its impact on the rangeland resources of Al-Roza enclosure.

II. MATERIALS AND METHODS

1. THE STUDY AREA: The study was conducted at Al-Khuwai locality, Western Kordofan State, at the end of the rainy season during the years 2010 and 2017. The study area lies between latitudes 12° 14' - 13° 22' N and longitudes 28° 33' - 29° 45' E (Figure_1 study area). The area falls in the semi-desert ecological zone. There are three livestock production systems practiced in the study area, namely, nomadic, transhumant and sedentary, [6].



Location of the study area _Source [6].

2. THE STUDY CONCEPT: The study will try to make a comparison between two periods, before entering the grazing animals in the enclosure (2010) and after the animal grazing, (2017), so as to find out the effect of intensive grazing which was practiced by grazing animals on rangeland resources of Al-Roza enclosure.

3. SAMPLING: The starting point was chosen randomly and nine lines transect of length 100 meters were established, systematically with 100 meter interval between each other.

4. VEGETATION MEASUREMENTS: Parker loop method [7], was used to determine the rangeland ground cover components such as bare soil, litter, plant cover and botanical composition and computing the cover percentages by using the following formulas:

$$\text{Bare soil \%} = \frac{\text{total hits of bare soil}}{100} \times 100.$$

$$\text{Plant litter \%} = \frac{\text{total hits of plant litters}}{100} \times 100.$$

$$\text{Botanical composition \%} = \frac{\text{total hits of each species}}{\text{total hits of all plant species}} \times 100.$$

The Quadrate method [8], was used for estimation of plant density, frequency and biomass production, by using quadrate of 1m² distributed along each transect with interval of 25 meters.

The available forage of the study area was determined by oven drying of all plant materials harvested above 5 cm of the ground level in each quadrat at 105°C for 24 hours. The average weight of forage productivity in a given area was then obtained and multiplied by the proper use factor (0.5), [9].

4. CARRYING CAPACITY DETERMINATION: The carrying capacity was determined by dividing the available forage produced in the recent year by the tropical animal unit requirements of the year. (The tropical animal unit is an adult cow weighs about 250 kg and is referred to as TAU).



5. DATA ANALYSIS: The collected data were analyzed by range management standards and percentages and averages were extracted and placed in tables for discussion.

III. RESULTS AND DISCUSSION

1. THE EFFECT OF INTENSIVE GRAZING ON GROUND COVER: The results represented in table (1) illustrate that the bare soil percentage increased from 13% before animal grazing to 43% after grazing process, as well as the plant litter. While the percentage of plant cover was decreased after the intensive grazing to only 7% compared with 73% before grazing. Increasing the percentage of bare soil and litter in rangeland is indicative of the negative impact of the intensive grazing on rangeland resources, and it is a clear indicator of the potential deterioration of rangeland soil from wind and water erosion. Also the decrease of plant cover in the range site is one of the most important indicators of rangeland resource degradation. The continuous grazing led to an increase in bare soil and a decrease in vegetation cover, [10]. Thus, the opening of Al-Roza enclosure to animal grazing without determining the optimum carrying capacity and stocking rate led to the rangeland resources deterioration through its negative impact on the ground cover. Grazing intensity leads to accelerated soil erosion and desertification, [11].

Table (1) Ground cover components of Al-Roza enclosure

Attributes	Percentage (%)	
	Before grazing (2010)	After grazing (2017)
Bare soil	13	43
Plant litter	14	50
Plant cover	73	7

2. EFFECT OF INTENSIVE USE ON BOTANICAL COMPOSITION: The results obtained in table (2) apparently showed a variation in the botanical composition of the plant species in Al-Roza enclosure before and after grazing. Before grazing, there was homogeneity in the plant composition, and the number of plant species was higher compared to the range site after grazing. Before intensive grazing, *Acanthus spp* and *Cenchrus biflorus* recorded the highest plant composition, 25.3% and 21.2 respectively, these plant species are considered the important forage plants in the study area. After intensive grazing, these species decreased to 15% and 10% of its previous contribution in to the plant community. On the other hand, the intensive grazing process led to the appearance of undesirable plant species, like *Sidacordifolia*, which recorded the highest percentage of plant species forming the plant community in Al-Roza enclosure. Intensive grazing has increased the unpalatable plants due to the disappearance of the desired plant species by grazing, which reduced their competitive ability with undesired plants. This result indicated that intensive grazing affected negatively on rangeland botanical composition. This agreed with [12] who stated that the open grazing system had a negative impact on plant growth and species composition. This result also revealed the range plant retrogression and the invasion of undesired plants in the enclosure which is a clear indicator of rangeland resource deterioration. [13], reported that continuous intensive grazing has increased the risk of natural range land degradation. The presence of *Andropogon gayanus* (10%), in the heavily grazed area may be due to its small size and occurred under invasive plants, especially *Sidacordifolia*, which has protected it from grazing. It is clear in this table that the plant diversity is rich before grazing, as the species reached 15 plant species, most of which are desirable plants, while these species decreased after grazing to only about seven, and most of them are undesirable plants. According to [14], the decline in the rangeland biodiversity is due to the intensive utilization for livestock production and the agricultural expansion.



Table (2) Botanical composition of the range at Al-Roza enclosure

Species scientific name	Percentage (%)	
	Before grazing (2010)	After grazing (2017)
<i>Acanthus spp</i>	25.3	15
<i>Cenchrusbiflorus</i>	21.2	10
<i>Merremiaomarginata</i>	9.4	0
<i>Zorniaspp</i>	8.4	0
<i>Ipomeaeriocapa</i>	8.4	0
<i>Aristidaspp</i>	5.2	11
<i>Commeliniaakotschy</i>	5.2	0
<i>Echinochlacolona</i>	5.2	9
<i>Desmodiumdichotomum</i>	3.1	0
<i>Mollugonudicaulis</i>	3.1	0
<i>Eragrostistramura</i>	2.2	10
<i>Jasminumnitidum</i>	1	0
<i>Leonotisafricana</i>	1	0
<i>Ceratothecasesamoid</i>	1	0
<i>Sidacordifolia</i>	0	30
<i>Andropogongayanus</i>	0	10
<i>Fimbristylsdichotomo</i>	0	5
Total	99.7	100

3. EFFECT OF INTENSIVE GRAZING ON PLANT DENSITY: According to the results obtained in table (3) it was found that the total plant density before grazing was higher than it was after grazing which were 81 plants/m² and 71 plants/m² respectively. Compared to the number of the species before and after grazing, eleven plant species were found before grazing in the enclosure, but these species decreased to just six plant species after grazing. Before the enclosure was grazed the highest species density was *Acanthus spp* (47 plants/m²) followed by *Cenchrusbiflorus* 11 plants/m². While after the grazing, the highest species density was *Fimbristylsdichotomo* and *Aristidaspp*, which recorded 29 plants/m² and 23 plants/m² respectively. This result indicated that intensive grazing reduced species density of the desirable plant species such as *Acanthus spp* (6 plants/m²) and (3 plants/m²) respectively. The grazing animal consumption of rangeland plants reduced its density. According to [15], the repeated defoliation of the same plant species leads to a decrease in the palatable and desirable species. This result indicates a decrease in the plant density in Al-Roza enclosure due to intensive grazing on rangeland resources, which has led to the deterioration of these resources.



Table (3) Plant species density of the Al-Roza enclosure

Species scientific name	Plant/m ²	
	Before grazing (2010)	After grazing (2017)
<i>Acanthus spp</i>	47	6
<i>Cenchrusbiflorus</i>	11	3
<i>Mollugonudicaulis</i>	6	0
<i>Zorniaspp</i>	4	0
<i>Desmodiumdichotomum</i>	3	0
<i>Merremiaomarginata</i>	2	0
<i>Aristidaspp</i>	2	23
<i>Tephrosiaspp</i>	2	0
<i>Echinocloacolonum</i>	2	0
<i>Fimbristylsdichotomo</i>	1	29
<i>Ipomeaeriocapa</i>	1	0
<i>Eragrostistramulla</i>	0	6
<i>Aristidaadscensionis</i>	0	4
<i>Sonchusoleraceus</i>	1	0
Total	81	71

4. PANT FREQUENCY AND INTENSIVEGRAZING:The results represented in table (4) indicated that the highest plant frequency before grazing was *Acanthus spp* 97.5%, followedby*Cenchrus biflorus*85%,*Tephrosia spp*75%,*Zornia spp*67.5%, and *Mollugo nudicaulis*55%. While the highest plant frequency after grazing was *Eragrostistremolo*75%, followed by *Acanthus sub*62% and *Cenchrusbiflorus* 59%. The homogenous distribution of*Eragrostistremola*after grazing may be attributed to its resistance to grazing. The result indicated that there was homogeneity in the distribution of plants frequency before grazing and heterogeneity after grazing.The continuous grazing had negative impacts on the range plant distribution, [10].The intensive grazing pressure reduced the palatable plant species frequency and influenced plant species diversity, [16].

Table (4).Plant frequency of the Al-Rosa enclosure

Species scientific name	Frequency (Percentage)	
	Before grazing (2010)	After grazing (2017)
<i>Acanthus spp</i>	97.5	62
<i>Cenchrusbiflorus</i>	85	59



<i>Tephrosiaspp</i>	75	0
<i>Zorniaspp</i>	67.5	0
<i>Mollugonudicaulis</i>	55	0
<i>Merremiaomarginata</i>	52.5	0
<i>Ipomeaeriocapa</i>	47.5	0
<i>Aristidamotablis</i>	30	30
<i>Desmodiumdichotomum</i>	30	0
<i>Eragrostistramulla</i>	27.5	79
<i>Fimbristylsdichotomo</i>	20	29
<i>Commeliniaakotschyi</i>	20	0
<i>Zaleyapentandra</i>	17.5	0
<i>Hymenocardiaacida</i>	17.5	0
<i>Aristidaspp</i>	0	18

5. RANGELANDPRODUCTIVITYANDCARRYINGCAPACITY:The results in table (4) showed that there was a high variation in the productivity and carrying capacity of the Al-Roza enclosure before and after the grazing. Before grazing the range forage plants produced 6.4 tons/ha/year, and this productivity, satisfied about 2.37 TLU/ha/year, but after grazing the range productivity and carrying capacity declined to 0.23 tons/ha/year and 0.084 TAU/ha/year respectively.[17], reported that grazing intensity influenced dry matter production of herbaceous plant species. The heavy grazing leads to decrease the biomass production. The biomass production was decreased significantly in heavy grazing pressure.

Table (4).Productivity and carrying capacity of the rangeland at Al-Roza enclosure.

Attributes	Before grazing (2010)	After grazing (2017)
Productivity ton/ha/year	6.40	0.23
Carrying capacity TLU/ha/year	2.37	0.085

- ha= hectare , TLU= Tropical Livestock Unit

Hectare= 10000m²

IV. CONCLUSION

The study concluded that the intensive grazing which was practiced in Al-Roza enclosure had a negative impact on ground cover of the rangeland, where the bare soil increased and the plant cover decreased. The intensive grazing led to a change in plant species botanical composition of the enclosure, through domination of unpalatable species like *Sidacordifolia*. The rangeland productivity and carrying capacity were negatively affected by the intensive grazing. The study recommended rehabilitation of Al-Roza enclosure by fencing again, reseeding and broadcasting the important desirable range plant seeds. Understanding the ecological consequences of grazing intensity provides useful information for assessing current grazing management scenarios and taking timely adaptation measures to maintain grassland capacity in the long-term system.



REFERENCES

- [1] Holechek, J. L, Pieper R. D and Herbrl C. H, (2011). Range Management Principles and Practices. Sixth Edition, Prentice Hall, One Lake Street, Upper Saddle River. USA.
- [2] FAO (2012). The Land Cover Atlas of Sudan.
- [3] Fadlalla, B., Eltahir, A. A, and Khier Alseed, S, (2018). Prospects for Development of the Traditional Pastoral Sector. The Paper was Presented at the National Conference on Animal Wealth, Ministry of Animal Resources. Friendship Hall-Khartoum, Sudan.
- [4] IFAD (The International Fund for Agricultural Development) and GEF (The Global Environment Facility), (2014). The Republic of Sudan livestock and Rangeland Resilience Programme Project Document.
- [5] Yadava N.D, Soni M.L., Rathore V.S., Bagdi G.L., Subulakhsmi, V. and Mahesh K. Gaur (2018). Management of Pastures and Rangeland in Arid Western Rajasthan: A Review. *Annals of Arid Zone* 57(3&4): 89-96.
- [6] Abdelkreim, M. M, (2012). Effect of Enclosure on Range Botanical Composition, Forage Productivity, Diet Selection and Intake by Sheep Grazing at El-Khuwei Locality, North Kordofan State, Sudan. PhD Thesis. Sudan University of Science and Technology.
- [7] Parker, K. W, (1951). A Method for Measuring Trend in Range Condition on National Forest Ranges. USDA Forest Services Washington, D. C. 26.
- [8] Wlim, H.G. Costello, D.F. and Kipple, G.E., (1944). Estimating Forage by double-sampling method, *Jour. American. Society Agronomy*, 36: 194-203.
- [9] Stoddard, L.A, Smithland and Box, T.W, (1975). Range Management, 2nd Ed. New York. McGrGrewill, USA.
- [10] Abdelsalam M. I., Abdalla N. I., Abdelkareim M., Ibrahim M. E. A, and Mohammed M. M, (2017). The Impact of Continuous Grazing on Natural Rangeland in Alazazah area-Blue Nile State, Sudan. *Journal of Rangeland Science*, 7 (4).309-315.
- [11] Kosmas, C, Detsis, V, Karamesout, M, Kounalaki, K, Vassiliou, P and Salvati, L (2015). Exploring Long-Term Impact of Grazing Management on Land Degradation in the Socio-Ecological System of Asteroussia Mountains, Greece. *Land* 4, 541-559; doi:10.3390/land4030541.
- [12] Fashir, G. A., Mohammed, A. A. and Salih, E M., 2012. Impacts Assessment of Open Grazing System on Vegetation Attributes and Biomass Productivity, El Dilling Lacolity -South Kordofan State–Sudan. *Jour. Science and Technology, Agricultural and Veterinary Sciences*, 13(2): 106-118.
- [13] Carlos P.C., Achin R., Francisco M. A, and Begona P, (2013). Grazing Management or Physiography? Factors Controlling Vegetation Recovery in Mediterrean Grassland. *Ecological Modelling*, Elsevier journal. (251). 73-84.
- [13] Alkemadea, R, Robin S. R, Maurits van den B, Jan de Leeuw, and Michel J (2013). Assessing the impacts of livestock production on biodiversity in rangeland cosystems. *PNAS*, 110 (52), 20900-20905. <https://www.pnas.org/content/110/52/20900>.
- [14] Gush, A., Masoch, J., D. M., and Mugabe, P. H., (2017). CImpact of grazing system on rangeland condition and grazing capacity in Zimbabwe. *The Rangeland Journal*, (39), 219–225.
- [15] Fashir G. A., Salih E. M and Abdelsalam M. I, (2016). 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. *International Journal of Innovative Science, Engineering & Technology*, 3 (3).328-339.
- [16] Melak , Y., Angassa , A and Abebe, A. (2019). Effects of grazing intensity to water source on grassland condition, yield and nutritional content of selected grass species in Northwest Ethiopia. *Ecological Processes*.1-13.
- [17] Škornik, S. , Vidrih, M. and Kaligarič, M.(2010) 'The effect of grazing pressure on species richness, composition and productivity in North Adriatic Karst pastures', *Plant Biosystems - An International Journal Dealing with all Aspects of Plant Biology*, 144: 2, 355 — 364.



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