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Original Article

Effect of Water Sources Distribution on Range Condition

H.A. Galallyn[1], M.A. Ali[2] and M.A. Ebrahiem[2,*]

[1]Admenistration of Range and Forage, Ministry of Agriculture, North Kordofan State, Sudan
[2]Department of Animal Production, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Sudan

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Corresponding Author:
M.A. Ebrahiem
Mahaali5656@gmail.com

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ABSTRACT

This study was conducted in 2005 at El Nuhud locality within the northern part of previously called Western Kordofan State. This part is situated in the Savanna low rainfall on sand within 27˚-29˚ latitudes and 14˚-20˚ longitudes. The objective of the study was to study the effect of water point's distribution on the main composition and attributes of range within ten years. The data were essential to fulfill the objectives of the study. The data were collected using questionnaire covering 200 respondents selected randomly. Five sites were chosen randomly (Elkhuwi, Ankosh, Elrowiana, Khamas Eldonky and Umdefais). The results revealed that, plant species around boreholes changed due to intensive grazing around these areas and selection of palatable species by animals leaving unpalatable species to dominate. Wide spread of fire and there was no participation in fire control, which could be one of the reasons that affected directly vegetation density and frequency. Conflict over range resources was presented between herder and farmer, herder and land owner due to scarce of range land as the main reason and the absent of roles. The presence and spreads of toxic plants for example *Zornia glochidiata*. Inadequate distribution of water sources leads to a higher stocking density and over stoking the around areas.

Keywords: Water source distribution, Range condition.

INTRODUCTION

Range and range land mean different things to different people. Crowder and chheda (1982) defined range land as vast arid and semi-arid land areas with sparse vegetation, immerse regions over which nomadic herds wonder in search of water and grass as dictated by season, grassy plains devoted to wild life preservation which are used for safaris and at attraction or large ranches with cowboys who herd and brand cattle and hold annual round-up. Heady (1967) and Pratt (1969) defined range land as a term referring to land area covered with natural and semi natural vegetation and are suitable habitats for extensive grazing for both domestic and wild animals. Also the grazing area may be restricted by fences or open range free to all cattle keepers and herders. Gonzales (1969) reported that continents on the earth have extensive arid and semi-arid land classified as range land .In Africa more than 45

per cent of the area between the equator and 20˚ N latitude is arid and semi-arid, and between 20º N and 40º N 94% of the land falls in this category. In east Africa Kenya has about 87% of the land area available for pasture and range lands, Uganda 60% and Tanzania 50% (Starnes, 1968).

Sudan is essentially a country of vast plains interrupted by rolling country and a few widely separated groups of hills or mountains (Tothil, 1968). According to Harrison and Jackson (1958) Sudan was classified into six ecological zones, Desert, semi-desert, savannah belt which in turn was divided into low rainfall and high rainfall savannah, flood region and mountain vegetation. The savannah is consists patches of trees, separated by grass land (Noordwijk, 1984). The characterization of the vegetation in the Sudan largely depends on rain fall and soil variation, it will be noticed that the classification follows the distribution of rainfall zones and soil types (Harrison and Jackson, 1958). Also Noordwijk (1984) mentioned that ecological zones in which the habitat is proximately the same can be distinguished on the basis of vegetation structure. Each zone is characterized by a combination of climate, soil, vegetation structure, flora and fauna.

Glallyn and Ebrahiem (2015) reported that, the uneven distribution of water sources points led to changes in range plants composition, plants frequency, density of species and carrying capacities. So this trail was designed to study the effects of water points distribution on range attributes.

MATERIALS AND METHODS

The Study Area

West Kordofan state is located within latitudes 27˚- 29˚ N, and longitude 14˚- 20 E. The State borders North Kordofan, North Darfur, South Darfur, North Bahr ElGhazal and South Kordofan. The state area is of 14400 kilometer extends from low rainfall savanna to high rainfall and hill catena and its vegetation varies greatly (Glallyn and Ebrahiem, 2015; Hammed *et al*., 2015). The State has many water resources such as Elnnuhud underground reservoir, surface water, seasonal streams and small lakes. Wadi *Shalongo*, Wadi *Elfola*, Wadi *Armal* and Wadi *Foja*, and water points *Abuzabad* and *Kylack* are some examples of these water sources. Also, Bahr Elarb passes through the State from the southern side. The rainfall ranges between 600 mm/year in the southeast to less than 100 mm/year in the northwest. The annual mean temperature ranges from 32˚C during the day to 16˚C at night in January (winter) and from 46˚C during the day to 27˚C at night in May-June (Ebrahiem *et al*., 2015a and b).

Data and Information

Five sites (Elkhuwi, Ankosh, Elrowiana, Khamas Eldonky and Umdefais) were chosen randomly for the study. Information obtained from local people through personal and group interviews conducted with old members of society, the leaders of the tribes and women. For this purpose a questionnaire was designed and distribute randomly to 200 of the respondents.

Statistical Analysis

The data were statistically analysed using frequencies and percentages according to SPSS v.14.0 software package (SPSS, 1996).

RESULTS

Demographic Characteristics

Some demographic characteristics of the respondents selected for the purpose of data collection for the study on effects of distribution of water sources on range plants composition is shown in table (1). The results have indicated that 75% of the respondents were male and 25% were female. The educational data have indicated that 45% of the

respondents were illiterate while 29% were primary school leavers, 16.5% completed secondary school, 6.5% were attendants of Quranic schools and only 3%were university graduates. The main occupations of the respondents were herder 49.0%, 29.5%were herder and farmer at the same time, farmers were 7.5% and students amounting to 6.5%. There were 4.5% of the respondents from Government employees and 3% were merchants. The marital status of the respondents is shown also in table (1) where 71% of them were married, 25% were single, 2% were widowed and only 1% did not specify their marital status.

Table 1: Some Demography Characteristics of the respondents of the study on effects of Water Sources on Range Composition (n=200)

Village	%
Alkhewi	20
Ankosh	20
Alrawiana	20
Khamas Eldonky	20
Umdiffais	20
Sex	
Male	75.0
Female	25.0
Education	
illiterate	45.0
Quranic	6.5
Primary	29.0
Secondary	16.5
University	3.0
Main occupations	
Herder	49
Farmer	7.5
Herder and farmer	29.5
Employee	4.5
Merchant	3.0
Student	6.5
Marital status	
Married	71.0
Single	26.0
Widowed	2.0
Not specific	1.0

Dominant Plant Species

Dominant plant species in the study areas as observed by the respondents now and as they remember before 10 years ago is presented in Table (2). Those observations which were classified into four groups with number of plant species in common. The percentage of the groups with common plant species represented (50%, 25.5%, 14%, and 10.5% for group one, two, three and four of the respondents, respectively). The observation of the respondents on plant species dominant 10 years ago were also classified into four groups one, two, three and four. The percentages of these groups were 36%, 18.5% and 29.5 % respectively (Table 2).

Range Condition, Fire and Methods of Utilization

Referring to Table (3) the range condition, which was evaluated by the respondents now, was 46.6% excellent compared with 67% who thought it so before 10 years. The range condition was considered by 31.5% good now compared with 21% before 10 years. About 10 and 2% considered range condition intermediate and fair respectively before 10 years.

Table (3) shows that 28.5% of the respondents observed increased bare soil percent now and 27.1% believed it was greater before ten years ago, compared with71.5% who denied the presence of bare soil now and 72.9% ten years ago. Presence of invador plants is presented on Table 3. Presence of invader species on range now was reported by 53% of the respondents compared with 47% who did not see any invader species. Before 10 years 30.5% of the respondents remembered presence of invador species on range lands compared to 69.5% who did not observe presence of invador plants on range land.

Table 2: Dominant Plants Specified in the Study Area as observed by the respondents now and before 10 years

Groups of respondents now	Plants species	%
1	Cenchrus biflorus, Zornia glochidiata, Eragrostis termula, Aristida hordacea, Echinocloa colonum, Alysicarpus oralifolius, Aristida Pallida, Alyscicarpus glumaceaus	50
2	Zornia glochidiata, Alyscicarpus stumaceas Aristida hordocea, Ruellia patula, Marrimia emarginata Acanthespermum hespidum, Ipomea cordofana Abutilon Figarianum	25.5
3	Eragrostis termula, Aristida Pallida, Ctenium elegans, Cencherus biflorus, Oldlandia herbaca, Aristida Stipcides	14.0
4	Eragrostis termula, Aristida hordacea, Tribulus torrestic, Sperma coce sp, Zelya pentanture, Dactyloctenium aegptiaum.	10.5
Group of Respondents before 10 years ago	**Plants Species**	%
1	Monosania Senegalensis, Blepharis linariifolia Aristida pallida, Monicima hespidum, Chrazopghora brochian, Stylosanthes Flavicans.	36.5
2	Andropogon gyanus, Aristida pallida, Ariatida Papposa, Ipomea Cordofana.	15.5
3	Bepharis Linarifolia, Zornia glochidiata, Monicina hysbidum, Cenchrus biflorus, Eragrostic termula, Aristida pallida.	18.5
4	Dactyloctenium aegptiaum, Eragostis termula ,Aristida pallida, Cenchrus biflours, Zornia glochidiata.	29.5

Table 3: Range condition, Soil Denudity, Method of Range Utilization and Invaders Species on Range Estimated by the Respondents

Range condition	Now %	Before 10 years %
Excellent	46.5	67.0
Good	31.5	21.0
Fair	21.0	10.0
Poor	1.0	2.0
Bare soil		
Yes	28.5	27.1
No	71.5	72.9
Invaders species on Range		
Yes	53.0	30.5
No	47.0	69.5

The fire incidence on range lands is shown in Table (4). 48.5% of the respondents said admitted bush fire incidence on range lands while 31.5% did not. The frequency of burning was reported by 56% to be widespread compared with 43.5% who reported that burning was frequent. Participation in fire controlling was reported by 23% of the respondents while 77% were did not participate in that activity. The methods adopted by respondents in controlling fire on range land clearance (15.5 %), building fire lines between villages (5.5%). The majority (75%) of the respondents did not know how to control bush fire.

Table (4): Fire Incidence, Participation in Fire control, Frequency of Burning and How Participation in Controlling burning

Fire Incidence	%
Yes	48.5
No	51.5
Frequency of Burning	
Wide spread	56.5
Frequent	43.5
Participation in Fire Controlling	
Yes	23.0
No	77.0
How Participate in Controlling Burning	
Land clearance	15.5
Line between villages	5.5
No	79.0

As presented in Table (5) the presence of toxic plants on range land was reported by 52.5% while 45.5% did not observe presence of toxic plants on range lands. A small group, 2%, did not notice anything about the subject. In Table (5) some examples of the toxic plants are presented. *Zornia glochidiata* which causes bloat in the early stages was reported as toxic plant by 47.7%, nevertheless 45.7% of the respondents did not mention toxic plants and 5.6%did not know the species toxicity. The majority 89.5% of th**e** respondents mentioned that they did not participate in toxic plants control, and 10.5% worked in *Prosopis sp.* (mesquite) eradication and 88 % worked on identification of toxic plant and reporting.

Table 5: Present of Toxic Plant on Range Land, Example of the Toxic Plants, Participation in Toxic Control and Example for Toxic Plants Controlled

Present of Toxic Plants on Range Lands	**%**
Yes	52.5
No	45.5
Don't know	2.0
Example of the Toxic Plants	
Zornia glochidiata	47.7
No thing	46.7
Don't know	5.6
Participation in Toxic Plants Control	
Yes	10.5
No	89.5
Means for Toxic Plants Control	
Mesquite eradication	12.0
Identification of Toxic Plants and reporting	88.0

Table (6) shows methods of range utilization 88.5 % was communal grazing where water and pasture available, 11.5% were nomads with their movement between specific areas. As observed from Table (6), the majority of the respondents (93.5%) did not participate or initiate reseeding of deteriorated areas on rangelands, and only 6.5 % indicated that they reseeded some areas beside the bore holes. The respondents did not mention any role played by Range and Pasture Administration (RPA).

Table 6: Reseeding of the denuded Areas, The Role Played by Range and Pasture Administration in the Study Areas and Methods of Range Utilization

Methods of Range Utilization	***%***
Communal	88.5
Nomadic Movement/specific areas	11.5
Reseeding of the Denuded Areas	
Yes	6.5
No	93.5
The Role Played by RPA	
Yes	0
No	100

Conflicts Over Range Resources

Conflicts over range resources is presented in Table (7) which showed 59.5% of the respondents experienced conflicts and admitted presence of conflicts over range resources while 40.5% of them did not admit presence of conflicts, 35.5% of those conflicts over range resources were between herders and farmers 60% between the herders and land owners and only 4.5% of the respondents did not know the parties of the conflicts. The reasons of conflicts over range is also presented on Table (7).The respondents mentioned the following reasons as causes for conflicts over this resource: range land scarcity, blockage of livestock traditional routes and disputes over land ownership. The causes were reported by 60%, 23.5% and 1.5% of the respondents respectively. On the other side 15% of the respondents said there were no conflicts.

Table 7: Conflicts over Range Resource, Parties of Conflict and Reasons for Conflicts Estimated by Respondents

Conflict over Range Resource	%
Yes	59.5
No	40.5
Parties of Conflicts over Range	
Herders +Farmers	35.5
Herders +Land Owners	60.0
Don't know	4.5
Reasons of Conflicts	
Scarce range lands	60.0
No routes	23.5
No conflicts	15.0
Dispute overland	1.5

Table (8) indicats the harmful plants in the study areas were *Zornia glochidata* 44.5%, *Merrimia emarginata*20.5%, *Calotropis procera* 3.5% and 2.5% *Zornia glotchidiata* and *Merrimia emarginata*, while 29% of the respondents did not know the harmful plants species. Disorders caused by harmful plants were Bloat, Toxicity, Koor (ball shaped bodies), Bloat and toxicity respectively 16.6%, 31.5%, 20% and 3%, while 29% mentioned there was no disorders.

Table 8: Harmful Plants in the Area, Disorders Caused and Degree of Spread of Harmful Plants in the Study Areas

Harmful Plants in the Area	%
Zornia glochidata	44.5
Merrimia emmarginata	20.5
No	29.0
Zomia glochidata and Merrimia emmarginata	2.5
Calotropis procera	3.5
Disorder Caused by Harmful	
Bloat	16.5
Toxicity	31.5
Koor	20.0
No	29.0
Bloat and Toxicity	3.0

Table 9: Arrangement in Water Use, Sources for Drinking Water in summer, winter and autumn

Arrangement in Water Use	%
Tankers	22.5
By Carts	16.0
Basin around bore hole	61.5
Sources for Drinking Water	
Bore holes	71.5
Hafirs and bore holes	23
Rahads and bore holes	5.5
Drinking Water Sources in autumn	
Hafirs	56
Bore hole	32.5
Rahads	7.0
Reservoirs	2.0
Drinking Water resources in summer	
Bore hole	90
Hafirs	2.5
Rahads	6.0
Drinking Water in winter	
Hafirs	0.5
Bore hole	93.5
Rahads	6.0

Table (9) shows arrangement in water uses, which were tankers 22.5%, by carts 16% and basins around bore holes 61.5%. The main sources for drinking water were bore holes 71.5 % another sources bore holes and hafirs 23% and boreholes and rahads 5.5%. The respondents indicated that the main sources of drinking water in autumn were hafirs 56%, bore holes 32.5%, rahads 7% and reservoirs 2%. The main sources of drinking water in summer and winter were bore holes 90.5 % and 93.5 % respectively, rahad in both season 6 % and hafirs 2.5 % in summer and 0.5 % in winter.

DISCUSSION

Most of the respondents were herders and they reported that the dominant species now are Zornia glochidiata, Aristida hordacea, Rullia patula, Merrimia emarginta, Acanthespermum hespidum, Ipomea cordofana and Abutilon Figarianum, while the dominant plants ten years ago were Monsania sengalensis, Blepharis Linariifolia, Aristida pallida, Monicima hespidum, Chrozophora hiona, Stylosanthus *Flavicans* that mean the plant species around boreholes changed due to intensive grazing around these areas and selection of palatable species by animals leaving unpalatable species to dominate. This is in lined with Skerman (1965) who concluded that grazing pressure could increase to a point where demands could no longer be met and palatable perennials disappeared leaving the annuals and the unpalatable perennials without compensation and these e.g. increase of *ushar* (*Calotropis procera*) around khuwi. The respondents mentioned the appearance of invader species on range lands and the increasing of bare soil around the permanent water sources.

Wide spread of fire and there was no participation in fire control, which could be one of the reasons that affected directly vegetation density and frequency. This is in line with Bartlet (1956) who observed large areas of range lands are reported burned every year either by design, mistake or natural causes. Because it seems omnipresence during the dry season, fire has a greater and more direct influence on bush encroachment and herbage productivity of grazing land than any other method used .

Conflict over range resources was presented between herder and farmer, herder and land owner due to scarce of range land as the main reason and the absent of routes this in lined with Blench (1966). Such conflicts reflected both resources (Mines, farms, reserves) and eco-zonal conflicts (water, grazing and hunting rights). Although attempts to involve the community and bring partially the reserve land successful in relation to reserve land conflicts over extensive and patchy common property reserve such as wet land and grazing has made them more difficult to conserve and manage.

The presence of toxic plants for example *Zornia glochidiata* due to absence of identification of toxic plants and reporting of it, also due to easy spread of the seed of *Zornia glochidiata* and easy transportation from place to another.

The most dependent source of water in all season was boreholes, due to inadequate of water in the study areas and the higher stocking density.

CONCLUSION

Plant species around boreholes changed due to intensive grazing around these areas and selection of palatable species by animals leaving unpalatable species to dominate. Wide spread of fire and there was no participation in fire control, which could be one of the reasons that affected directly vegetation density and frequency. Conflict over range resources was presented between herder and farmer, herder and land owner due to scarce of range land as the main reason and the absent of roles. The presence and spreads of toxic plants for example *Zornia glochidiata*. Inadequate distribution of water sources leads to a higher stocking density and over stoking the around areas.

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