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RANGE INVENTORY AND EVALUATION OF ZALINGEI AREA VEGETATION. WESTERN DARFUR STATE, SUDAN

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ABSTRACT
Two studies were conducted for two consecutive seasons 2005/2006 and 2006/2007 in a semi-arid Savannah zone, at Zalingei town perimeter, two kilometers east of Zalingei town , western Darfur state. The aim of the research was to evaluate the vegetation type, vegetation cover, their composition and frequency in addition to their biomass production. Species- area- curve and Parker Loop Methods were used to determine the range inventory in the selected area.Vegetation cover survey measurements during the dry season showed that the area was dominated by grasses mainly Abuasabi *(Dactyloctenium aegyptium)* and Ghabash *(Schonefeldia gracilis*) with some herbs and shrubs and few trees Kiter (*Acacia mellifera*) Haraz trees (*Faidherbia albida*), with low composition and frequency. Vegetation cover was about (33-38%) and biomass production was 0.679 ton/ha, which is very low to hold the targeted animals in the area. Their composition and frequency during the rainy season were extremely high, which coupled with moderately high plant and forage density indices of 85.25% and 79.75%, respectively.

KEYWORDS: Savannah zone, Zalingei town, forage density, vegetation cover.

INTRODUCTION

Range inventory:

The area under study is traditionally grazed by Bedouin nomadic and local small ruminant flocks (goats and sheep). Continuous overgrazing, through shrubs removal and complete consumption of grasses and herbs especially before maturity, has resulted in an overall land degradation. The top soil surface is often crusted and resistant to water infiltration which may result in germination failure. The native vegetation is mostly composed of annual grasses and occasional shrubs plant sparsely scattered in the area and some annual broad leaves, while the perennial range types had completely been eradicated.

Management of rangelands depends upon knowledge of the physical and biological characteristics of the land. Unless these are known, prescribing kinds and levels of use appropriate to a specific area is impossible. Effective range management practices require careful inventories of resource characteristics (Stoddart, *et al* 1975).

Range inventory is a systematic acquisition and analysis of resource information needed for planning and for management of rangeland. Range inventory is an appropriate decision about land pasture use entail gathering baseline information. Utilization of the features of pastures such as the key species, percent canopy cover, amount of bare ground, presences of noxious weeds, annual forage production and amount residue to determine pasture condition and productivity represent a distinct role of range inventory (Rinehart, 2006 and Stoddart, *et al* 1975)**.**

MATERIALS AND METHODS

Site description;

Two studies were carried out at Zalingei perimeter, 2km East of Zalingei town, Western Darfur state. The research was conducted for two consecutive seasons 2005/2006 – 2006/2007, to evaluate the range inventory of the area selected.

The study site lies at latitude 12° 54' 0N and longitude 23° 28' 60E, with altitude of 900m above the sea level. The area lies on the semi-arid Savannah zone, which is affected by the elevation of Jabel Marra Massif (rain and temperature) for the larger part of the area under consideration.

The soils are derived from the gneisses Schist's and granites of underlining basement complex. The soils include those of drift alluvial and dry plains (Wickens, 1967). The predominant top soil is sandy loam, becoming loam or sandy clay with depth **(**HTS, 1958). The soil is mostly neutral or slightly acid with little or no lime content. Soil organic matter and the available phosphorous are low, with relatively highly soluble potassium and the Carbon/ Nitrogen ratio is wide. (Ali, 2002).The climate is generally characterized by cold dry winter and hot rainy summers. The beginning of the rainy season is typical of the semi-arid savannah which is marked by great irregularity **(**Wickens, 1967**).**The rainy season usually begins in the late June and extends to middle of October, with occasional limited shower in April- May and November **(**Mohammed, 2000).

Vegetation

Agriculture has been practiced in the study area for centuries and crop production is mainly based on rainfall through various traditional farming systems. The main feature of the study area is a savannah type vegetations, savannah wood land, thorn shrub, thorn bushes and broad leaves deciduous trees with short to medium annual grasses. Livestock rearing is practiced by nomadic tribes and settlers. Livestock raising (cattle and coats) is common in the area and camels are predominant in the Northern part of the province.

Range inventory and evaluation

Reconnaissance survey was made, here the square frame method was used, where the frame is thrown at random in the selected area, the vegetation cover was estimated visually and the ground vegetation types were recorded. Forage production which is estimated as total dry matter produced, is determined by using species- area- curve method (10 samples), in which the biomass Forage of the selected area around the study area was measured by using the quadrat method.

Determination of the vegetation composition and frequency:

The species composition of the area was recorded using line transect method. Four (4) line transect were set, in order to determine species composition and plant frequencies parameters, using loop Methods (Parker Loop Methods) as described by Abusuwar (2005). The parameters are :

Plant density index; forge density index; ground cover index; percent plant composition; percent species composition; percent forage composition; frequency of each plant species.

Equipments used:

- 3/4inch diameter loop.
- 100 meters tape.
- Recording sheet made of 100 points.

Vegetation measurement were taken at every meter (100 reading for each transect) by lowering the loop down at the meter marking by the sampler.

Plant composition and frequency of the site was determined according to the formulae below

- Plant density index = Total hits on vegetation.
- Forage density index = Total hits on vegetation – non palatable species.
- Ground cover index = Total hits on vegetation + Rock + plant litter or (Total hits – Bare soils).

$$Percent\ plant\ composition = \frac{Total\ hits\ on\ vegetation}{100} x100$$

$$Plant\ species\ composition = \frac{Total\ hits\ of\ each\ vegetation}{Total\ hits\ of\ vegetation} x100$$

$$Percent\ forage\ composition = \frac{Total\ hits\ on\ desirable\ species}{Total\ hits\ on\ vegetation} x100$$

$$Frequency\ of\ each\ species = \frac{Number\ of\ occurrence\ of\ the\ species}{Total\ number\ of\ samples} x100$$

RESULTS

Range inventory and evaluation:

As demonstrated in Table 1, in all 43 vascular plant species identified during the two growing seasons around the experimental area, of which 25.58% were grasses**,** 58.14% were herbs and shrubs (woody vines) and 16.28% were trees. Abuasabi *(Dactyloctenium aegyptium)* and Ghabash *(Schonefeldia gracilis*) were the dominant species in the study area while the other species varies between common and few. Concerning herbs and shrubs Lissan eltair, (*Amaranthus viridis L*) Senamakka, **(***Cassia senna L)* Ibrig elfaki- hassk, **(***Commelina kotschyi***)** and Huntout **(***Ipomoea sinensis)* were commonly occupying the area while the others varies between few and rare. It has been observed that the area is largely dominated by Haraz trees (*Faidherbia albida*) which in turn represent the second choice of feeding of small flocks. However, Kiter (*Acacia mellifera*) is commonly scattered while the trees like Hashab (*Acacia Senegal*) and Mokhait (*Boscia senegalensis*) were thereby considered as few but Hegleeg (*Balanites aegyptiaca*), Sonot (*Acacia nilotica*) and Sayal (*Acacia tortilis*) were rarely found in the area.

Average forage production of the selected area:

The vegetation cover was measured visually by using square frame method, and the average ground vegetation cover was in the range 33 .5 to 38.67% in the dry season. Forage yield is the weight of the usable part of the plant that is produced within a designated period of time (one year) on a given area. The average forage production was about 0.679 Tons/ha. (Table, 2).

Vegetation composition and frequency of different pasture plants in the area;

The vegetation composition measurement at the study area during the experimental period was summarized in Tables 3a, 3b and 4. It was observed that the range condition is extremely good during the fall period in which the average hits on vegetation of the four transects lines used was more than 85.25%, the average hits on rocks was 5.25% and the average hits on plant litters was 4%. The average ground cover percent which is an important indicator for soil erodability was 96.25%. The average plant density and forage density index was 85.25% and 79.75%, respectively, while the average percent plant composition and percent forage composition was 85.25% and 93.67%.

It was concluded that the composition and frequency of most common species varied consistently along the four transect lines measured in the study area (Table 4). During the two seasons of the experimental period results showed that the average readings of Abuasabi (*Dactyloctenium aegyptium*), Hantot (*Ipomea sinensis Desr*), Gaw (*Aristida spp*), Baniu (*Eragrostis tremula*) and Seida (*Cyperus rotundus L.*) scored the highest percent plant composition and percent plant frequency. Species such as Lissan eltair*(Amaranthus viridis L.)*, Nageel(*Cynodon dactylon*), Stylo(*Stylosanthes hamata*), Umshoka(*Oxygonum atriplicifolium*), Rehan(*Ocimum basilicum L.*), Defra (*Echinochloa colona L*)., Afan Elkhadeem (*Chloris virgtla*), and Haskanit (*Cenchrus biflorus*) scored lower percent plant composition and frequency. While the rest, Horab hosa *(Acanthospermum hispidum*), Weka alkhala (*Hibiscus trionum L.*), Dereisa (*Tribulus terrestris L.*), Molukhia (*Corchorus olitorius L.)*, Umdofofo

(Pennisetum pedicellatum), Hambouk(*Abutilon pannosum*), Ghabash (*Schonefeldia gracilis*), Kawal (*Cassia tora*) and Umlbeina (*Euphorbia aegyptiaca*) scored the lowest percent plant composition and plant frequency during the two growing seasons of the experimental period.

TABLE 1. Experimental Site Ground Cover Vegetation

Species	Common Name	Status			
		Dominant	Common	Few	Rare
Grasses:					
Dactyloctenium aegyptium	Abuasabi	+			
Brachiaria kotsikyana	Umfuraw		+		
Chloris varigata	Abumalih		+		
Cynodon dactylon	Nageala		+		
Dactyloctenium aegyptiacum	Koreib		+		
Echinochloa colona L.	Defra			+	
Setaria acromelaena	Losseig			+	
Cenchrus biflorus	Haskanit		+		
Schonefeldia gracilis	Ghabash	+			
Sorghum aethiopicum	Adar			+	
Cyperus rotundus L.	Seida				
Herbs and Shrubs*:*					
Zaleya pentandra L.	Arig alarab			+	
Amaranthus viridis L.	Lissan eltair		+		
Xanthium brasilicum (Vell.)	Rantouk			+	
Pennisetum pedicellatum	Um dofofo				+
Farsetia longisiliqua	Um adafir				
Cassia senna L.	Senamakka		+		
Cleome gyandra L.	Tamalaka		+		
Commelina kotschyi	Ibrig elfaki-hassk		+		
Ipomoea cordofana	Tabar		+		
Ipomoea sinensis	Huntout		+		
Cucumis dipsaceus	Ajur Elkhazal			+	
Euphorbia aegyptiaca.	Umlbeina			+	
Euphorbia heterophylla l.	Umlaban				+
Ocimum basilicum L.	Rehan			+	
Abutilon pannosum	Hambouk				+
Hibiscus trionum L.	Weka alkhala			+	
Boerhavia erecta L.	Shokal elkhail			+	
Oxygonum atriplicifolium	Umshoka			+	
Portulaca oleracea L.	Regla		+		
Kohautia aspera	UmHibayba				+
Solanum dubium	Gubbein		+		
Corchorus olitorius L.	Molukhia		+		
Corchorus trilocularis L.	Moluokhia elkhala		+		
Tribulus terrestris L.	Dereisa		+		
Acanthospermum hispidum	Horab hosa				
Trees:					
Acacia mellifera	Kiter		+		
Faidherbia albida	Haraz	+			
Acacia Senegal	Hshab			+	
Balanites aegyptiaca	Hegleeg				+
Boscia senegalensis	Mokhait			+	
Acacia nilotica	Sonot				+
Acacia tortilis	Sayal				+

Key: concern grasses and shrubs
Dominant 30 - 50plants/m^2. *Common 15 - 30 plants/m^2.*Few 5- 15plants/m^2. *Rare 1-5 plants/m^2.

TABLE 2. Average forage production of the selected area around the experimental site.

Sample No.	Forage production tons/ha.
1-	0.955
2-	0.857
3-	0.789
4-	0.659
5-	1.237
6-	0.497
7-	0.560
8-	0.445
9-	0.386
10-	0.367
Average	0.679

TABLE 3A. Summary sheet for (4) line transects (1)

Readings	Transect lines			
	Transect No.1	Transect No.2	Transect No.3	Transect No.4
Hits on vegetation	84	81	91	85
Hits on Rock	7	4	3	7
Hits on Bare soil	5	9	2	6
Hits on plant litter	4	6	4	2
Grand Total	100	100	100	100

TABLE 3B. Summary sheet for (4) line transects (2)

Readings	Transect lines			
	Transect No.1	Transect No.2	Transect No.3	Transect No.4
Plant density index	84	81	91	85
Forage density index	80	71	87	81
Ground cover index	95	98	98	94
Percent plant composition	84%	81%	91%	85%
Percent forage composition	95%	88.75%	95.6%	95.29%

TABLE 4. Plant composition and frequency of different pasture plants in the area

Botanical name	Common name	Lines Transect							
		Transect No.1		Transect No.2		Transect No.3		Transect No.4	
		Comp%	Freq.%	Comp%	Freq.%	Comp%	Freq.%	Comp%	Freq.%
Ipomea sinensis Desr	Hantot	23.81	20	8.64	7	12.09	11	9.41	8
Stylosanthes hamata	Stylo	_	_	8.64	7	_	_	3.35	3
Aristida spp	Gaw	_	_	18 52	15	13.19	12	15.29	13
Cynodon dactylon	Nageel	5.95	4	6.17	5	7.69	7	5.88	5
Dactyloctenium aegyptium	Abuasabi	8.33	7	18.52	15	16.48	15	12.94	11
Echinochloa colona L.	Defra	8.33	7	_	_	_	_	4.71	4
Eragrostis tremula	Baniu	15.84	13	12.35	10	5.49	5	8.24	7
Cenchrus biflorus	Haskanit	_	_	_	_	4.40	4	7.06	6
Cyperus rotundus L.	Seida	8.33	7	_	_	13.19	12	5.88	5
Ocimum basilicum L.	Rehan	_	_	3.70	3	_	_	2.35	2
Abutilon pannosum	Hambouk	_	_	2.47	2	_	_	2.35	2
Oxygonum atriplicifolium	Umshoka	4.76	4	_	_	4.40	4	4.71	4
Amaranthus viridis L.	Lissan eltair	9.52	7	_	_	8.79	8	8.24	7
Tribulus tlerrestris L.	Dereisa	_	_	6.17	5	_	_	2.35	2
Chloris virgtla	Afan Elkhadeem	4.76	4	_	_	4.40	4	2.35	2
Cassia tora	Kawal	_	_	1.23	1	_	_	_	_
Acanthospermum hispidum	Horab hosa	_	_	7.41	6	_	_	3.53	3
Corchorus olitorius L.	Molukhia	4.76	4	_	_	2.20	2	_	_
Schonefeldia gracilis	Ghabash	1.19	1	_	_	3.30	3	_	_
Hibiscus trionum L.	Weka alkhala	4.76	4	_	_	4.40	4	1.18	1
Euphorbia aegyptiaca	Umlbeina	_	_	1.23	1	_	_	_	_
Pennisetum pedicellatum	Um dofofo	_	_	4.94	4	_	_	_	_

DISCUSSION

The main feature of the study area is savannah type vegetation, savannah woodland, thorn shrubs and broad leave deciduous trees with short to medium annual grasses. Plant species identified during the study composed of 25.58% grasses, 58.1% forbs and shrubs and 16.28% trees. During the dry season the average ground cover was in the range of 33.5 to 38.67%, while the biomass production was about 0.679 tons/ha, which is very low to hold the target animals in the area. On the other hand, their composition and frequency during the rainy season were extremely high, which coupled with moderately high plant and forage density indices of 85, 25% and 79.75%, respectively.

Results of vegetation survey around the experimental area revealed that the dominant species were Abuasabi *(Dactyloctenium aegyptium)* and Ghabash *(Schonefeldia gracilis*) followed by shrubs and forbs. The domination of these grasses and shrubs may indicate that these pastures species are drought tolerant and most adapted to the local environmental conditions. However, the current existing pasture species in the study area were found to be fewer in number, composition and frequency and lower in biomass production, especially during the dry season. The reason behind the overall degradation may be due to several factors;

*Drought: due to inadequate rainfall and their distribution.
* Premature mowing and early grazing
*Nomadic patterns of grazing (continuous grazing) and overstocking.
*Continuous cutting of trees for fire wood and charcoal, in addition to accidental fires.

Drought due to inadequate rainfall and their distribution especially during the last decades drastically resulted in poor emergence and hence poor vegetation cover. Similarly Call and Roundy (1991) reported that rainfall is a single factor affecting plant growth and herbage dry matter production in most of the tropics and sub-tropics. While Suliman, (1980) stated that the amount of precipitation is considered as the most single factor influencing seedling emergence, plant growth and productivity of pasture plants in arid environment. The negative activities of premature mowing and grazing (shrub removal and complete consumption of grasses before maturity), nomadic grazing patterns (continuous grazing system), and overstocking dramatically resulted in rangeland degradation. This is because grazing animals exert an influence upon the productive rangeland system by their defoliation of plants through their eating and cause physical damage by their digestive process and continuous movement which inturn affect very much the vegetation stands and promote deformed pastureland. On the other hand, premature mowing and grazing of pasture before maturity consistently resulted in complete deterioration through defoliation of their intensity, frequency and seasonality.

The seasonal forage quantity, quality and palatability can be managed by adopting proper grazing program. Similarly, Heady (1975) reported that controlling the number of animals, the time of grazing or cutting is an important issue in defining proper stocking rate. However, Bement (1981) summarized that when plants cut or grazed in the growing season (before maturity), the annual growth will not start over unless there is sufficient soil moisture to permit regrowth. On the other hand, the continuous grazing patterns practiced by the nomadic people in the area substantially degraded the vegetation cover through grazing of a single pasture for period of several months to more than one year. In order to conserve and manage the poor rangelands it is to adopt a proper grazing system in which animals are evenly distributed and their number should not exceed the carrying capacity of the range. These justifications were in line with the findings of Mott (1960); Bement (1969); Heady (1975) who pointed out that stocking rate that exceeded carrying capacity of the range may increase the livestock off-take in short term but in few years will lead to decline in rangelands productivity.

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