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RESEARCH ARTICLE

FLORISTIC COMPOSITION IN THE RANGELANDS OF GAMBELLA, SOUTHWESTERN ETHIOPIA.

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Abstract

A research study was conducted in the rangelands of Nuer pastoral area, Gambella, with the objective of investigating the herbaceous and woody vegetation composition of the rangeland. The pastoral area was stratified by districts namely: Itang and Jikawo and each district is further divided into four major grazing types (communal grazing, seasonal grazing, river basins and less grazed). The result revealed a total of 42 grass species, 5 legume species, 3 sedges and 9 non-grass herbaceous species and 31 tree/shrub species in the districts. *Hyparrhenia rufa* dominated the less grazed areas of the two districts. In seasonally grazed areas of Itang and Jikawo districts, *H. filipendula* and *H. hirta*, respectively were dominated. Echinochloa species were dominant in communally grazed areas and river basins of both districts. Accacia and Grewia species were found to be common and Combretom species were observed in the districts. There were significant ($p<0.05$) differences among the major grazing areas in their woody vegetation density. In Itang, there were 379; 300 No/ha, in less and moderately grazed areas and < 80 No/ha in the communal lands and river basins. While, in the stated grazing areas of Jikawo the density of trees/shrubs were: 408; 329 and <90 No/ha, respectively. Therefore, it can be concluded that the floristic composition of the communally grazed and river basins the rangelands have highly affected by over grazing and invasion of unwanted species. This situation should be reverted through employing proper grazing systems, rehabilitation and conservation.

Introduction:-

Rangelands dominated by grass and grass-like species with or without scattered woody plants, occupy between 18-23% of the world land area (Blench and Sommer, 1999). In Africa, rangelands constitute about 65% of the total land area (Friedel *et al*., 2000).The range lands of Ethiopia are located around the peripheral or the outer edge of the country, lmost surrounding the central highland mass (Alemayehu, 2004), constituting 62% of the country's land area (EARO, 2000; PFE, 2001; BLPDP, 2004). These areas are mainly found in the northern, northwestern and

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along the Baro River basin in the extreme western part of the country (Coppock, 1993). Most of these areas are below 1,500 m.a.s.l (EARO, 2000), characterized by arid and semi-arid agro-ecologies; experienced a relatively harsh environmental condition of unreliable, low and erratic rainfall with annual range of 200 to 700 mm, a regularly high temperature, between 15 and 50^0C, and low human population density (Beruk, 2003; Alemayehu, 2004; PFE, 2004), varied markedly in terms of the number of plant growing days per year, forage production, common plant associations, livestock and human carrying capacities and incidences of important livestock diseases (Coppock, 1993).

The pastoral areas of Ethiopia have a rich resource potential (PFE, 2001) despite the fact that, the country has not yet benefited from these resources. This could be attributed to various constraints (Coppock, 1994). Of the immense constraints, livestock feed scarcity resulting from rangeland degradation and productivity deterioration is known to be the prime and common features of the pastoral areas. Moreover, the current condition of rangelands, their future prospect and the pastoral production systems do not seem favorable (PADS, 2004). For efficient and sustainable utilization of the highest livestock potential from rangeland resources, ultimately, it is invaluable to understand the available resource base. Like other pastoral areas of the Ethiopia, in Gambella Regional State (GRS), extensive pastoral production system is experienced, predominantly in areas where the Nuer Pastoral communities inhabit. According to GRS (2003), the Nuer pastoral communities subsist on the more arid area of the regional state, which is unsuited for crop production. The area consists of wide treeless grassy and seasonally flooded plains of the Itang, Jikawo and Akobo district. The communities are grouped on language and territorial grazing area and move back and forth with the seasonal flooding regime of the rivers.

Various range research and development works were conducted in the southern and eastern rangelands of Ethiopia (Coppock, 1993), in Borana by Ayana (1999), Oba (2001) and Gemedo-Dalle (2004), Middle Rift Valley by Russel (1984) and Amsalu (2000), part of the Somali region by Ahmed (2003), Belayenesh (2006) and Amaha (2006). However, in the Gambella Regional State in general and the Nuer pastoral areas in particular, research and development interventions have never been done. Moreover, there are little or no researches and documentations made regarding floristic composition in this rangelands. The study of floristic composition helps to build a mental picture of an area under investigation and also permit the comparison as well as the ultimate classification of different units of vegetation (Kershaw, 1973). It is, therefore, necessary to develop baseline scientific information on the currently available rangeland resources in terms of the herbaceous and woody species composition. This would help to suggest ecologically sound and socio-economically feasible development and management interventions towards sufficient and sustainable use of the rangeland resources. To this effect the study aimed at investigating the herbaceous and woody species composition of the rangeland vegetation cover.

Materials and Methods:-

Description of the Study Area:-

The study was conducted in the Gambella Regional State which is located in the southwest part of Ethiopia, situated in the lowlands of the Baro-Akobo River Basin between latitudes $6^0$22' and $8^0$30' N, and longitudes $33^0$10' and $35^0$50' E, and covers a total area of about 34,063 square kilometers (GRS, 2003). The regional state is characterized as mid, lowland and semi-desert agro-ecological zones. Itang and Jikawo districts are located in the semi- desert agro-ecological zone. Forests and woodlands are in existent except for some scattered bushes and shrubs, thus it is logical to defining the grassland as open grassland (GRS, 2003) with an extensive plain topographic feature (PADS, 2004). The annual rainfall and mean annual temperature in the Regional State are 1,247 mm and 34.37 ^{0}C, respectively (IAR, 1990). The rainfall regime is unimodal, referred to as the "Sudan Type", occurs in the lowlands along the border with Sudan (Coppock, 1994). Poorly drained vertisol is the characteristic soil type of the grassland (GRS, 2003). The highest livestock population in Tropical Livestock Unit (TLU) is found in Jikawo district 156,168.5 (53%), followed by Akobo, 114,390.8 (39.3%). The lowest TLU in Gog, which is, 1,341.6 (0.5%) (PADS, 2004). The major breed is the Nuer (zebu) which is a very good performer in dairying and beef production provided proper management levels (GRS, 2003) and considered to have high tolerance to tse-tse challenges (Alemayehu, 2004). A vegetation survey was conducted in the two districts (Itang and Jikawo) (Figure 1), which are predominantly inhabited by the Nuer pastoral community.

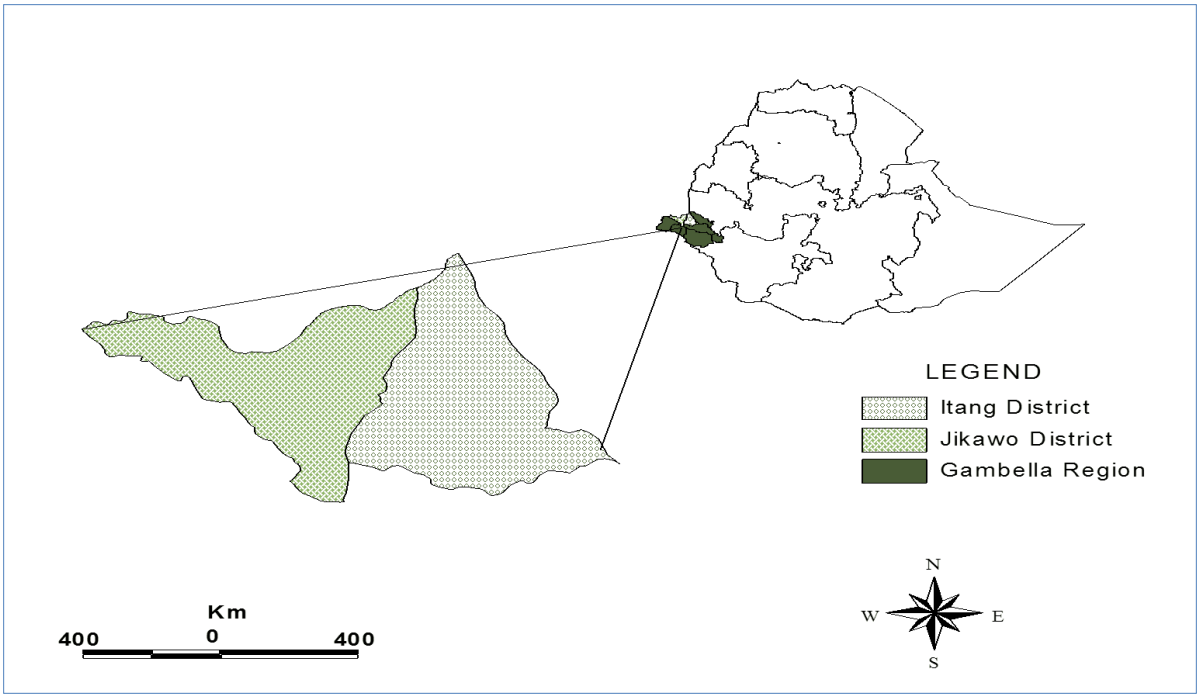

Figure 1: Map of the study area

Site Selection and Sampling Procedure:-

The sampling method used was 'Systematically Stratified Random Sampling Technique' (ILCA, 1990). Accordingly, each district was stratified into four range sites namely: communal grazing, seasonal grazing, river basins and less grazed areas, which represent the major grazing areas of the pastoral community. As a benchmark, the relatively less grazed areas were used for comparison with other grazing areas in their representative districts. A total of 11 range sites (3 from each of less grazed, communally grazed and river basins and 2 from seasonal grazing areas) were selected from Itang district. For each grazing types, from Jikawo district (3 range sites with a total of 12) were selected. Each range site was further divided into three randomly selected sample sites. Four samples from each sample site were grouped using 0.5 m x 0.5 m quadrat. Using GPS channel 12; the altitude, longitude and latitude readings of each range site were determined and recorded. From a randomly established reference points, samples were taken by radiating 30m to four directions. The random selection reference point was made using line coordination, for communal grazing lands, less grazed lands and seasonally grazed areas. Samples from river basin were taken on the flat side of the river within the range of 100 - 400 m from the river bank on non-water logged area. The assessment was carried out late in the long rainy season 2006, when most of the grasses were flowered.

Vegetation Composition Assessment:-

Herbaceous vegetation layer:-

At each range site, within 0.5m x 0.5m (0.25 m^2) sample quadrats, herbaceous vegetation were harvested at ground level. Then the cut samples were weighted and put into paper bags, securely fastened at the top and kept in cool place till sampling was over. Within 12 hours, the samples were transported to Gambella Research Center and then species composition was determined by hand separating into its component species. In the field, the identities of almost all species were recorded (using their vernacular name) in each quadrat with the help of the elder pastoralists. Some of the sample specimens were pressed, labeled, and transported to Ethiopian Institute of Agricultural Research (EIAR) at Debre-zeit and some others to the Herbarium of Haramaya University for further scientific identification. Vegetation samples from each site were classified into grasses, legumes, sedges and forbs thereafter into different species. According to the succession theory (Dykstehuris, 1949; Tainton, 1981) and based on the information aid to semi-arid South Africa (Ivy, 1969; Tainton, 1981), classification of grasses into desirable species likely to decrease with heavily grazing pressure (decreases), intermediate species likely to increase with heavy grazing pressure (increasers) and undesirable species likely to increase or invade with heavy grazing pressure (pioneers), was done. The opinion of pastoralists on vigor and palatability of a particular species was considered. The fresh and dry weights of each individual species were determined by using an electronic digital balance. DM of each species was

determined on dry weight basis dried in an oven at 60 ^{0}C for 72 hours. Total herbaceous dry weight, dry weight of grasses, increasers, decreasers and invaders of the experimental unit were derived from the dry weight of each species in each sample.

Woody vegetation layer:-
In each range site, for woody vegetation (trees/shrubs) within 20 m x 20 m (400 m^2) quadrats, only live woody plant species were recorded and identified as presented. To estimate the woody plants density per hectare, the number of individuals of each tree and shrub species was counted. All plant height was measured using calibrated aluminum poles of 2 and 4 meters. For species composition assessment, the criterion developed by Baars *et al*. (1997) was used. Accordingly, in each quadrat, the density of woody plants (trees/shrubs) was enumerated and an area with no trees/shrubs was given 0 point and that with more than 20 trees/shrubs scored 10 points.

Statistical Analysis and Interpretation:-
For the herbaceous vegetation assessment, from each range site composite samples of the four quadrates of 0.5 m x 0.5 m (0.25 m^2) was considered as an experimental unit. The composite samples were sorted out by districts and major grazing types. Thereafter, the data was subjected to ANOVA. Accordingly, 33 samples fell in the Itang district and 36 in Jikawo (a total of 69 samples) were used for the analysis. For the woody vegetations, from each range site, 20 m x 20 m (400 m^2) quadrat was used as an experimental unit. Accordingly, a total of 46 samples (22 from Itang and 24 from Jikawo) were used for data analysis. The data obtained from the vegetation variables were subjected to ANOVA using the GLM procedure of Statistical Analytical System (SAS) (1999) computer software. Duncan's Multiple Range Test was used for mean comparison.

Results and Discussion:-
Floristic composition in the rangelands of the Nuer pastoral area:-
A total of 42 grass species, 5 legumes species, 3 sedges and 9 non-grass herbaceous species were identified from the study districts of Nuer pastoral area (Table 1 and Table 2). The dominant and common grass species identified include: *Aristida micans, Brachiaria xantholeuca, Cenchrus mitis, Chloris gayana, Digitaria adscendens, Echinochloa colunum, Eriochloa procera, Echinochloa pyramidelis, Hyparrhania filipendula, Hyparrhenia hirta, Hyparrhenia rufa, Pennisetum adoensis, Pennisetum clandestinum, Pennisetum glabrum* and *Setaria verticullata.* Some grass species appeared in both districts and others fell within a particular district. *Hyparrhenia rufa* dominated the relatively less grazed areas of the two districts. *Digitaria adscense* and *Pennisetum clandestinum* dominated the relatively less grazed areas of Jikawo and Itang respectively. In seasonally (moderately) grazed areas of Itang and Jikawo district, *Hyparrhenia filipendula* and *Hyparrhenia hirta* dominated. *Echinochloa* species were the dominant in communally grazed areas and river basins of both districts. In the heavily grazed river basins of Itang and Jikawo, *Echinochloa procera, Echinochloa pyramidelis, Pennisetum glabrum* and *Setaria verticillata* were dominants. In terms of the woody vegetation a total of 31 shrubs/tree species were identified from the study districts (Table 3). *Accacia* species such as *Accacia hecatophylla, Accacia hockii, Accacia seyal* and *Accacia Senegal* and *Grewia* species like *Grewia mollis* and *Grewia tenax* were common in the districts. From *Combretom* species, *Combretom adenogoniun, Combretom collium* and *Combretom molle* were observed. In line with the concept of RISC (1983), by which the potential community of a site is dominated by one or a few species, which are best adapted to the specific combination of environmental factors of the site.

Table 1:- Grass species categories and their distribution in major grazing areas of the study districts

Scientific name	Desirability	District							
		Itang				Jikawo			
		LG	SG	CG	RB	LG	SG	CG	RB
Andropogon schirensis	HD	C	-	-	-	P	-	-	-
Aristida micans	UD	C	-	-	-	P	-	-	-
Brachiaria comata	HD	P	-	-	-	-	-	-	-
Brachiaria deflexa	HD	P	P	-	-	P	-	-	-
Brachiaria semiundulata	HD	-	-	-	-	P	-	-	-
Brachiaria xantholeuca	HD	C	C	-	-	P	-	-	-
Cenchrus mitis	HD	-	-	-	-	P	C	-	-
Chloris gayana	HD	P	-	-	-	P	-	-	-
Cynodon dactylon	LD	-	C	-	C	-	P	-	C
Digitaria adscendens	HD	P	-	-	-	C	P	-	-
Digitaria nuda	LD	P	-	-	-	P	-	-	-
Digitaria ternata	LD	-	-	-	-	P	P	-	-
Digitaria velutina	UD	C	-	P	-	P	-	-	-
Echinochloa colonum	LD	P	P	D	P	P	P	C	C
Echinochloa pyramidelis	LD	P	-	-	-	P	-	C	C
Echinochloa stagnina	LD	-	-	-	-	P	-	-	-
Eragrosits multiplosa	LD	P	-	C	-	-	-	-	-
Eragrostis pilosa	HD	P	-	-	-	C	-	-	-
Eragrostis tremula	UD	-	C	-	-	C	C	-	-
Eleusina africana	LD	-	-	-	-	P	-	-	-
Eleusina indica	UD	C	P	C	P	-	-	-	-
Eleusina jaegeri	LD	P	-	P	C	P	P	C	-
Eleusina multiflora	LD	P	C	-	-	-	-	-	-
Eriochloa nubica	LD	C	-	C	-	P	-	-	-
Eriochloa procera	LD	P	-	-	P	P	P	D	C
Hyparrhenia filipendula	LD	C	D	-	-	P	P	-	-
Hyparrhenia hirta	LD	P	-	-	-	P	D	-	-
Hyparrhenia rufa	LD	D	P	-	-	D	-	-	-
Linotonia nutans	LD	P	C	-	-	-	-	-	-
Loudetia simplex	LD	-	P	-	-	P	-	-	-
Oryza barthi	HD	P	-	-	-	P	P	-	-
Panicum hochstetteri	HD	C	-	-	-	-	-	-	-
Panicum maximum	HD	-	-	-	-	P	-	-	-
Pennisetum adoense	HD	C	C	-	-	P	-	-	-
Pennisetum clandestinum	HD	P	-	-	-	D	P	-	-
Pennisetum glabrum	UD	P	-	P	C	C	-	C	D
Pennisetum polystachyon	LD	P	C	-	-	P	-	-	-
Poa annua	LD	-	P	-	-	P	P	-	-
Setaria verticillata	UD	P	-	-	D	-	C	P	D
Tetrapogon villosa	LD	-	-	-	-	P	-	-	-
Rhynchelytrium nerviglum	LD	P	-	-	-	P	-	-	-
Rhynchelytrium repens	LD	-	-	-	-	P	-	-	-

HD= Highly desirable; LD=Less desirable; UD= Undesirable; LG= Less grazed; SG= Seasonally grazed; CG= Communally grazed; RB= River basins; D= Dominant (>20% of DM); C= Common (>5% and < 20% of DM); P= Present (<5% of DM).

Table 2:- Non-grass herbaceous species identified in the study districts

Group/Scientific name	Family
Legumes	
Aeschynomenna abyssinica	Fabaceae
Crotolaria brevidens	Fabaceae
Crotolaria goreensis	Fabaceae
Crotolaria ochroleuca	Fabaceae
Desmodium dichotunum	Fabaceae
Indigofera preureana	Fabaceae
Tephrosia liniaris	Fabaceae
Sedges	
Cyperus eleusinoides	Cyperaceae
Cyperus esculentus	Cyperaceae
Cyperus rotundus	Cyperaceae
Forbs	
Cissus quadrangular	Vitaceae
Commelina spp.	Commelinaceae
Convolvulus olitorius	Convolvulaceae
Convolvulus sagittatus	Convolvulaceae
Convolvulus siculus	Convolvulaceae
Erucastrum arebicum	Brassicaceae
Hygrophylla auricula	Acanthaceae
Ipomoea aquatic	Commelinaceae
Ipomoea eriocarpa	Commelinaceae
Ipomoea purpurea	Commelinaceae
Leucas mollis	Lamiaceae
Leonotis raineriana	Labiateae
Ociumum basilicum	Lamiaceae
Sida ovata	Malvaceae

Table 3:-The woody vegetation identified in major grazing areas of the study districts

Scientific name	Family	Life form
Accacia hecatophylla	Fabaceae	Tree
Accacia hockii	Fabaceae	Tree
Accacia senegal	Fabaceae	Tree
Accacia seyal	Fabaceae	Tree
Balanties aegyptica	Balanitaceae	Tree
Cadaba farinosa	Cadabaceae	Tree
Combretom adenogonium	Combretaceae	Shrub
Combretom collium	Combretaceae	Shrub
Combretom molle	Combretaceae	Shrub
Crateva adansoni	Capparidaceae	Tree
Crotolaria bongenisis	Fabaceae	Shrub
Euphorbia abyssinica	Euphorbiaceae	Shrub
Ficus sur	Moraceae	Tree
Ficus sycomorus	Moraceae	Tree
Flueggea virosa	Euphorbiaceae	Tree
Grewia mollis	Tilliaceae	Tree
Grewia tenax	Tilliaceae	Tree
Gutenbergia corditolia	Asteraceae	Shrub
Indigofera brevicalyx	Fabaceae	Shrub
Lannea welwitschii	Anacordiaceae	Tree

Portulaca oleracea	Portulaceae	Shrub
Pterocarpus lucens	Fabaceae	Shrub
Rhynchosia malacaphylla	Fabaceae	Shrub
Sclerocarya birrea	Anacordiaceae	Tree
Senna septemtrinalis	Fabaceae	Shrub
Solanum nigrum	Solonaceae	Shrub
Tamaridus indica	Fabaceae	Tree
Temanalia macroptera	Combretaceae	Tree
Ximenia americana	Olacaceae	Tree
Ziziphus abyssinica	Rhamnaceae	Tree
Ziziphus spinachrstichrsti	Rhamnaceae	Tree

Table 4:- Average height (m), density (No./400m^2) and percent coverage of the woody vegetation in major grazing areas of the study districts

Scientific name	Av. H (m)	Grazing areas across districts															
		ILG		ISG		ICG		IRB		JLG		JSG		JCG		JRB	
		D	%	D	%	D	%	D	%	D	%	D	%	D	%	D	%
A. hecatophylla	4.71	13	7.7	4	2.4	1	0.6	6	3.57	0	0.00	0	0.00	0	0.00	0	0.00
A. hockii	5.5	16	9.52	8	4.76	1	0.60	1	0.60	11	6.55	16	9.52	0	0.00	4	2.38
A. senegal	4.11	2	1.19	0	0.00	0	0.00	0	0.00	6	3.57	8	4.76	0	0.00	3	1.79
A. seyal	3.88	1	0.60	1	0.60	0	0.00	0	0.00	8	4.76	4	2.38	0	0.00	0	0.00
B. aegyptica	9.12	9	5.36	5	2.98	0	0.00	0	0.00	3	1.79	0	0.00	3	1.79	4	2.38
C. farinosa	5.21	0	0.00	0	0.00	0	0.00	0	0.00	13	7.74	2	1.19	0	0.00	0	0.00
C. adenogonium	2.05	0	0.00	0	0.00	0	0.00	0	0.00	1	0.60	0	0.00	0	0.00	0	0.00
C. collium	3.4	0	0.00	0	0.00	0	0.00	0	0.00	1	0.60	1	0.60	0	0.00	1	0.60
C. molle	2.42	4	2.38	0	0.00	0	0.00	0	0.00	2	1.19	0	0.00	0	0.00	0	0.00
C. adansoni	5.53	3	1.79	2	1.19	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
C. bongenisis	1.96	0	0.00	1	0.60	0	0.00	0	0.00	1	0.60	1	0.60	0	0.00	0	0.00
E. abyssinica	1.55	0	0.00	0	0.00	0	0.00	0	0.00	1	0.60	0	0.00	0	0.00	0	0.00
F. sur	4.79	0	0.00	3	1.79	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
F. sycomorus	3.48	0	0.00	0	0.00	0	0.00	0	0.00	1	0.60	2	1.19	0	0.00	0	0.00
F. virosa	4.92	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	5	2.98	2	1.19	0	0.00
G. mollis	6.14	0	0.00	8	4.76	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
G. tenax	8.37	17	10.1	2	1.19	4	2.38	7	4.17	20	11.90	14	8.33	6	3.57	5	2.98
G. corditolia	2.12	0	0.00	0	0.00	0	0.00	0	0.00	1	0.60	2	1.19	0	0.00	0	0.00
I. brevicalyx	2.39	2	1.19	0	0.00	0	0.00	0	0.00	1	0.60	1	0.60	0	0.00	0	0.00
L. welwitschii	5.25	3	1.79	0	0.00	0	0.00	0	0.00	11	6.55	16	9.52	0	0.00	4	2.38
P. oleracea	1.31	0	0.00	0	0.00	0	0.00	0	0.00	6	3.57	8	4.76	0	0.00	3	1.79
P. lucens	1.44	1	0.60	2	1.19	0	0.00	0	0.00	8	4.76	4	2.38	0	0.00	0	0.00
R. malacaphylla	1.9	0	0.00	0	0.00	0	0.00	0	0.00	3	1.79	0	0.00	3	1.79	4	2.38
S. birrea	7.05	0	0.00	0	0.00	0	0.00	0	0.00	13	7.74	2	1.19	0	0.00	0	0.00
S. septemtrinalis	1.38	1	0.60	1	0.60	3	1.79	1	0.60	1	0.60	0	0.00	0	0.00	0	0.00
S. nigrum	3.05	0	0.00	0	0.00	0	0.00	0	0.00	1	0.60	1	0.60	0	0.00	1	0.60
T. indica	6.51	1	0.60	3	1.79	0	0.00	0	0.00	2	1.19	0	0.00	0	0.00	0	0.00
T. macroptera	10.47	1	0.60	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
X. americana	7.59	0	0.00	2	1.19	0	0.00	0	0.00	1	0.60	1	0.60	0	0.00	0	0.00
Z. abyssinica	8.23	6	3.57	3	1.79	0	0.00	0	0.00	1	0.60	0	0.00	0	0.00	0	0.00
Z. spinachrstichrsti	8.44	11	6.55	3	1.79	1	0.60	4	2.38	0	0.00	0	0.00	0	0.00	0	0.00
Total		**91**	**54.17**	**48**	**28.57**	**10**	**5.95**	**19**	**11.31**	**98**	**58.33**	**79**	**47.0**	**11**	**6.55**	**22**	**13.10**

Av. H=Average height; ILG= Less grazed area of Itang; ISG= Seasonally grazed area of Itang; ICG= Communally grazed area of Itang; IRB= River basins of Itang; JLG= Less grazed area of Jikawo; JSG= Seasonally grazed area of Jikawo; JCG= Communally grazed area of Jokawo; JRB= River basins of Jikawo; D= Density of trees/shrubs (No./ 400m^2).

Floristic composition of the herbaceous vegetation layer:-

A total of 35, 2, 2, and 6 species of grasses, legumes, sedges and non-grass herbaceous vegetation were identified in Itang district of the Nuer pastoral area (Table 1 and Table 2). Of the herbaceous species composition in the district, the grass species consisted 89.8% with the categories decreasers (highly desirable), increasers (moderately desirable) and invaders (less desirable) accounting 33.4, 48.8 and 17.8 % of the total grass species composition, respectively (Table 1). In Jikawo district, a total of 40, 3, 5 and 9 species of grasses, legumes, sedges and other non-grass herbaceous vegetation were identified (Table 1 and Table 2). Out of the total herbaceous species identified in the district, 87.8% were grasses, of which 23.3, 51.3 and 25.4% were within the categories of decreasrs, increasers and invaders, respectively (Table 2). The higher proportion of palatable species (decreasers and increasers) in the two districts was due to the dominance of Hyparrhenia species in the relatively less and moderately grazed areas. The same study conducted in the mid rift valley by Amsalu (2000) indicated that due to the influence of high proportion of Hyparrhenia species in the enclosure and seasonally grazed areas increasers constituted the highest composition (56%), of the total grasses. Moreover, this report agreed with the concept of Tainton (1981); accordingly under low grazing pressure, and good rainfall, different vegetation of the same species vary in their ability to extract their requirements from the environment. Furthermore, Amsalu (2000) stated that, in the competitive struggle for light, some plant species like Hyparrhenia, might be physiologically or morphologically better suited to intercept sufficient light to meet their requirements than others.

Table 5:- Dominant and common grass species in the study districts

Grazing areas	Districts			
	Itang		Jikawo	
	Scientific name	**% DM**	**Scientific name**	**% DM**
LG	*Andropogon schirensis*	5.51	*Eragrostis pillosa*	6.99
	Aristida micans	6.20	*Eragrostis tremula*	12.00
	Brachiaria xantholeuca	5.27	*Digitaria adscendense*	10.64
	Eleusina indica	5.90	*Hyparhhenia rufa*	35.92
	Hyparhhenia filipendula	7.53	*Pennisetum clandestinum*	23.50
	Hyparhhenia rufa	31.13	*Pennisetum glabrum*	6.35
	Panicum hochstetteri	5.22	*Tetropogon villosa*	5.47
	Pennisetum adoense	23.00	*Cenchrus mitis*	12.70
SG	*Brachiaria xantholeuca*	7.27	*Chloris gayana*	8.92
	Cynodon dactylon	10.38	*Eragrostis tremula*	10.43
	Eragrostis tremula	9.62	*Hyparhhenia hirta*	23.69
	Eleusina multiflora	5.90	*Oryza barthi*	14.00
	Hyparhhenia filipendula	27.24	*Rhynchelytrium repense*	7.49
	Pennisetum adoense	15.20	*Setaria verticillata*	8.30
	Pennisetum polystachyon	5.19	*Cenchrus mitis*	12.70
CG	*Echinochloa colunum*	25.33	*Echinochloa pyramidelis*	7.50
	Eleusina indica	16.85	*Eleusina jaegeri*	9.85
	Eragrostis multiplosa	13.57	*Eragrostis tremula*	16.94
	Eriochloa nubica	11.41	*Eriochloa procera*	45.21
	Lintonia nutans	8.63	*Pennisetum glabrum*	7.11
RB	*Cynodon dactylon*	9.04	*Cynodon dactylon*	8.14
	Echinochloa pyramidelis	37.00	*Echinochloa pyramidelis*	15.10
	Eleusina jaegeri	13.80	*Eriochloa procera*	9.52
	Pennisetum glabrum	25.09	*Pennisetum glabrum*	30.00
	Setaria verticillata	16.55	*Setaria verticillata*	22.50

LG= Less grazed; SG = Seasonally grazed; CG = Communally grazed; RB = River basins; Dominant (> 20% of DM); Common (<5% and > 20% of DM)

Indicators of heavy grazing such as *Pennisetum glabrum* and Setaria verticillata were the dominant grass species in the river basins of the districts while in the communally grazed areas of Itang, Eluesin indica and that of Jikawo, *Eragrostis termula* and *Pennisetum glabrum*, were common (Table 1). In the heavily grazed areas, relatively highly desirable grass species such as *Cenchrus mitis, Chloris gayana, Brachiaria semiundulata* and *Panicum* species were non-existent. On the other hand, these desirable species were observed and common in the less grazed and seasonally grazed areas. This vegetation community change would be attributed due to the high intensity of grazing pressure in the communally grazed and river banks. In agreement with Amsalu (2000), Amsalu and Baars (2002), Abule et al. (2005), who stated that as grazing intensity increases, the herbaceous layer changes from highly to less palatable species.

Floristic composition of woody vegetation layer:-

A total of 21 and 25 tree/shrub species were identified in Itang and Jikawo district, respectively. The woody vegetation layer in Itang district, composed of mainly *Accacia* species like *Accacia hecatophylla, Accacia hockii; Balanties aegyptica; Grewia* species such as *Grewia mollis* and *Grewia tenax;* and from *Ziziphus species, Ziziphus abysinica and Ziziphus spinachrstichrsti*. While *Accacia* species mainly *Accacia hockii* and *Accacia seyal; Cadaba farinosa; Combretom species;* and *Ziziphus spinachrstichrsti* were constituted in the woody vegetation layer of Jikawo. The species composition of trees/shrubs of the major grazing areas in both district were with significantly ($p<0.05$) highest score in less grazed areas followed by moderately grazed. The river basins and communally grazed areas showed no significant difference in their woody vegetation species composition score (Table 6).

There were significant ($p<0.05$) differences among the major grazing areas of the districts in terms of woody vegetation density. In Itang district, the trees/shrubs density of lass grazed and moderately grazed areas were: 379 and 300 No/ha, respectively. In the stated grazing areas of Jikawo district, the density of woody vegetation were 408 and 329 No/ha, respectively. At the periphery of the open grasslands in communally grazed and river basins, the woody vegetation density recorded were significantly ($p<0.05$) the least with < 92 No/ha (Table 6). However, the overall woody vegetation density was not beyond the equilibrium (40% cover), according to the assumption by Roques et al. (2001), to have an impact on the productivity of the herbaceous layer. In the height distribution of tree and shrub species, the proportion of individual plant species belonged to the height of lower class (< 6 m) were 74.2 and 78%, respectively in Itang and Jikawo districts while those individual plants attaining the highest height class (>9 m) were less in their proportion (i.e., 6.45 and 13.1%, respectively) for the stated districts (Table 4).

Table 6:- LSM ±SE of woody vegetation species composition and density (No./ha) in the study districts

Grazing areas	Districts			
	Itang		Jikawo	
	WSC	WD (No. /ha)	WSC	WD (No. /ha)
LG	6.83±0.17[a]	379.17±10.48[a]	7.50±0.32[a]	408.33±17.72[a]
SG	4.75±0.21[b]	300.00±12.84[b]	6.17±0.32[b]	329.17±17.72[b]
CG	0.50±0.17[c]	33.33±10.48[c]	0.67±0.32[c]	45.83±17.72[c]
RB	1.00±0.17[c]	79.17±10.48[d]	1.17±0.32[c]	91.67±17.72[d]
CV	13.20	13.62	20.40	19.85
CR	0.53	33.05	0.95	52.29

WSC = Woody species composition; WD = Woody vegetation density; LG= Less grazed; SG = Seasonally grazed; CG = Communally grazed; RB = River basins; CV = Coefficient of variation; CR = Critical range; Means with different letters in a row are significantly different ($p<0.05$).

Conclusions:-

The present findings clearly demonstrated the floristic composition of the rangeland particularly those of communally grazed and river basins that have highly affected by over grazing and invasion of unwanted species. The grazing areas have been over grazed due to overstocking. This situation has been a threat for the livelihood of the pastoral community in the districts and should be reverted through employing proper grazing systems (grassland management practices), rehabilitation and conservation. The floristic composition analysis in this study was based on a single season data where such parameters could be influenced by both spatial and temporal variations. Therefore, further studies need to be carried out on the basis of different deriving factors so as to finally produce unbiased information on the range resources and potentials.

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