SPECIES LIST AND RELATIVE DENSITIES OF SOME RANGELAND PLANT RESOURCES IN ADAMAWA STATE, NIGERIA

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ABSTRACT
The study examined the herbaceous and woody plant resources of Adamawa rangelands, northeast Nigeria. The study involved ecological surveys. The two ecological zones in the State (Guinea and Sudan savanna) were delineated. The three major range sites in the State: Gongoshi, Guyaku and Chekelek were purposively selected for this study. The checklist of the herbaceous and woody species was obtained using the Whittaker plot method. The Whittaker plot consisted of a 0.1ha plot that measures 20m by 50m. One hundred and ten (110) herbaceous plant species were identified belonging to twenty (20) families. The most common herbaceous family is the Poaceae family, followed by the Papilioniodeae and thirdly by Asteraceae. For the woody plant resources, thirty-Seven (37) species were identified belonging to sixteen (16) families. The most common woody family is the Fabaceae family, followed by the Combretaceae then Ceasalpinioideae and Moraceae respectively. Among the herbaceous plant species found in the area are Borreria verticellata, Aeschynomene indica, Ctenium newtonni, Cymbopogon giganteus, Dactyloctenium aegyptium, Desmodium scorpiurus, Eragrostis ciliaris, Cynodon dactylon, Crotalaria retusa and Brachiaria falcifera while the woody plant resources obtained in this study included Acacia erhenbergiana, Boswellia dalzielli, Daniellia oliverii, Bombax costatum, Balanites aegyptiaca, Combretum collinum, Vittelaria paradoxum and Terminalia glauscescens..It is recommended that functional laws and effective surveillance be put in place to control the incidence of wildfire and planned burning combined with reseeding of the range sites should be encouraged.
Keywords: Species list, relative density, herbaceous plants, woody plant, resources,

INTRODUCTION
Although commonly used for nomadic and transhuman pastoralism, African rangelands contain a variety of extant large and medium-sized herbivores. Their persistence is an exception in global terms. Today, the greatest concentration of large mammals in the world is said to be found in the savanna of Northern Tanzania, but this is largely an accident of colonial history. For instance, the distribution maps in Kingdon (1997), the rangelands of Eastern and Southern Africa do shelter the greatest diversity of large mammals found anywhere, although Madagascar and Ethiopia are notable for their high degree of endemism (Blench and Sommer, 1999).

Rangelands are generally characterized with low rainfall and variable climate, arid and semi-arid areas and usually situated north of the Tropic of Capricorn. The main ecosystem types are shrublands, grasslands and woodlands. Boundaries to rangelands are not clearly defined; they vary according to variation in climatic condition. Rangelands are homes to a significant number of species of animals and plants with a high value both in scientific terms and leisure (Moore, 1970). The literature uses several terms for the main world's rangelands: South American savanna, African savanna, Eurasian steppe, Indian savanna, Australian grasslands and North American prairies. It is a broader term than grasslands, encompassing areas where woody vegetation is dominant; moreover, it is a term common in texts looking at land from the viewpoint of livestock production (Bourlière, 1983; Coupland, 1993).

Ecologically sustainable management of natural resources should be the underlying principle of rangeland resources management, and the principle against which commercial use of rangeland resources must be tested. Legislative and compliance responsibility for ensuring ecologically sustainable management resides with government at all levels. However, primary responsibility for natural resource management rests with land users, in accordance with regional objectives, planning processes and relevant legislation (Australian and New Zealand Environment and Conservation Council-ANZECC, 1999).

This objective study is to paper therefore, to present the species list and relative densities of plant resources found on the Adamawa rangelands, Nigeria.

METHODOLOGY
Study Location
Adamawa State is located in the North eastern part of Nigeria. It lies between latitude 7º and 11ºN of the equator and between longitude 11º and 14ºE of the Greenwich Meridian. It shares common boundary with Taraba State in the south and west, Gombe State in the north west and Borno State to the North. Adamawa State has an international boundary with Cameroun

Republic along its eastern boarder. The State covers a land area of about 39,741km^2 (Adebayo, 1999) (Fig. 1).

Vegetation

The major vegetation formations in the State are the Guinea savanna and the Sudan savanna. Within each formation is an interspersion of thickets, tree savanna, open grass savanna and fringing forests around river valleys (Akosim *et al*., 1999).

In the Guinea Savanna Zone, the mean annual rainfall here is between 900 and 1,600mm and the rainy season lasts for about 6 – 7 months. The local government areas in this zone include Lamurde, Numan, Guyuk, Shelleng, Song, Gombi, Maiha, Fufore, Toungo, Ganye, Jada, and Mayo-Belwa. The common woody species in the zone are *Afzelia africana, Vittelaria paradoxum, Terminalia laxiflora, Terminalia glauscescens, Annona senegalensis, Burkea africana, Prosopis africana, Albizia zygia, Ficus exasperata, Pterocarpus lucens, Detarium microcarpum, Anogeissus leiocarpus, Balanites aegyptiaca, Tamarindus indica, Sclerocarya birrea, Khaya senegalensis, Ficus sycomorus, Borassus aethiopum, Boswellia dalzielli, Zizipus spina-christi, Daniella oliveri, Diospyros ellioti, Ceiba pentandra, Nauclea latifolia, Bombax costatum, Parkia biglobosa, Drypetes floribunda, Brachystegia eurycoma, Bysocarpus coccinens, Zanthoxylum zanthoxyloides, Vitex doniana, Piliostigma thonningii* and *Entada abyssinica.* The most abundant grasses in the zone are species of *Andropogon, Hyparrhenia, Panicum, Ctenium, Pennisetum, Hyparrhenia, Brachiaria* and *Aristida* (Akosim *et al*., 1999; Etukudo*et al.,* 1994).

The Sudan Savanna Zone has a mean annual rainfall ranging from 700 to 900mm and the rainy season lasts for about 3-4 months. This zone covers Gulak, Michika and northern parts of Mubi. The dominant woody plant species in this zone are *Acacia senegalensis, Acacia nilotica, Adansonia digitata, Borassus aethiopum, Zizipus spina-christi, Scelerocarya birrea* and *Terminalia avicennioides.* Species of Guinea savanna zone may be found in this zone. More abundant grass species of the zone include *Aristida longiflora, Cenchrus biflorus, Pennisetum pedicellatum* and *Eragrostis spp* (Akosim *et al.,* 1999; Etukudo *et al.,* 1994).

Study Design

The study involved ecological surveys. The survey examined the status and distribution pattern of plant resources of the study sites. The two ecological zones in the State (Guinea and Sudan savanna) were delineated. Rangeland sites representative of each zone were selected. In view of the relative size of Guinea savanna to Sudan savanna in the State, two range sites (Gongoshi in Mayo Belwa and Guyaku in Gombi LGAs) were purposively selected in the Guinea savanna and Chekelek range site in Madagali LGA was chosen in the Sudan savanna. The area of each site was determined and all the ecological investigations carried out on the selected rangeland sites.

Procedures for Ecological Field Data Collection

Evaluation of the herbaceous and woody plant resources

Examination of the Herbaceous and Woody plant resources involved the use of the Whittaker Plot method. The Whittaker plot consisted of a 0.1ha plot that measures 20m by 50m. The locations of these plots were chosen randomly. Within each plot were several sub-plots of different sizes. The largest sub-plot (C) was 20 by 5m and was in the centre of the plot. Two smaller sub-plots (B_1 and B_2) were 2 by 5m and located in two opposite corners of the plot. Finally, there were ten small sub-plots (A_1 – A_{10}) of 2 by 0.5m placed just inside the periphery of the plot. Relative density, diversity and pattern of distribution of plant resources were examined using the 2 by 0.5m plots (Plate 1). All the herbaceous plant species in the plots were counted and identified. The list of all the herbaceous plant species was made from all the plots and their relative density, frequency distribution and diversity calculated. Woody plant resources ≥ 1cm diameter at breast height (dbh) were identified and enumerated in 5m by 2m plots; those ≥ 5cm were identified in 20 by 5m plots; the ones ≥ 10cm were identified in the entire 0.1ha plot. The dbh of the species were also measured and recorded (Comiskey *et al*., 1999) (Fig. 1).

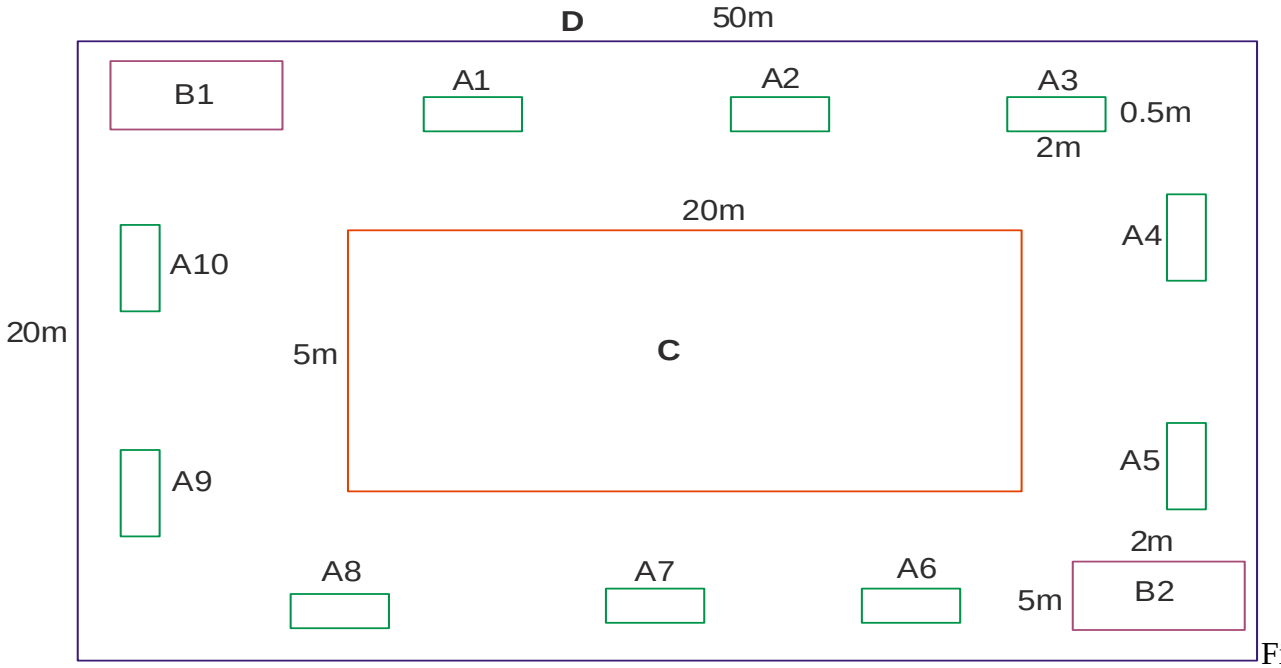

Fig. 1: Layout of the Whittaker and its Sub-Plots (Comiskey *et al*., 1999).

Data Analysis

(i) The Species list and relative densities of plant resources are presented in tabular form.

(ii) Relative density = A/B x 100/1

(A = Number of individual species; B = Number of individual of all the species)

RESULTS

Species List of Herbaceous Plant Resources in the Study Areas

Table 1 presents a checklist of herbaceous plants resources in the study areas. One hundred and ten (110) herbaceous plant species were identified belonging to twenty (20) families. The most populated is the Poaceae family, followed by the Papilioniodeae and thirdly the Asteraceae.

Table 1: Checklist of Herbaceous Plant Resources

S/N	Family	Scientific Name	Range Sites		
			Gongoshi	Guyaku	Chekelek
1.	Acanthaceae	*Hypoestes cancellata*	X	-	-
2.		*Monechma ciliatum*	X	x	x
3.	Aizoaceae	*Trianthema postulacastrum*	X	x	-
4.	Amaranthaceae	*Amaranthus spinosus*	X	x	x
5.		*Celosia leptostachya*	X	-	-
6.	Asteraceae	*Acanthopermum hispidum*	X	x	x
7.		*Ageratum conyzoides*	X	-	x
8.		*Aspiliabussei*	X	x	x
9.		*Chrysanthelium indicum*	X	x	x
10.		*Laggera aurita*	X	-	-
11.		*Sclerocarpus africanus*	X	-	-
12.		*Tridax procumbens*	X	x	x
13.		*Vernonia cinerea*	-	x	-
14.	Boraginaceae	*Heliotropium ovalifolium*	-	x	-
15.	Caryophyllaceae	*Polycarpaea corymbosa*	X	x	-
16.	Ceasalpinioideae	*Chamecrista mimosoides*	-	x	x
17.		*Senna obtusifolia*	X	x	x
18.		*Senna occidentalis*	X	x	x
19.	Cleomaceae	*Cleome viscosa*	X	-	-
20.	Commelinaceae	*Commelin abenghalensis*	x	x	x
21.		*Commelina nudiflora*	x	x	-
22.	Convolvulaceae	*Evolvulu salsioides*	-	x	-

23.	Cyperaceae	*Cyperus esculentus*	x	x	x
24.		*Cyperu siria*	x	-	x
25.		*Cyperus rotundus*	x	x	x
26.		*Fimbristylis littoralis*	x	x	-
27.		*Gomphrena celosioides*	x	-	-
28.		*Kyllinga erecta*	x	x	-
29.		*Kyllinga squamulata*	x	x	-
30.	Euphorbiaceae	*Acalypha fimbriata*	-	x	x
31.		*Euphorbia hirta*	x	x	x
32.		*Euphorbia hyssopifolia*	x	-	-
33.	Laminaceae	*Hyptis lanceolata*	x	x	x
34.		*Hyptis spicigera*	x	x	x
35.		*Hyptis suaveolens*	x	x	x
36.		*Leucas martinicensis*	x	x	x
37.		*Platostoma africanum*	-	-	x
38.	Malvaceae	*Hibiscus asper*	x	x	x
39.		*Sida acuta*	x	x	x
40.		*Sida cordifolia*	x	x	x
41.		*Sida rhombifolia*	x	x	-
42.	Papilionoideae	*Aeschynomene indica*	-	x	x
43.		*Crotalaria macrocalyx*	x	-	-
44.		*Crotalaria retusa*	x	x	x
45.		*Desmodium scopiurus*	x	x	x
46.		*Desmodium tortusom*	x	x	-
47.		*Eriosema psoraleiodes*	-	x	-
48.		*Tephrosia linearis*	x	x	x
49.		*Tephrosia pedicellata*	x	x	x
50.		*Zornia latifolia*	x	x	-
51.	Poacea	*Andropogon gayanus*	x	-	-
52.		*Acroceros zizanioides*	-	x	-
53.		*Axonepus compressus*	x	-	-
54.		*Brachiaria deflexa*	x	x	x
55.		*Brachiaria falcifera*	x	x	-
56.		*Brachiaria lata*	x	x	x
57.		*Cenchrus biflorus*	x	-	x
58.		*Cenchrus ciliaris*	x	x	x
59.		*Chloris gayana*	x	x	x
60.		*Chloris pilosa*	x	x	x
61.		*Chrysopogon aciculatus*	x	-	x
62.		*Ctenium newtonni*	x	x	x
63.		*Cymbopogongiganteus*	x	-	-
64.		*Cynodon dactylon*	x	x	x
65.		*Dactyloctenium aegyptium*	x	x	x
66.		*Digitaria gayana*	x	x	x
67.		*Digitaria horizontalis*	x	x	-
68.		*Digitaria tanata*	x	x	x
69.		*Echinochloa colona*	x	x	-
70.		*Eleusine indica*	x	x	x
71.		*Eragrosis tremula*	x	x	x
72.		*Eragrostis atrovirens*	x	x	-
73.		*Eragrostis ciliaris*	x	x	x
74.		*Eragrostis megaphylla*	-	x	-
75.		*Eragrostis tenella*	x	x	x
76.		*Eragrostis tenuebabis*	x	x	x
77.		*Hackelochloa granularis*	-	x	-
78.		*Hyparrhenia involucrata*	x	x	x
79.		*Hyparrhenia rufa*	x	x	x

80.		*Hyperthelia dissoluta*	x	x	-
81.		*Imperata cylindrica*	x	x	x
82.		*Leptochloa caerulescens*	x	-	-
83.		*Loudetia annua*	x	-	-
84.		*Loudetia arundinaceum*	x	x	-
85.		*Loudetia simplex*	x	x	x
86.		*Panicum maximum*	x	x	x
87.		*Panicum repens*	-	x	-
88.		*Paspalum conjugatum*	x	-	-
89.		*Paspalum scrobiculatum*	x	x	x
90.		*Pennisetum pedicellatum*	x	x	x
91.		*Pennisetum polystachion*	x	x	x
92.		*Pennisetum violaceum*	x	x	x
93.		*Perotis indica*	x	x	x
94.		*Rhynchelytrum repens*	x	x	x
95.		*Setaria barbata*	x	x	x
96.		*Setaria longiseta*	x	x	x
97.		*Setaria megaphylla*	x	x	x
98.		*Setaria pumila*	x	x	x
99.		*Sorghum bipennatum*	-	x	-
100.		*Sporobolus pyramidalis*	x	x	x
101.	Rubiaceae	*Borreria verticellata*	x	x	x
102.		*Mitracarpus villosus*	-	x	x
103.		*Oldenlandia herbacea*	-	x	x
104.		*Spermacoce octodon*	x	-	-
105.		*Spermacoce verticellata*	x	-	-
106.	Scrophulariaceae	*Striga hermonthica*	x	x	x
107.		*Striga senegalensis*	x	-	x
108.	Sterculiaceae	*Waltheria indica*	x	x	x
109.	Tiliaceae	*Triumfetta cordifolia*	x	-	-
110.		*Triumfetta rhomboidea*	-	x	x

Note: x = represents presence of a species; - = indicates the absence of species

Species List of Woody Plant Resources in the Study Areas

Table 2 shows a list of woody plant resources in the study areas. Thirty-Seven (37) woody plant species were identified belonging to sixteen (16) families. The most populated is the Fabaceae family, followed by the Combretaceae while two of the species belonged to the Ceasalpinioideae and Moraceae respectively.

Table 2: Checklist of Woody Plant Resources

S/N	Family	Scientific Name	Range Sites		
			Gongoshi	Guyaku	Chekelek
1.	Anacardiaceae	*Sclerocarya birrea*	-	x	x
2.	Annonaceae	*Hexalobus monopetalus*	x	-	-
3.	Balanitaceae	*Balanites aegyptiaca*	x	x	x
4.	Bombacaceae	*Bombax costatum*	x	x	-
5.	Burseraceae	*Boswellia dalzielii*	-	x	-
6.	Caesalpinioideae	*Isoberlinia doka*	x	-	x
7.		*Isoberlinia tomentosa*	-	-	x
8.	Combrataceae	*Guierra senegalensis*	x	-	x
9.		*Anogeissus leiocarpus*	x	-	-
10.		*Combretum collinum*	-	-	x
11.		*Combretum fragrans*	-	-	x
12.		*Combretum molle*	x	x	-
13.		*Terminalia avicennioides*	x	-	x
14.		*Terminalia glaucescens*	x	x	x
15.		*Terminalia laxiflora*	x	x	-
16.		*Terminalia mollis*	x	-	-

17.	Ebenaceae	*Diospyros mespiliformis*	x	-	-
18.	Fabaceae	*Acacia dudgeoni*	-	x	x
19.		*Acacia erhenbergiana*	x	x	x
20.		*Acacia erythrocalyx*	-	-	x
21.		*Acacia nilotica*	-	x	x
22.		*Acacia senegalensis*	x	-	-
23.		*Afzelia africana*	x	-	-
24.		*Albizia zygia*	x	x	-
25.		*Daniellia oliveri*	x	x	-
26.		*Detarium microcarpum*	x	x	-
27.		*Ptericarpus lucens*	-	x	x
28.		*Parkia biglobosa*	-	x	-
29.	Leguminoseae	*Prosopis africana*	-	x	-
30.	Meliaceae	*Khaya senegalensis*	-	x	-
31.	Mimosoideae	*Burkea africana*	x	-	-
32.	Moraceae	*Ficus sycomorus*	-	-	x
33.		*Ficus exasperata*	-	x	-
34.	Sapotaceae	*Vitellaria paradoxum*	x	x	-
35.	Sterculiaceae	*Sterculia setigera*	x	-	-
36.	Tamaricaceae	*Tamarindus indica*	-	-	x
37.	Verbenaceae	*Vitex doniana*	x	x	x

Note: x = represents presence of a species; - = indicates the absence of species

Relative density of herbaceous plant species in the study areas

The relative density of herbaceous plant resources in the study areas shown in Table 3 indicated that *Setaria pumila* had the highest relative density when compared to the other species in the three range sites with 0.1080, 0.1425 and 0.0873, followed by *Tephrosia pedicellata* with 0.0638, 0.0777 and 0.0660 respectively. In Gongoshi range site, *Sporobolus pyramidalis* followed *Setariapumila* (0.1080) with a relative density of 0.0676 while *Tephrosia pedicellata* and *Brachiariadeflexa* had 0.0638 and 0.0634 respectively. In Guyaku range site, *Hibiscus asper*, *Senna occidentalis*and *Vernonia cinerea* have the lowest relative density of 0.0003 while *Setariapumila*has the highest relative density of 0.01425. In Chekelek range site, the relative density of the herbaceous plant species ranged from 0.0003 for *Hyptis suaveolens*, *Monechma ciliatum* and *Striga senegalensis* to 0.0873 for *Setaria pumila*.

Table 3: Relative Density of Herbaceous Plant Species at Gongoshi, Guyaku and Chekelek Range Sites

S/N	Scientific Name	Range Site		
		Gongoshi	Guyaku	Chekelek
1.	*Acalypha fimbriata*	-	0.0007	0.0127
2.	*Acanthospermum hispidum*	0.0009	0.0021	0.0012
3.	*Acroceros zizanioides*	-	0.0007	-
4.	*Aeschynomene indica*	-	0.0034	0.0003
5.	*Ageratum conyzoides*	0.0004	-	0.0046
6.	*Amaranthus spinosus*	0.0046	0.0024	0.0012
7.	*Andropogon gayanus*	0.0002	-	-
8.	*Aspilia bussei*	0.0004	0.0007	0.0006
9.	*Axonepus compressus*	0.0013	-	-
10.	*Borreria verticellata*	0.0018	0.0034	0.0012
11.	*Brachiaria deflexa*	0.0634	0.0771	0.0568
12.	*Brachiaria falcifera*	0.0118	0.0095	-
13.	*Brachiaria lata*	0.0472	0.0327	0.0429
14.	*Celosia leptostachya*	0.0013	-	-
15.	*Cenchrus biflorus*	0.0015	-	0.0006
16.	*Cenchrus ciliaris*	0.0190	0.0140	0.0123
17.	*Chamecrista mimosoides*	-	0.0014	0.0009
18.	*Chloris gayana*	0.0258	0.0065	0.0185
19.	*Chloris pilosa*	0.0348	0.0344	0.0253
20.	*Chrysanthelium indicum*	0.0004	0.0014	0.0006
21.	*Chrysopogon aciculatus*	0.0039	-	0.0019
22.	*Cleome viscosa*	0.0002	-	-
23.	*Commelina benghalensis*	0.0018	0.0034	0.0085
24.	*Commelina nudiflora*	0.0020	0.0024	-
25.	*Crotalaria macrocalyx*	0.0009	-	-
26.	*Crotalaria retusa*	0.0031	0.0034	0.0099
27.	*Ctenium newtonni*	0.0024	0.0085	0.0080
28.	*Cymbopogon giganteus*	0.0007	-	-
29.	*Cynodon dactylon*	0.0035	0.0072	0.0111
30.	*Cyperus esculentus*	0.0042	0.0024	0.0040
31.	*Cyperus iria*	0.0035	-	0.0009
32.	*Cyperus rotundus*	0.0284	0.0256	0.0231
33.	*Dactyloctenium aegyptium*	0.0547	0.0546	0.0426
34.	*Desmodium scopiurus*	0.0050	0.0021	0.0043
35.	*Desmodium tortusom*	0.0007	0.0014	-
36.	*Digitaria gayana*	0.0529	0.0488	0.0321
37.	*Digitaria horizontalis*	0.0094	0.0191	-
38.	*Digitaria tanata*	0.0184	0.0089	0.0608
39.	*Echinochloa colona*	0.0028	0.0048	-
40.	*Eleusine indica*	0.0345	0.0300	0.0460
41.	*Eragrostis atrovirens*	0.0011	0.0010	-
42.	*Eragrostis ciliaris*	0.0128	0.0246	0.0049
43.	*Eragrostis megaphylla*	-	0.0031	-
44.	*Eragrostis tenella*	0.0050	0.0055	0.0022
45.	*Eragrostis tenuebabis*	0.0271	0.0150	0.0290
46.	*Eragrostistremula*	0.0245	0.0167	0.0228
47.	*Eriosema psoraleiodes*	-	0.0010	-
48.	*Euphorbia hirta*	0.0020	0.0010	0.0022
49.	*Euphorbia hyssopifolia*	0.0004	-	-
50.	*Evolvulus alsioides*	-	0.0007	-
51.	*Fimbristylis littoralis*	0.0011	0.0014	-
52.	*Gomphrena celosioides*	0.0026	-	-
53.	*Hackelochloa granularis*	-	0.0007	-
54.	*Heliotropium ovalifolium*	-	0.0007	-
55.	*Hibiscus asper*	0.0004	0.0003	0.0009
56.	*Hyparrhenia involucrata*	0.0022	0.0048	0.0034
57.	*Hyparrhenia rufa*	0.0031	0.0027	0.0046
58.	*Hyperthelia dissoluta*	0.0018	0.0048	-
59.	*Hypoestes cancellata*	0.0002	-	-
60.	*Hyptis lanceolata*	0.0002	0.0010	0.0009
61.	*Hyptis spicigera*	0.0020	0.0021	0.0019
62.	*Hyptis suaveolens*	0.0026	0.0010	0.0003
63.	*Imperata cylindrica*	0.0011	0.0021	0.0009
64.	*Kyllinga erecta*	0.0035	0.0007	-
65.	*Kyllinga squamulata*	0.0142	0.0034	-
66.	*Laggera aurita*	0.0007	-	-
67.	*Leptochloa caerulescens*	0.0020	-	-
68.	*Leucas martinicensis*	0.0055	0.0147	0.0068
69.	*Loudetia annua*	0.0094	-	-

70.	*Loudetia arundinaceum*	0.0004	0.0010	-
71.	*Loudetia simplex*	0.0262	0.0215	0.0497
72.	*Mitracarpus villosus*	-	0.0051	0.0176
73.	*Monechma ciliatum*	0.0018	0.0010	0.0003
74.	*Oldenlandia herbacea*	-	0.0010	0.0123
75.	*Panicum maximum*	0.0007	0.0007	0.0012
76.	*Panicum repens*	-	0.0010	-
77.	*Paspalum conjugatum*	0.0002	-	-
78.	*Paspalum scrobiculatum*	0.0004	0.0024	0.0022
79.	*Pennisetum pedicellatum*	0.0068	0.0113	0.0074
80.	*Pennisetum polystachion*	0.0011	0.0024	0.0006
81.	*Pennisetum violaceum*	0.0004	0.0014	0.0015
82.	*Perotis indica*	0.0034	0.0039	0.0065
83.	*Platostoma africanum*	-	-	0.0043
84.	*Polycarpaea corymbosa*	0.0004	0.0007	-
85.	*Rhynchelytrum repens*	0.0195	0.0256	0.0207
86.	*Sclerocarpus africanus*	0.0004	-	-
87.	*Senna obtusifolia*	0.0133	0.0194	0.0250
88.	*Senna occidentalis*	0.0009	0.0003	0.0015
89.	*Setaria barbata*	0.0151	0.0133	0.0025
90.	*Setaria longiseta*	0.0267	0.0133	0.0111
91.	*Setaria megaphylla*	0.0085	0.0171	0.0309
92.	*Setaria pumila*	0.1080	0.1425	0.0873
93.	*Sida acuta*	0.0090	0.0061	0.0099
94.	*Sida cordifolia*	0.0028	0.0034	0.0006
95.	*Sida rhombifolia*	0.0004	0.0028	-
96.	*Sorghum bipennatum*	-	0.0007	-
97.	*Spermacoce octodon*	0.0013	-	-
98.	*Spermacoce verticellata*	0.0002	-	-
99.	*Sporobolus pyramidalis*	0.0676	0.0661	0.0778
100.	*Striga hermonthica*	0.0031	0.0010	0.0022
101.	*Striga senegalensis*	0.0004	-	0.0003
102.	*Tephrosia linearis*	0.0321	0.0232	0.0349
103.	*Tephrosia pedicellata*	0.0638	0.0777	0.0660
104.	*Trianthema postulacastrum*	0.0009	0.0014	-
105.	*Tridax procumbens*	0.0004	0.0010	0.0006
106.	*Triumfetta cordifolia*	0.0004	-	-
107.	*Triumfetta rhomboidea*	-	0.0014	0.0056
108.	*Vernonia cinerea*	-	0.0003	-
109.	*Waltheria indica*	0.0050	0.0007	0.0053
110.	*Zornia latifolia*	0.0050	0.0021	-
	Total	1.0010	0.9948	0.9995

Relative density of woody species

The relative density of woody plant resources ranged from 0.0196 to 0.1569 with the lowest shown by *Acacia erhenbergiana, A. senegalensis, Afzelia africana,* and *Terminalia avicennioides* (0.0196) and highest shown by *Balanites aegyptiaca* (0.1569). Others are *Isoberlini adoka, Terminalia glaucescens* and *Terminalia laxiflora* with relative densities of 0.0784 each at Gongoshi. In Guyaku range site, *Balanites aegyptiaca* had the highest relative density of 0.1667 followed by *Acacia erhenbergiana* and *Ficus exasperata* with 0.0833 each. *Acacia dudgeoni, Boswellia dalzielli, Combretum molle, Detarium microcarpum, Khaya senegalensis, Parkia biglobosa, Ptericarpuslucens, Vittelaria paradoxum* and *Vitex doniana* had the lowest relative densities of 0.0278 each. At Chekelek range site, the relative densities of woody plant species ranged from 0.0286 to 0.1143 with the highest shown by *Acacia nilotica* (0.1143) followed by *Acacia dudgeoni, Acacia erhenbergiana, Acacia erythrocalyx, Balanites aegyptiaca* and *Ptericarpus lucens* with 0.0857 each. *Combretum collinum, C. fragrans, Ficus sycomorus, Tamarindus indica* and *Vitex doniana* had the lowest relative densities of 0.0286 each (Table 4).

Table 4: Relative Density of Woody Plant Resources at the Range Sites

S/N	Scientific Name	Range Site		
		Gongoshi	Guyaku	Chekelek
1.	*Acacia dudgeon*	-	0.0278	0.0857
2.	*Acacia erhenbergiana*	0.0196	0.0833	0.0857
3.	*Acacia erythrocalyx*	-	-	0.0857
4.	*Acacia nilotica*	-	0.0278	0.1143
5.	*Acacia senegalensis*	0.0196	-	-
6.	*Afzelia africana*	0.0196	-	-
7.	*Albizia zygia*	0.0196	0.0278	-

8.	*Anogeissus leiocarpus*	0.0196	-	-
9.	*Balanites aegyptiaca*	0.1569	0.1667	0.0857
10.	*Bombax costatum*	0.0588	0.0278	-
11.	*Boswellia dalzielii*	-	0.0278	-
12.	*Burkea africana*	0.0588	-	-
13.	*Combretum collinum*	-	-	0.0286
14.	*Combretum fragrans*	-	-	0.0286
15.	*Combretum molle*	0.0196	0.0278	-
16.	*Daniellia oliveri*	0.0392	0.0556	-
17.	*Detarium microcarpum*	0.0588	0.0278	-
18.	*Diospyros mespiliformis*	0.0196	-	-
19.	*Ficus exaperata*	-	0.0833	-
20.	*Ficus sycomorus*	-	-	0.0286
21.	*Guiera senegalensis*	0.0392	-	0.0571
22.	*Hexalobus monopetalus*	0.0392	-	-
23.	*Isoberlinia doka*	0.0784	-	0.0286
24.	*Isoberlinia tomentosa*	-	-	0.0571
25.	*Khaya senegalensis*	-	0.0278	-
26.	*Parkia biglobosa*	-	0.0278	-
27.	*Prosopis africana*	-	0.0556	-
28.	*Ptericarpus lucens*	-	0.0278	0.0857
29.	*Sclerocarya birrea*	-	0.0556	0.0571
30.	*Sterculia setigera*	0.0196	-	-
31.	*Tamarindus indica*	-	-	0.0286
32.	*Terminalia avicennioides*	0.0196	-	0.0571
33.	*Terminalia glaucescens*	0.0784	0.0833	0.0571
34.	*Terminalia laxiflora*	0.0784	0.0833	-
35.	*Terminalia mollis*	0.0588	-	-
36.	*Vittelaria paradoxum*	0.0588	0.0278	-
37.	*Vitex doniana*	0.0196	0.0278	0.0286

DISCUSSION

The composition of plant species at the three sites for both herbaceous and woody layers is typical of the savanna ecosystem. However, the result at the herbaceous layer indicated a decline in the number of species at the three sites when compared with the 101 herbaceous plant species inventoried by Akosim *et al*. (2004) in the study area. Records of the herbaceous plant species in this study showed that Gongoshi recorded 94 species while Guyaku and Chekelek recorded 88 and 70 species respectively. The results are indicative of a progressive decline in herbaceous plant composition from the guinea savanna to sudan savanna ecosystems of the State. This finding is consistent with the report of the Natural Resources Conservation Council of Nigeria-NRCCN (1992).

Results of woody plant species composition and relative abundance indicated a fair representativeness of guinea and sudan savanna woody plant species and relatively equal distribution of individuals among the species. The total number of woody plant species at each site; 22 for Gongoshi, 20 for Guyaku and 17 for Chekelek may not be unconnected with the size of the sites and the ecological factors operative at the sites. Archer *et al*. (1996) reported that the size of an area could be a factor that determines the species richness of an area. Furthermore, most of the woody plant species are significant as food resources for both livestock and wildlife species and thus add value to the range sites.

CONCLUSION

The study presented a checklist of some herbaceous and woody plant resources of Adamawa rangelands. The findings indicated adequate representation of herbaceous forage species of the savanna ecosystem on the three range sites including their relative densities. A hundred and ten (110) herbaceous plant species and thirty-seven (37) woody plant species were identified. Among the herbaceous plant species found in the area were *Aeschynomene indica, Ctenium newtonni, Cymbopogon giganteus, Dactyloctenium aegyptium, Desmodium scorpiurus, Eragrostis ciliaris, Cynodon dactylon, Crotalaria retusa and Brachiaria falcifera* while the woody plant resources obtained in this study included *Acacia*

erhenbergiana, Boswellia dalzielli, Daniellia oliverii, Bombax costatum, Balanites aegyptiaca, Combretum collinum and *Vittelaria paradoxum.* The sustainable utilization of the forage resources of the range sites should be of topmost priority. This will go along way in improvement the range sites and alleviating the livelihood of the common man. In this case, the pastoralist and their livestock because their day-to-day activities depends on the future of rangelands.

RECOMMENDATIONS

In view of the foregoing, the following recommendations are made:

i. Proper grazing plan that should take into consideration the carrying capacity of the range sites should be developed.
ii. Functional laws and effective surveillance should be put in place to control the incidence of wildfire.
iii. Planned burning combined with reseeding of the range sites should be carried out to improve on the composition and abundance of forage resources of the rangelands.
iv. Pests and diseases control should be carried out on the range sites.

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