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Floristic Enumeration and Taxonomic Profile of Rupicolous Species of Naraguta Mountain Jos Plateau State Nigeria

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----------ABSTRACT----------

A survey was conducted between March to December 2020 to determine the floristic diversity and taxonomic profile of rupicolous species of Naraguta mountain. Ten (10) plots of (20 m x 20 m) were surveyed at sub-Montane and Montane altitude of the sites. All woody plants with a stem diameter of 3 cm at breast height (DBH) in the plots were identified. Three 1m x 1m quadrat was established in each (20 m x 20 m) for inventory of herbs and grasses. One thousand five hundred and seventy one (1571) plants species distributed in 43 families were encountered. The most abundant families were, Papilionoideae, Rubiaceae, Sapindaceae and caesalpinioideae. Consequently the most occurring families of herbaceous plants occurred in decreasing order were, Asteraceae, Acanthaceae and Malvaceae. On the other hand, the percentage of grass covered was less than twenty five percent (<25%) and the most abundant grass species were, Sporobolus pyramidalis, Hyperrhenia rufa, Setaria spp. Plant diversity and distribution were affected by altitude and anthropogenic activities. The results showed that plant species diversity and abundance was higher in the lower strata compared to that of lower strat, this could be attributed to human disturbance, available ground water and soil particles from weathering of rocks which makes soil minerals readily available for plants within this stratum.

Keywords: Inventory, Plant diversity,Habitat, Nomenclature, Rocky out crops,Naraguta Mountain.

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I. INTRODUCTION

The Naraguta Mountains is one of the major mountains in the central region of Nigeria with typical Guinean savannah vegetation. These mountains formed the major part of the Jos Plateau mountain range which are sources of several rivers that flow in the northern part of the country. There was a proposal in 1996 for some part of the mountains to be gazetted as protected area. However, due to insufficient data and changes in government regimes and policies, the idea was abandoned. The area has been under a lot of anthropogenic pressures especially in the last few years owing to an increase in population due to rural – urban migration, agricultural activities and other factors like insurgency in the North-east region of Nigeria resulting in a lot of inflow of persons to the central region (Rufford, 2015).

Therefore, floristic inventory and diversity assessments are necessary to understand the present diversity status of the Naraguta Mountains forest biodiversity. It is essential for human survival, economic well being, for ecosystem function and stability (Singh, 2002).The total number of species available on the earth is not determined yet however, it is estimated that the total number of animal and plant species could be between 13 and 14 million (Heywood, 1995). Conservation biologists warn that 25 percent of all species could become extinct during the next twenty to thirty years (Khera *et al*.,2001). The causes for the loss of species are numerous but the most important is the loss and fragmentation of natural habitats. One of the foundations for conservation of biological diversity in forest landscapes is understanding and managing the disturbance regimes of a landscape (Spies and Turner, 1999). Many forests are under great anthropogenic pressure and require management intervention to maintain the overall biodiversity, productivity and sustainability (Kumar *et al*., 2002). Understanding species diversity and distribution patterns is important to evaluate the complexity and resources of these forests (Kumar *et al*.,2006). Floristic inventory is a necessary prerequisite for much

fundamental research in tropical community ecology, such as modeling patterns of species diversity or understanding species distributions (Phillips *et al*.,2003). Many floristic diversity studies have been conducted in different parts of world. Majority of studies focus on inventory (Whittaker and Niering,1965; Risser and Rice, 1971; Gentry,1988; Linder *et al.*, 1997; Chittibabu and Parthasarathy,2000; Sagar *et al*.,2003;Padalia *et al*.,2004; Appolinario *et al*., 2005). Apart from inventory, disturbance intensity on regeneration, (Kennard *et al*.,2002; Denslow, 1995), phenological assessment (Frankie *et al*., 1974), comparison of tree species diversity (Pitman *et al*. ,2002), monitoring (Sukumar *et al*.,1992), species area and species individual relationship (Condit *et al*., 1996) have also been studied through floristic analysis. Thus, it is clear that floristic studies are undertaken by many researchers worldwide at different levels following variety of sampling and measurement techniques based on their objectives.

II. MATERIALS AND METHODS

Figure 1: Map of Nigeria showing Plateau State and study area (Naraguta area)

Study Site

The study was carried out on the Naraguta mountains ($9^0$59'8'' N, $8^0$54'0'' East) which has an elevation of about 1287 m above sea level. It lies within the central Guinea savanna zone classified as woodland savanna vegetation with under-story dominated by grasses (Keay, 1953). The area is characterized by Koppen classification, with an elevation of 1289 meters.

The area experiences a mean annual rainfall of 1260 mm (1050 – 1403 mm) peaking between July and August and the mean temperature ranges from 19.4^0C – 24.5^0C (Okpara *et al*, 2015). The topography is undulating sloping, generally towards different direction in different locations.

Naraguta Mountains is 4.219 feet/1.286 m mountain near Jos Plateau State Nigeria based on Peakery data, it ranks as the 3rd highest mountain in plateau state and 35th highest mountain in Nigeria (Mbneli, 2016).

Establishment of the Sampling Site and Plant Inventory

Ten 20 m x 20 m quadrats were established in the South eastern portion of Naraguta mountains. All woody plants with a stem diameter of 3 cm at breast height inside the quadrat were identified. 1m x 1m subplot was laid inside each 20 m x 20 m quadrat for the inventory of herbs and grasses..The plant specimens were identified using Flora of West Tropical Africa and Taxonomic literature. Samples of species that were not identified in the field were sent to Forest Herbarium Ibadan (FHI), Forestry Research Institute of Nigeria for identification.

III. RESULTS AND DISCUSSION

Taxonomic Profile

Table I: Species Diversity under families

Family	Number
Families with 1 – 5 species	=75
Families with 6 – 10 species	=17
Families with 11 – 15 species	=8
Families with 16 – 20 species	=4
Families 21 – 25 species	=6
Families with 26 – 30 species	=4
Families with 31 – 50 species	=2
Families with 51–200 species	=8

From the table I families with 1 – 5 species have the highest species diversity. Families with 31 – 50 species have the lowest.

Table 2: Generic Diversity Under Families

Genus	Number
Families with 1 – 2 Genera	=26
Families with 3 – 4 Genera	=7
Families with 5 – 6 Genera	=3
Families with 7 – 8 Genera	=4
Families with 9 – 10 Genera	=3

From the table 2, family which have 1 – 2 genera have the highest generic diversity. While families which have 5 – 6 & 9 – 10 genera have the lowest generic diversity.

Table 3: Species diversity under genera

Species	Number
Genera with 1 – 2 species	92
Genera with 3 – 4 species	5
Genera with 5 – 6 species	-
General with 7 – 8 species	1
Genera with 9 – 10 species	-

From the table 3 the genera which have 1 – 2 species have the highest diversity. While genera with 7 – 8 species have lowest.

Table 4: Ten dominant genera in Naraguta Mountain

S/N	Names of Genera	Number of species
1	Ficus	7
2	Combretum	4
3	Lannea	4
4	Ochna	3
5	Terminalia	3
6	Senna	3
7	Bridelia	2
8	Keetia	2
9	Entanda	2
10	Ekebergia	2

From the table 4, Ficus has the highest number of species

IV. RESULTS

Table 5: Status of different group of plant in Naraguta Mountain

Name of the groups	Family	Genera	Species
Angiosperm	44	95	127
Dicots	42	91	123
Monocots	1	5	6
Gymnosperm	-	-	-
Pteridophyta	1	2	8

From the table 5, the group of Angiosperm have the highest number of families, genera and species.

$$H = -\sum_{i=1}^{s} p_i \ln p_i$$

Shannon wiener Diversity index of Woody Plant was 3.75 while the diversity of Herbs was 1.88

Table 6: Comparative diversity of Woody species, Herbaceous species and Grass cover

	Woody plants	Herbs	% Grass Cover
Total	120	68	6 species
Shannon wiener Diversity	3.75	1.88	<25%

Table 6 shows the distribution of the different habits.

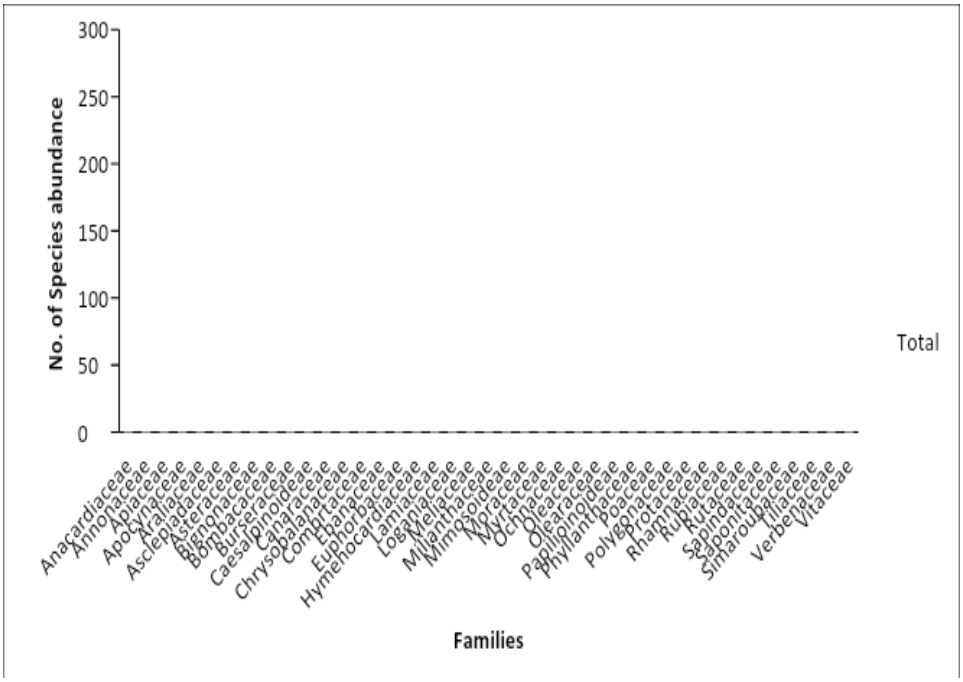

Figure 2: Family abundance of woody trees

From the figure2 above, the family Papilioniodeae has the highest number of speices abundance while the family Proteaceae has the lowest

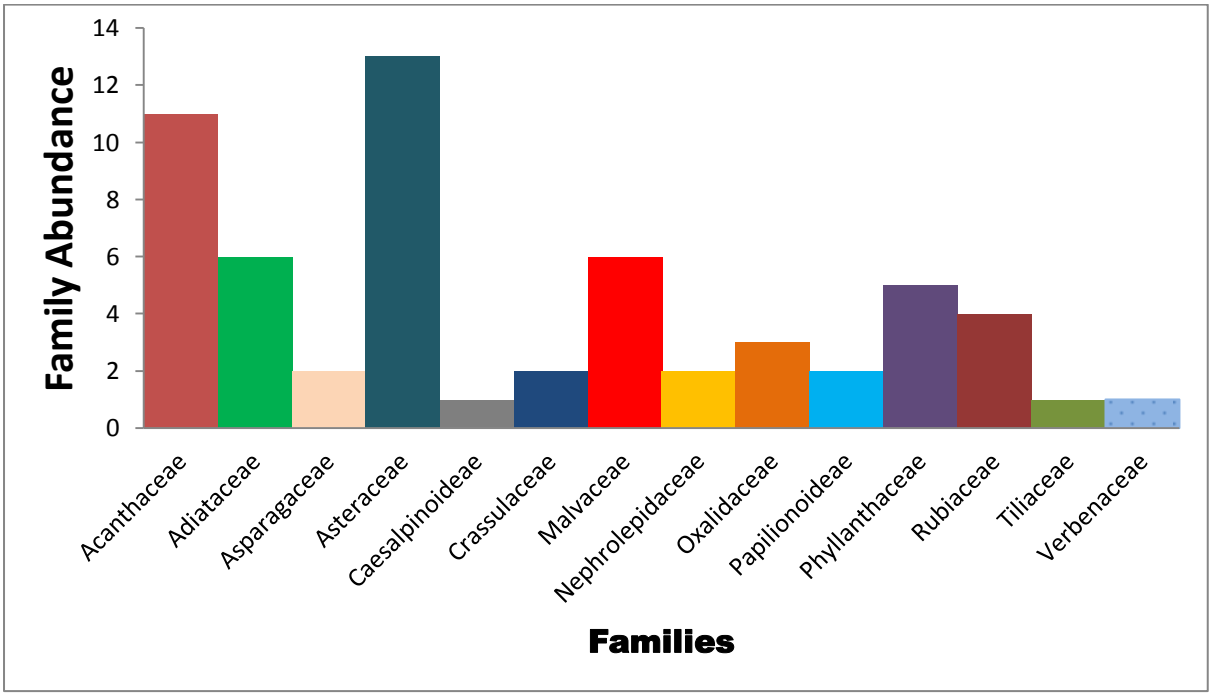

Figure: 3 Family abundance of herbs

From the figure3 above, the family Asteraceae has the highest number of species abundance, while the family Tiliaceae has the lowest.

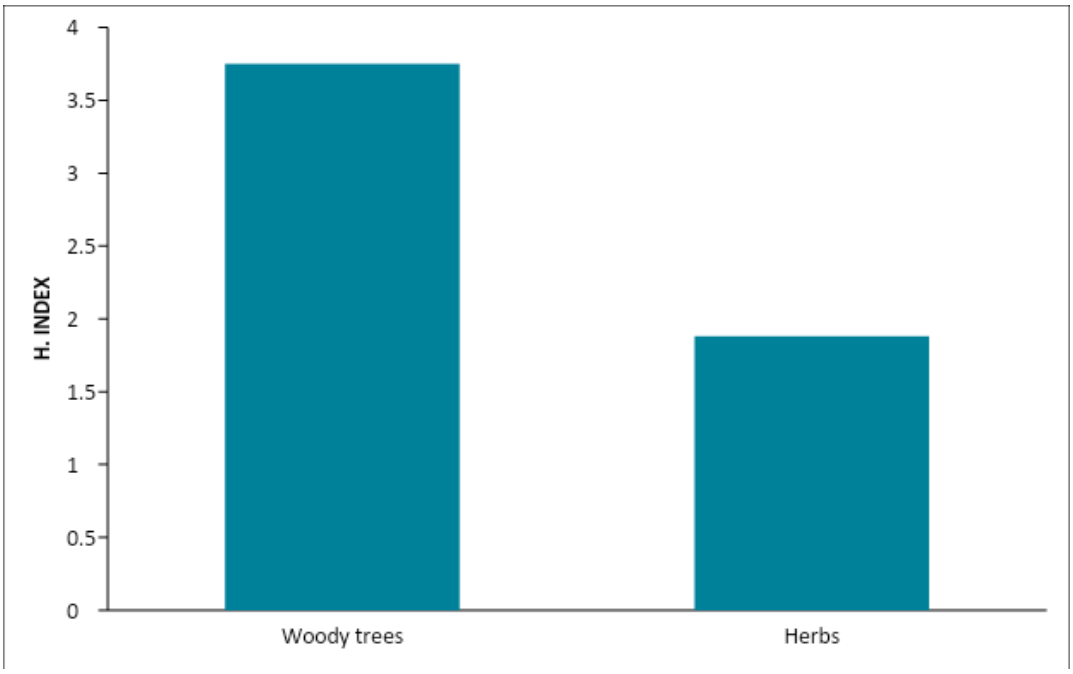

Figure 4: Shannon Weiner diversity index of Species

Table 7: Percentage grass cover

S/N	Plot	Grass species	%Cover
1	*3*	*Sporobolus pyramidalis Beauv.*	*<25%*
2	*4*	*Setaria pumila (Poir.) Roem. & Schult.*	*<25%*
3	*5*	*Hyparrhenia rufa (Nees) Stapf*	*<25%*
4	*5*	*Andropogon gayanus Kunth*	*<25%*
5	*9*	*Setaria spp .Beauv.*	*<25%*
6	*10*	*Setaria barbata (Lam.) Kunth*	*<25%*

Table 8; List of herbaceous plants & their families

S/N	*Family*	*Species*	*Frequency*
1	Adiantaceae	Adiantum philippense L.	6
2	Asteraceae	Ageratum conyzoides L.1753.	2
3	Asparagaceae	Asparagus africanus Lam.	1
4	Asparagaceae	Asparagus officinalis L.	1
5	Asteraceae	Aspilia africana (Pers.) C.D.Adams	5
6	Acanthaceae	Asystasia gangetica (L.) T.Anderson	1
7	Asteraceae	Bidens pilosa L.1753	2
8	Oxalidaceae	Biophytum sensitivum (L.) DC.	3
9	Asteraceae	Crassocephalum rubens (Juss. ex Jacq.) S. Moore	2
10	Papilionoideae	Crotalaria spp L.	2
11	Rubiaceae	Hexasepalum teres (Walter) J.H.Kirkbr.	1
12	Asteraceae	Guizotia spp.Cass. 1829	1
15	Acanthaceae	Justicia flava (Vahl) Vahl	2
16	Acanthaceae	Justicia insularis T. Anders	4
17	Crassulaceae	Brillantaisia owariensis P.Beauv.	2
18	Rubiaceae	Sabicea brevipes Wernham	1
19	Nephrolepidaceae	Nephrolepis exaltata (L.) Scott	2
20	Lamiaceae	Ocimum spp. L.	1
21	Acanthaceae	Phaulopsis falcisepala C.B.Clarke	4
22	Phyllanthaceae	Phyllanthus spp L.	5
23	Caesalpinoideae	Cassia mimosoides L.	1
24	Malvaceae	Sida urens Linn.	5
25	Rubiaceae	Spermacoce ocymoides. Burm.f.	1
26	Rubiaceae	Spermacoce spp L.	1
27	Tiliaceae	Triumfetta rhomboidea Jacq.	1
28	Asteraceae	Vernonia perrottetii Sch. Bip.	1
29	Malvaceae	Waltheria indica L.	1
		Grand Total	*59*

From the table 8, the family Adiataceae has the highest number of species abundance.

Table9: List of Woody Species and their families

S/N	*Family*	*Species*	*Frequency*
1	*Papilioinoideae*	*Adenodolichos paniculatus (Hua) Hutch.*	*199*
2	*Caesalpinoideae*	*Afzelia africana Sm.*	*1*
3	*Caesalpinoideae*	*Albizia zygia. (DC.) J.F.Macbr.*	*2*
4	*Sapindaceae*	*Allophylus africanus P. Beauv.*	*8*
5	*Sapindaceae*	*Allophylus spicatus (Poir.) Radlk.*	*74*
6	*Annonaceae*	*Annona senegalensis Pers.*	*69*
7	*Combretaceae*	*Anogeissus leiocarpa (DC.) Guill. & Perr.*	*3*
8	*Meliaceae*	*Bersama abyssinica Fresen.*	*23*
9	*Bombacaceae*	*Bombax costatum Pellegr. & Vuill.*	*67*
10	*Burseraceae*	*Boswellia dalzielii Hutch.*	*2*
11	*Euphorbaceae*	*Bridelia ferruginea Benth.*	*7*
12	*Euphorbaceae*	*Bridelia scleroneura Müll.Arg.*	*3*
13	*Burseraceae*	*Canarium schweinfurthii Engl.*	*1*
14	*Apocynaceae*	*Carissa spinarum L.*	*2*
15	*Caesalpinoideae*	*Cassia arereh Delile.*	*1*
16	*Asclepiadaceae*	*Cecropia yorubana Schltr.*	*1*
17	*Vitaceae*	*Cissus populnea Guill. & Perr.*	*11*
18	*Rutaceae*	*Clausena anisata (Willd.) Hook.f. ex Benth.*	*9*
19	*Rubiaceae*	*Clerodendron capitatum (Willd)*	*92*
20	*Combretaceae*	*Combretum fragrans F.Hoffm.*	*2*
21	*Combretaceae*	*Combretum molle R.Br. ex G.Don.*	*8*
22	*Combretaceae*	*Combretum nigricans Lepr.*	*1*
23	*Combretaceae*	*Combretum spp Loefl.*	*3*
24	*Araliaceae*	*Cussonia arborea Hochst. ex*	*34*
25	*Caesalpinoideae*	*Daniellia oliveri (Rolfe) Hutch. & Dalziel*	*3*
26	*Papilioinoideae*	*Desmodium velutinum (Willd.) DC.*	*29*
27	*Mimosoideae*	*Dichrostachys cinerea Wight et Arn.*	*23*
28	*Ebanaceae*	*Diospyros mespiliformis Hochst. ex A. DC.*	*3*
29	*Meliaceae*	*Ekebergia capensis Sparrm*	*2*
30	*Meliaceae*	*Ekebergia senegalensis A Juss.*	*1*
31	*Mimosoideae*	*Entada abyssinica Steud. ex A. Rich.*	*15*
32	*Mimosoideae*	*Entada africana - Guill. & Perrott.*	*25*
33	*Papilioinoideae*	*Erythrina senegalensis DC.*	*2*
34	*Papilioinoideae*	*Erythrina sudanica Baker ,f.*	*2*
35	*Moraceae*	*Ficus abutilifolia (Miq.) Miq.*	*1*
36	*Moraceae*	*Ficus citrifolia Mill.*	*2*
37	*Moraceae*	*Ficus glumosa Delile*	*15*
38	*Moraceae*	*Ficus ingens (Miq.) Miq. 1867*	*1*
39	*Moraceae*	*Ficus petiolaris Kunth*	*1*
40	*Moraceae*	*Ficus sur Forssk. 1775*	*7*
41	*Moraceae*	*Ficus umbellata Vahl.*	*1*
42	*Phyllanthaceae*	*Flueggea virosa · (Roxb. ex Willd.) Royle*	*2*
43	*Tiliaceae*	*Grewia bicolor Juss.*	*4*
44	*Tiliaceae*	*Grewia venusta Fresen.*	*1*
45	*Simaroubaceae*	*Hannoa undulata (Guill.&Perr.) Planch.*	*1*
46	*Anacardiaceae*	*Heeria insignis (Delile) Kuntze.*	*2*
47	*Anacardiaceae*	*Heeria pulcherrima (Schweinf.) O. Kuntze*	*4*
48	*Apocynaceae*	*Holarrhena floribunda (G.Don) T.Durand & Schinz*	*53*
49	*Hymenocardiaceae*	*Hymenocardia acida Tul.*	*5*
50	*Olearaceae*	*Jasminum dichotomum Vahl*	*3*
51	*Olearaceae*	*Jasminum obtusifolium Baker*	*2*
52	*Rubiaceae*	*Keetia cornelia (Cham. & Schltdl.) Bridson.*	*1*
53	*Rubiaceae*	*Keetia venosa (Oliv.) Bridson*	*11*
54	*Caesalpinoideae*	*Khaya senegalensis (Desr.) A.Juss.*	*5*
55	*Asteraceae*	*Kleinia cliffordiana (Hutch.) C.D. Adams*	*3*
56	*Anacardiaceae*	*Lannea microcarpa Engl. & K. Krause*	*1*
57	*Anacardiaceae*	*Lannea schimperi (Hochst. ex. A. Rich.) Engl.*	*2*
58	*Anacardiaceae*	*Lannea spp A. Rich. in Guillem.*	*3*
59	*Anacardiaceae*	*Lannea velutina A. Rich. [family*	*8*
60	*Anacardiaceae*	*Lannea acida A. Rich.*	*1*
61	*Rubiaceae*	*Macrosphyra longistyla (DC.) Hook.f.*	*16*
62	*Papilioinoideae*	*Mucuna poggei Taub.*	*26*
63	*Phyllanthaceae*	*Margaritaria discoidea (Baill.) G.L.Webster*	*3*
64	*Ochnaceae*	*Ochna rhizomatosa (Tiegh.) Keay*	*5*
65	*Ochnaceae*	*Ochna schweinfurthiana F.Hoffm.*	*28*
66	*Ochnaceae*	*Ochna serrulata (Hochst.) Walp.*	*25*
67	*Lamiaceae*	*Ocimum spp L.*	*18*
68	*Oleaceae*	*Olax subscorpioidea Oliv.*	*5*
69	*Oleaceae*	*Opilia celtidifolia (Guill. & Perr.) Endl.*	*2*
70	*Poaceae*	*Oxytenanthera abyssinica · (A.Rich.) Munro ·*	*40*
71	*Chrysobalanaceae*	*Parinari curatellifolia Planch. ex Benth.*	*68*
72	*Mimosoideae*	*Parkia biglobosa (Jacq.) R.Br. ex G.Don*	*22*

73	*Sapindaceae*	*Paullinia pinnata L.*	*22*
74	*Papilioinoideae*	*Pericopsis laxiflora (Benth.) Van Meeuwen*	*10*
75	*Phyllanthaceae*	*Phyllanthus muellerianus (O Ktze) Exell*	*5*
76	*Caesalpinoideae*	*Piliostigma thonningii (Schum.) Milne-Redh.*	*2*
77	*Proteaceae*	*Protea madiensis Oliv.*	*1*
78	*Papilioinoideae*	*Pterocarpus erinaceus Poir.*	*8*
79	*Anacardiaceae*	*Rhus natalensis Bernh.*	*1*
80	*Anacardiaceae*	*Searsia longipes (Engl.) Moffett*	*10*
81	*Connaraceae*	*Santaloides afzelii (R. Br.) Schellenb.*	*10*
82	*Rubiaceae*	*Sarcocephalus latifolius (JE Sm.) EA Bruce*	*12*
83	*Polygalaceae*	*Securidaca longipedunculata Fresen.*	*1*
84	*Mimosaceae*	*Senegalia ataxacantha (DC.) Kyal. & Boatwr.*	*6*
85	*Ceasalpinioideae*	*Senna singueana (Del.) Lock*	*2*
86	*Caesalpinoideae*	*Senna spp Mill.*	*97*
87	*Apiaceae*	*Steganotaenia araliacea Hochst.*	*1*
88	*Bignoniaceae*	*Stereospermum kunthianum Cham.*	*13*
89	*Loganiaceae*	*Strychnos spinosa Lam.*	*15*
90	*Loganiaceae*	*Strychnos innocua Delile*	*2*
91	*Myrtaceae*	*Syzygium guineense var. macrocarpum Engl.*	*2*
92	*Combretaceae*	*Terminalia schimperiana Hochst.*	*8*
93	*Combretaceae*	*Terminalia laxiflora Engl. & Diels.*	*9*
94	*Combretaceae*	*Terminalia microcarpa Decne.*	*38*
95	*Lamiaceae*	*Tinnea rhodesiana S.Moore.*	*4*
96	*Meliaceae*	*Trichilia emetica Vahl.*	*8*
97	*Annonaceae*	*Uvaria chamae P.Beauv.*	*19*
98	*Sapotaceae*	*Vitellaria paradoxa C.F.Gaertn.*	*30*
99	*Lamiaceae*	*Vitex doniana Sweet.*	*6*
100	*Rhamnaceae*	*Ziziphus abyssinica Hochst. ex A. Rich*	*12*
101	*Rhamnaceae*	*Ziziphus mucronata Willd.*	*10*
102	*Sapindaceae*	*Zanha africana (Radlk.) Exell*	*18*
		Total	1512

From the table 9, the family Pipilionoideae has the highest number of species abundance.

Table 10: Total number of species in each plots

Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10
190	171	476	214	260	298	95	479	232	144

From the table 10, plot 7 has the lowest number of species while plot 3 & 8 has the highest number of species.

TABLE (11) DIVERSITY OF HERBACEOUS PLANTS

S/n	Species	Frequency	Pi	LnPi	Pi[Ln{Pn)]
1	Adiantum philippense L.	6	0.1016	-2.2867	-0.2323
2	Ageratum conyzoides L.1753.	2	0.0338	-3.3872	-0.1144
3	Asparagus africanus Lam.	1	0.0169	-4.0804	-0.0689
4	Asparagus officinalis L.	1	0.0169	-4.0804	-0.0689
5	Aspilia africana (Pers.) C.D.Adams	5	0.0847	-2.4686	-0.2090
6	Asystasia gangetica (L.) T.Anderson	1	0.0169	-4.0804	-0.0689
7	Bidens pilosa L.1753	2	0.0338	-3.3872	-0.1144
8	Biophytum sensitivum (L.) DC.	3	0.0508	-2.9785	-0.1513
9	Crassocephalum rubens (Juss. ex Jacq.) S. Moore	2	0.0338	-3.3872	-0.1144
10	Crotalaria spp L.	2	0.0228	-3.3872	-0.1144
11	Hexasepalum teres (Walter) J.H.Kirkbr.	1	0.0169	-4.0804	-0.0689
12	Guizotia spp.Cass. 1829	1	0.0169	-4.0804	-0.0689
13	Justicia flava (Vahl) Vahl	2	0.0338	-3.3872	-0.1144
14	Justicia insularis T. Anders	4	0.0677	-2.6926	-0.1822
15	Brillantaisia owariensis P.Beauv.	2	0.0338	-3.3872	-0.1144
16	Sabicea brevipes Wernham	1	0.0169	-4.0804	-0.0689
17	Nephrolepis exaltata (L.) Scott	2	0.0338	-3.3872	-0.1144
18	Ocimum spp. L.	1	0.0169	-4.0024	-0.0689

19	Phaulopsis falcisepala C.B.Clarke	4	0.0677	-2.6926	-0.1822
20	Phyllanthus spp L.	5	0.0847	-2.4686	-0.2090
21	Cassia mimosoides L.	1	0.0169	-4.0804	-0.0689
22	Sida urens Linn.	5	0.0847	-3.4686	0.2090
23	Spermacoce ocymoides. Burm.f.	1	0.0169	-4.0804	-0.0689
24	Spermacoce spp L.	1	0.0169	-4.0804	-0.0689
25	Triumfetta rhomboidea Jacq.	1	0.0169	-4.0804	-0.0689
26	Vernonia perrottetii Sch. Bip.	1	0.0169	-4.0804	-0.0689
27	Waltheria indica L.	1	0.0169	-4.0804	-0.0689
	Grand Total	59			-3.2000

$$H = -\sum \quad [Pi(ln)Pi]$$

$$H = -(-3.2)$$
$$H = 3.2$$

Diversity index rages from 0-5
0-2.4 shows low diversity while 2.5-5 shows high diversity

TABLE (12) DIVERSITY WOODY PLANTS

S/N	*Species*	*Frequency*	*Pi*	*Ln (Pi)*	*Pi[Ln(Pi)]*
1	*Adenodolichos paniculatus (Hua) Hutch.*	*199*	*0.1516*	*-2.0279*	*-0.2668*
2	*Afzelia africana Sm.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
3	*Albizia zygia. (DC.) J.F.Macbr.*	*2*	*0.0013*	*-6.6453*	*-0.0086*
4	*Allophylus africanus P. Beauv.*	*8*	*0.0052*	*-5.2590*	*-0.0273*
5	*Allophylus spicatus (Poir.) Radlk.*	*74*	*0.0489*	*-3.0179*	*-0.1475*
6	*Annona senegalensis Pers.*	*69*	*0.0456*	*-3.0878*	*-0.1408*
7	*Anogeissus leiocarpa (DC.) Guill. & Perr.*	*3*	*0.0019*	*-6.2659*	*-0.0119*
8	*Bersama abyssinica Fresen.*	*23*	*0.0152*	*-4.1864*	*-0.0636*
9	*Bombax costatum Pellegr. & Vuill.*	*67*	*0.0443*	*-3.1167*	*-0.1380*
10	*Boswellia dalzielii Hutch.*	*2*	*0.0013*	*-6.6452*	*-0.0086*
11	*Bridelia ferruginea Benth.*	*7*	*0.0046*	*-5.386*	*-0.0247*
12	*Bridelia scleroneura Müll.Arg.*	*3*	*0.0019*	*-6.2659*	*-0.0119*
13	*Canarium schweinfurthii Engl.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
14	*Carissa spinarum L.*	*2*	*0.0013*	*-6.6452*	*-0.0086*
15	*Cassia arereh Delile.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
16	*Cecropia yorubana Schltr.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
17	*Cissus populnea Guill. & Perr.*	*11*	*0.0072*	*-4.9336*	*-0.0355*
18	*Clausena anisata (Willd.) Hook.f. ex Benth.*	*9*	*0.0059*	*-5.1328*	*-0.0502*
19	*Clerodendron capitatum (Willd)*	*92*	*0.0608*	*-2.8001*	*-0.1702*
20	*Combretum fragrans F.Hoffm.*	*2*	*0.0013*	*-6.6452*	*-0.0086*
21	*Combretum molle R.Br. ex G.Don.*	*8*	*0.0052*	*-5.2590*	*-0.2273*
22	*Combretum nigricans Lepr.*	*1*	*0.0006*	*7.4185*	*-0.0119*
23	*Combretum spp Loefl.*	*3*	*0.0019*	*-6.2659*	*-0.0119*
24	*Cussonia arborea Hochst. ex*	*34*	*0.0224*	*-3.7986*	*-0.0850*
25	*Daniellia oliveri (Rolfe) Hutch. & Dalziel*	*3*	*0.0191*	*-6.2659*	*-0.0119*

26	*Desmodium velutinum (Willd.) DC.*	*29*	*0.0191*	*-3.9580*	*-0.0755*
27	*Dichrostachys cinerea Wight et Arn.*	*23*	*0.0152*	*-4.1864*	*-0.0636*
28	*Diospyros mespiliformis Hochst. ex A. DC.*	*3*	*0.0019*	*-6.2659*	*-0.0119*
29	*Ekebergia capensis Sparrm*	*2*	*0.0013*	*-6.6452*	*-0.0086*
30	*Ekebergia senegalensis A Juss.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
31	*Entada abyssinica Steud. ex A. Rich.*	*15*	*0.0099*	*-4.6152*	*-0.0456*
32	*Entada africana - Guill. & Perrott.*	*25*	*0.0165*	*-4.1043*	*-0.0677*
33	*Erythrina senegalensis DC.*	*2*	*0.0013*	*-6.6452*	*-0.0086*
34	*Erythrina sudanica Baker ,f.*	*2*	*0.0013*	*-6.6453*	*0.008 4*
35	*Ficus abutilifolia (Miq.) Miq.*	*1*	*0.0066*	*-7.4185*	*-0.0044*
36	*Ficus citrifolia Mill.*	*2*	*0.0013*	*-6.6453*	*-0.0456*
37	*Ficus glumosa Delile*	*15*	*0.0099*	*-4.6152*	*-0.0456*
38	*Ficus ingens (Miq.) Miq. 1867*	*1*	*0.0006*	*7.4185*	*-0.0044*
39	*Ficus petiolaris Kunth*	*1*	*0.0006*	*7.4185*	*-0.0044*
40	*Ficus sur Forssk. 1775*	*7*	*0.0046*	*-5.3816*	*-0.0247*
41	*Ficus umbellata Vahl.*	*1*	*0.0006*	*7.4185*	*-0.0044*
42	*Flueggea virosa · (Roxb. ex Willd.) Royle*	*2*	*0.0013*	*-6.6453*	*-0.0084*
43	*Grewia bicolor Juss.*	*4*	*0.0026*	*-5.9522*	*-0.0154*
44	*Grewia venusta Fresen.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
45	*Hannoa undulata (Guill.&Perr.) Planch.*	*1*	*0.0006*	*7.4185*	*0.0044*
46	*Heeria insignis (Delile) Kuntze.*	*2*	*0.0013*	*-6.6453*	*0.0084*
47	*Heeria pulcherrima (Schweinf.) O. Kuntze*	*4*	*0.0026*	*-59522*	*-0.0154*
48	*Holarrhena floribunda (G.Don) T.Durand & Schinz*	*53*	*0.0350*	*-3.3524*	*-0.1173*
49	*Hymenocardia acida Tul.*	*5*	*0.0033*	*-5.7138*	*-0.0188*
50	*Jasminum dichotomum Vahl*	*3*	*0.0019*	*-6.2659*	*-0.0119*
51	*Jasminum obtusifolium Baker*	*2*	*0.0013*	*-6.6453*	*0.0084*
52	*Keetia cornelia (Cham. & Schltdl.) Bridson.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
53	*Keetia venosa (Oliv.) Bridson*	*11*	*0.0072*	*-4.9336*	*-0.0355*
54	*Khaya senegalensis (Desr.) A.Juss.*	*5*	*0.0033*	*-5.7138*	*-0.0188*
55	*Kleinia cliffordiana (Hutch.) C.D. Adams*	*3*	*0.0019*	*-7.4185*	*-0.0044*
56	*Lannea microcarpa Engl. & K. Krause*	*1*	*0.0006*	*-7.4185*	*-0.0044*
57	*Lannea schimperi (Hochst. ex. A. Rich.) Engl.*	*2*	*0.0013*	*-6.6453*	*0.0084*
58	*Lannea spp A. Rich. in Guillem.*	*3*	*0.0019*	*-6.2659*	*-0.0119*
59	*Lannea velutina A. Rich. [family*	*8*	*0.0052*	*-5.2590*	*-0.0273*
60	*Lannea acida A. Rich.*	*1*	*0.0006*	*-7.418*	*-0.0044*
61	*Macrosphyra longistyla (DC.) Hook.f.*	*16*	*0.0105*	*-4.4185*	*-0.0478*
62	*Mucuna poggei Taub.*	*26*	*0.0171*	*-4.0686*	*-00695*
63	*Margaritaria discoidea (Baill.) G.L.Webster*	*3*	*0.0019*	*-6.2659*	*-0.0119*
64	*Ochna rhizomatosa (Tiegh.) Keay*	*5*	*0.0033*	*-5.7138*	*-0.0188*
65	*Ochna schweinfurthiana F.Hoffm.*	*28*	*0.0185*	*-3.9899*	*-0738*
66	*Ochna serrulata (Hochst.) Walp.*	*25*	*0.0165*	*-4.1043*	*-00677*
67	*Ocimum spp L.*	*18*	*0.0119*	*-4.1043*	*-0.0527*
68	*Olax subscorpioidea Oliv.*	*5*	*0.0033*	*-5.7138*	*-00188*
69	*Opilia celtidifolia (Guill. & Perr.) Endl.*	*2*	*0.0013*	*-6.6453*	*-0.0084*
70	*Oxytenanthera abyssinica · (A.Rich.) Munro ·*	*40*	*0.0264*	*-3.6343*	*-0.0959*

71	*Parinari curatellifolia Planch. ex Benth.*	*68*	*0.0449*	*-3.1033*	*-0.1393*
72	*Parkia biglobosa (Jacq.) R.Br. ex G.Don*	*22*	*0.0145*	*-4.2336*	*-0.0613*
73	*Paullinia pinnata L.*	*22*	*0.0145*	*-4.2336*	*-0.0613*
74	*Pericopsis laxiflora (Benth.) Van Meeuwen*	*10*	*0.0066*	*-5.0206*	*-0.3310*
75	*Phyllanthus muellerianus (O Ktze) Exell*	*5*	*0.0033*	*-5.7138*	*-0.0188*
76	*Piliostigma thonningii (Schum.) Milne-Redh.*	*2*	*0.0013*	*-6.6453*	*-0.0084*
77	*Protea madiensis Oliv.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
78	*Pterocarpus erinaceus Poir.*	*8*	*0.0052*	*-5.2590*	*-0.0273*
79	*Rhus natalensis Bernh.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
80	*Searsia longipes (Engl.) Moffett*	*10*	*0.0066*	*-5.0206*	*-0.0331*
81	*Santaloides afzelii (R. Br.) Schellenb.*	*10*	*0.0066*	*-5.0206*	*-00331*
82	*Sarcocephalus latifolius (JE Sm.) EA Bruce*	*12*	*0.0079*	*-4.8408*	*-00382*
83	*Securidaca longipedunculata Fresen.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
84	*Senegalia ataxacantha (DC.) Kyal. & Boatwr.*	*6*	*0.0039*	*-5.5367*	*0.0216*
85	*Senna singueana (Del.) Lock*	*2*	*0.0013*	*-6.6453*	*-0.0084*
86	*Senna spp Mill.*	*97*	*0.0641*	*-2.7473*	*-0.1761*
87	*Steganotaenia araliacea Hochst.*	*1*	*0.0006*	*-7.4185*	*-0.0044*
88	*Stereospermum kunthianum Cham.*	*13*	*0.0085*	*-4.7676*	*-0.0405*
89	*Strychnos spinosa Lam.*	*15*	*0.0099*	*-4.6152*	*-00456*
90	*Strychnos innocua Delile*	*2*	*0.0013*	*-6.6453*	*-0.0084*
91	*Syzygium guineense var. macrocarpum Engl.*	*2*	*0.0013*	*-6.6453*	*-0.0084*
92	*Terminalia schimperiana Hochst.*	*8*	*0.0052*	*-5.2590*	*-0.0273*
93	*Terminalia laxiflora Engl. & Diels.*	*9*	*0.0052*	*-5.2590*	*-0.0273*
94	*Terminalia microcarpa Decne.*	*38*	*0.0251*	*-3.6848*	*-0.0924*
95	*Tinnea rhodesiana S.Moore.*	*4*	*0.0026*	*-5.9522*	*-0.0154*
96	*Trichilia emetica Vahl.*	*8*	*0.0052*	*-5.2590*	*-0.0273*
97	*Uvaria chamae P.Beauv.*	*19*	*0.0125*	*-4.3820*	*-0.0547*
98	*Vitellaria paradoxa C.F.Gaertn.*	*30*	*0.0198*	*-3.9220*	*-0.0776*
9	*Vitex doniana Sweet.*	*6*	*0.0039*	*-5.5467*	*-0.0216*
100	*Ziziphus abyssinica Hochst. ex A. Rich*	*12*	*0.0079*	*-4.8408*	*-0.382*
101	*Ziziphus mucronata Willd.*	*10*	*0.0066*	*-5.0206*	*-0.0382*
102	*Zanha africana (Radlk.) Exell*	*18*	*0.0119*	*-4.4312*	*-0.0527*
	Grand Total	*1512*			*-3.8718*

$$H = -\sum \quad |Pi(ln)Pi|$$

$$H = -(-3.8)$$

$$H = +3.8$$

Diversity index rages from 0-5
0-2.4 shows low diversity while 2.5-5 shows high diversity

V. DISCUSSION

A total of 1571 plant species distributed in 43 families were encountered. The most abundant families on the mountains were *Papilionoideae, Rubiaceae, Sapindaceae, and Caesalpinoideae.*

Other substantially represented families were *Annonaceae, Mimosoideae, Chrysobalanaceae, and Combretaceae,* while the least families were *Proteaceae, Simaroubaceae, Annonaceae and Asteraceae*. Fig (2).

Consequently, the most occurring family of herbaceous occurred in decreasing other were *Asteraceae, Acanthaceae, Adiantaceae, and Malvaceae*, while the least were *Caesapinnioideae, Tiliaceae, and Verbenaceae* fig. (3). On the other hand, the percentage grass cover was less than 25% [<25%] and the most abundant grass species were *Sporobolus pyramidalis, Setaria pumila, Hyparrhenia rufa, Setaria spp* and *Setaria barbata.*Table 7. This implies that the most occurring member families are most rocky or hilly plant. This observation is in agreement with the findings of Asase and Yeboah (2007) and Asase *et al.* (2009) who noted that the *Fabaceae, Combretaceae* were dominate tree families in the Guinea savannah vegetation. Naraguta mountains is more diverse in woody plants than herbaceous plants and grasses. A high diversity of plant species was observed of the Naraguta mountain as shown by the diversity index on Table (6). Also in terms of woody species abundance our observation is in agreement with the research findings of (Geofe *et al*.2010) who noted that more than half (61.7%) of the recorded taxa were woody species (including seedlings) , 34.7% were herbs , and the remaining 3.8% were vines. Most of the vines were found at higher elevations. Plant species richness and diversity were significantly higher in the low stratum, this could be attributed to human disturbance, available ground water and soil particles from weathering of rocks which makes soil minerals readily available for plants within this stratum. Species richness varies with disturbance and fertility levels due to the differential response of species to various environmental gradient (Wellnitz and Proff. 2001).Elevation is a key variable affecting species diversity in Mountains as established in numerous studies (Rahbek.2005: Fentene *et al.* 2006) in comparison with other studies ,maximum diversity at an intermediate elevation has been the most commonly observed pattern (Kaster, 2001: Austrheim, 2002). At a higher elevation, decrease disturbance was experienced resulting in decrease in plant diversity (Austrheim, 2002). Plots within the middle stratum were more spread out compared to the plots on the low and top strata. There were some plots within the three strata that were characterized by similar shrubs and trees. The studies have shown that the differences in plant community structure are a reflection of the ecological characteristics of the area (Ulrey, 2002).

VI. CONCLUSION

The mountains is extremely rich in biodiversity and it shows a great importance of the region in terms of plant diversity. The study has shown that plant species abundance and diversity is higher in the low stratum compared to that of middle and top strata due to the redistribution of nutrients.

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