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Tree species Abundance Status in Aleiro Local Government Area, Kebbi State, Nigeria

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Abstract

This study was conducted to determine tree species abundance status and the factors responsible for tree species endangerment in Aliero local government, Nigeria. Twenty two percent (22 %) ofthe total villages were randomly selected from the three districts (Aliero, Dan warai and Sabyal) in the study area for the purposes of tree species composition survey and questionnaire administration. Point Quarter Centre Method (PQCM) was used to enumerate tree species in the study area. Ten (10) transects of 1 km (1000m) length each was cut in each of the survey area (Aliero, DanWarai and Sabiyal District). Out of the ten (10) transects, three (3) were randomly selected in each survey area. Transects were pegged at 100m interval and the point centre quadrant dropped systematically at this points. This gave a total of 30 sampling points. Only trees of 1m and above in height nearest to the sampling point in each quarter of the quadrant were enumerated and recorded. Questionnaire was administered in each village to 5 individuals using purposive sampling method (60 years and above selected) to find out factors responsible for the threatened species. Data obtained from tree species composition was analysed using tree species relative density (RD) and classified as abundant ($RD \geq 5.00$), frequent ($4.00 \leq RD \leq 4.99$), Vulnerable ($3.00 \leq RD \leq 3.99$), rare ($1.00 \leq RD \leq 2.99$) and threatened / endangered ($0.00 < RD \leq 1.00$) (Daniel *et al*., 2012). Data generated from questionnaire administered were analysed using descriptive statistics. Eighteen (18) species were recorded endangered in Aliero District, thirteen (13) species in DanWarai District and twelve (12) in Sabiyal District. Eleven (11) factors were found to be responsible for tree species endangerment out of which six (6)factors were most responsible in all the three (3) districts namely; Agricultural land expansion (ALE), Firewood Collection (FWC), Bush Burning (BB), Overgrazing (OG), Building Material (BM) and Medicine. Enactment of environmental laws associated with conservation and preservation of woody species in the study area for sustainability is recommended. To ensure the conservation and preservation of tree species, it is also recommended that NGOs and CBOs should take active part in community forestry activities in order to reduce the pressure on the forest tree species. Research into assessment of endangered tree species and strategies for conservation in the study area should be further conducted.

Introduction

Trees are known to provide diverse benefits which include ecological (soil erosion control, watershed management, windbreak, shelterbelt, desertification control and climate change mitigation), socio-economic (source of income from the sale of fuel-wood, timber, edible fruits, and other non-timber forest products) and cultural (medical, spiritual, aesthetic, historical) uses. For example in Africa 60–80% of the population were reported to depend solemnly on plants for their wellbeing (Adesuyi, *et al.*, 2012), while about 85% of domestic energy use in Nigeria was reported to come from wood (FMEnv. , 2006). In Northern Nigeria over 80% of the population depend on wood as their source of energy and fuel wood collection accounts for about 90% of forest removal in Nigeria (Abdulrashid and Yaro, 2014; Adegbehin, 1990). With a large and ever growing population, it is expected that these figures will continue to rise unless a viable alternative devoid of irregularities in supply and affordable as well as accessible is provided.

The type of vegetation in Aliero local government area, Kebbi state is mainly savannah, climatically defined into Northern Sudan savannah and Sahel savannah. The vegetation is characterised by dense population of grasses with little vegetation of shrubs and few trees. The vegetation cover is now altered as a result of climate change and human activities. These have led to the

degradation of the hitherto useful trees under intensive pressure of exploitation (Bello, 2005; Adamu, 2006; Alonso *et al*., 2001), making some of the useful species to become threatened (IUCN, 1995).The need for accurate and adequate information on the prevalence and composition of tree species and factors responsible for their extinction is an important step towards the management and conservation of our forest resources. Thus, forest composition survey using Point Centre Quadrant Method (PCQM) and oral interview approach were used to assess the tree species abundance and the factors of tree species endangerment in the study area respectively.

Material and Methods

Study area

Aliero local government area is located at approximately latitudes 11° 03S, 12° 47N and longitudes 3°6'W and 4°27'E in Kebbi state with a total area of 412 square kilometres. The geology of Aliero local government is characterized by thick sedimentary deposited of the Sokoto-Rima basin. It is also under laid by Precambrian Basement rocks (Singh, 2013). Aliero local government area enjoys a tropical type climatic condition, generally characterize by wet and dry season. The rainfall begins April with the heaviest rainfall recorded in the month of July and August. The cold harmattan periods characterized by dust laden wind prevails in the month of November to January while the month of February and March are extremely hot. The mean annual temperature vary considerably but usually stand at 42°C. The mean annual rainfall is 500 mm (Singh, 2013).

Natural vegetation consist of Sudan savannah type characterized by open woodland with scattered trees such as *Pakia biglobosa, Vitellaria paradoxa*, *Combretum species, Porassus* , dum palms and many others.

Method ology

Twenty two percent (22%) of the total villages were randomly selected that is9 villages out of 42 villages from the three districts (Aliero, Danwarai and Sabyal) in the study area for the purposes of tree species composition survey and questionnaire administration. From each village, 5 people were purposively selected (60 years old and above) for the purpose of questionnaire administration and three (3) transects which were 50m apart and 100 m long were located in the Savanna woodland bordering each of the three villages that were randomly selected for tree species enumeration.

The data for the study was obtained from two sources: Point Centre Quadrant Method (PCQM) and oral interview using questionnaire. The Point Centre Quadrant Method (PCQM) as described by Bryant *et al.* (2005) was employed to assess tree species composition in the study area. Ten (10) transects of 1 km (1000m) length each was cut in each of the survey area (Aliero, Danwarai and Sabyal district). Out of the ten (10) transects, three (3) were randomly selected in each survey area. This gave a total of 3 km (3000m) length of transects in each survey area. Transectswere pegged at 100m interval and the point centre quadrant dropped systematically at this points. This gave a total of 30 sampling points. Only trees of 1m and above in height nearest to the sampling point in each quarter of the quadrant were enumerated and recorded.Parameters measured include tree species frequency and species relative density to assess threatened/extinct and abundant species that were still found in the study area.

Factors responsible for threatened species were collected using questionnaire administeredto respondents using purposive sampling method, that is, only those who attained the age of 60 and above were selected to determine the causes of species disappearance.

Data Analysis

Data obtained from tree species composition was analysed to obtain relative density (RD) using the formula:

Relative density of species (RD) $= \frac{Number\ of\ individual\ tree\ specie}{Total\ number\ of\ trees\ species} \times 100$

Tree species were scored according to their relative density (RD) as described by Daniel *et al.*(2012) into abundant (RD ≥ 5.00), frequent (4.00 ≤ RD ≤ 4.99), Vulnerable (3.00 ≤ RD ≤ 3.99), rare (1.00 ≤ RD ≤ 2.99) and threatened / endangered (0.00 < RD ≤ 1.00).

Data generated from questionnaire administered were analysed using descriptive statistics.

Results

Tree Abundance status in the study area.

Table 1 shows tree species frequency, relative density and classes of endangerment in Aliero district. A total of 37 species were encountered in the district. *Cassia siberiana* and *Guiera senegalensis* recorded the highest frequency and relative density of 149 and 196, 13.61 and 17.89 respectively while *Ficus sycomorus, Ximenia americana*, *Parinari macrophylla* and *Vitellaria paradoxa* have the lowest frequency and relative density of 1and 0.09 respectively. Based on the relative density five classes of endangerment were identified namely: 18 endangered species; 6 abundant; 11 rare; 1 vulnerable; 1 frequent which gave a total of 37 species from the grand total of 1095.

Table 2 shows tree species frequency, relative density and classes of endangerment in Dan Warai district. A total of 32 species were encountered in the district. *Calotropis procera* and *Mimoza pigma* recorded the highest frequency and relative density of 120 and 101, 17.09 and 14.38 respectively while *Combretum glunotinosum*, *Celtis zenkeri*, *chloris robusta Diospyros mespiliformis* have the lowest frequency and relative density 1 and 0.14respectively.Based on the relative density four classes of endangerment were identified namely: 13 endangered species; 7 abundant; 9 rare; 3 vulnerable; which give a total of 32 species from the grand total of 702.

Table 3 shows tree species frequency, relative density and classes of endangerment in Sabiyal district. A total of 31 species were encountered in the district. *Guiera senegalensis* and *Combretum micrantum* recorded the highest frequency andrelative density of 210 and 75, 22.08 and 7.88 respectively while *Acacia nilotica*, and *Cochlospermum planchonii* have the lowest frequency and relative density 1, and 0.10respectively. Based on the relative density four classes of endangerment were identified namely: 12 endangered species; 8 abundant; 4 rare; 4 vulnerable; 3 frequent which give a total of 31 species from the grand total of 951.

Table1: Tree Abundance Status in Aliero District

Scientific name	Species local name	Species Frequency	Species Relative Density (RD)	Abundance status
Adonsonia digitata	Kuka	49	4.47	Frequent
Acacia albida	Gao	8	0.73	Endangered
Acacia nilotica	Bagaruwa	5	0.45	Endangered
Acacia senegal	Farar kaya	20	1.82	Rare
Albizia chevalieri	Katsari	2	0.18	Endangered
Balanites aegyptiaca	Adua	27	2.46	Rare
Bauhinia rufescens	Jirga	2	0.18	Endangered
Borassus aethiopum	Giginya	18	1.64	Rare
Calotropus procera	Tunfafia	14	1.27	Rare
Cassia sieberiana	Malga	149	13.61	Abundant
Celtis zenkeri	Duckii	3	0.02	Endangered
Combretum glutinosum	Taramniya	23	2.1	Rare
Combretum micrantun	Geza	100	9.13	Abundant
Combretum nigricans	Tsiriri	57	5.21	Abundant
Detarium microcarpum	Taura	40	3.65	Vulnerable
Diospyros mespiliformis	Kaywa	7	0.63	Endangered
Ficus sycomorus	Baurai	1	0.09	Endangered
Gardenia erubescens	Gaude	119	10.86	Abundant
Guiera senegalensis	Sabara	196	17.89	Abundant
Holarrhena floribunda	Gamon saawa	24	2.19	Rare
Hyphaene thebaica	Goriba	22	2	Rare
Lawsonia inermis	Lale	31	2.83	Rare
Maurea crassifolia	Jiga	7	0.63	Endangered
Mimosa pigma	Gumbi	78	7.12	Abundant
Parinari macrophylla	Gawasa	1	0.9	Endangered
Parkia biglobosa	Dorowa	13	1.18	Rare
Piliostigma reticulatum	Kalgo	24	2.19	Rare
Prosopis africana	Kirya	18	1.64	Rare
Rogeria adenomophylla	Loda	10	0.91	Endangered
Securidaca longepeduncula	Abi Daji	2	18	Endangered
Securidaca longepedunculata Fresen	Uwar Magunguna	2	0.18	Endangered
Scurinega virosa	Tsa	11	1	Endangered
Tamarendis indica	Tsamiya	1	0.09	Endangered
Vitellaria paradoxal	Kade	1	0.09	Endangered
Vitex doniana	Dumniya	7	0.63	Endangered
Ximenia americana	Tsada	1	0.09	Endangered
Zizipus Mauritian	Magariya	2	0.18	Endangered

Source: 2017 field survey

Table 2: Tree species abundance status in Dan Warai District

Scientific name	Species local name	Species Frequency	Species Relative Density (RD)	Tree abundance status
Acacia albida	Gao	26	3.7	Vulnerable
Acacia nilotica	Bagaruwa	36	5.12	Abundant
Acacia Senegal	Farar kaya	3	0.42	Endangered
Anogeissus leiocarpus	Marke	2	0.28	Endangered
Balanites aegyptiaca	Aduwa	12	1.17	Rare
Bauhinia rufescens	Jirga	26	3.7	Vulnerable
Borassus aethiopum	Giginya	54	7.69	Abundant
Calotropus procera	Tunfafia	120	17.09	Abundant
Cassia sieberiana	Malga	26	3.7	Vulnerable
Ceiba pentandra	Rimii	2	0.28	Endangered
Celtis zenkeri	Duckii	1	0.14	Endangered
Chloris robusta	Katsari	1	0.14	Endangered
Combretum glutinosum	Taramniya	1	0.14	Endangered
Combretum micrantun	Geza	43	6.12	Abundant
Combretum nigricans	Tsiriri	5	0.17	Endangered
Detarium microcarpum	Taura	4	0.56	Endangered
Diospyros mespiliformis	Kaiwa	1	0.14	Endangered
Ficus sycomorus	Baurai	4	0.56	Endangered
Gardenia erubescens	Gaude	10	1.42	Rare
Guiera senegalensis	Sabara	75	10.68	Abundant
Holarrhena floribunda	Gamom saawa	20	2.84	Rare
Hyphaene thebaica	Goriba	13	1.68	Rare
Lawsonia innermis	Lale	8	1.13	Rare
Mimosa pigma	Gumbi	101	14.38	Abundant
Parkia biglobosa	Dorowa	5	0.17	Endangered
Piliostigma reticulatum	Kalgo	18	2.56	Rare
Prosopis Africana	Kirya	2	0.28	Endangered
Rogeria adenophylla	Loda	9	1.28	Rare
Tamarandis indica	Tsamiya	12	1.7	Rare
Vitex doniana	Dumniya	3	0.42	Endangered
Zizipis mauritiana	Magariya	10	1.42	Rare

Source: 2017 field survey

Table 3: Tree species abundance status in Sabiyal District

Scientific name	Species local name	Species Frequency	Species Relative Density (RD)	Tree species abundance status
Acacia albida	Gao	5	0.52	Endangered
Acacia nilotica	Bagaruwa	1	0.1	Endangered
Acacia Senegal	Farar kaya	30	3.15	Vulnerable
Balanites aegyptiaca	Aduwa	10	1.05	Rare
Bauhinia rufescens	Jirga	4	0.42	Endangered
Borassus aethiopum	Giginya	31	3.25	Vulnerable
Cassia sieberiana	Malga	64	6.72	Abundant
Calotropus procera	Tunfafiya	52	5.46	Abundant
Ceiba pentandra	Rmii	4	0.42	Endangered
Cochlospermum planchonii	Rawaya	1	0.1	Endangered
Combretum micrantun	Geza	75	7.88	Abundant
Combretum nigricans	Tsiriri	40	4.2	Frequent
Celtis zenkeri	Duckii	6	0.63	Endangered
Chloris robusta	Katsari	2	0.21	Endangered
Ficus glumosa	Kadaggi	30	3.15	Vulnerable
Ficus sycomorus	Baurai	6	0.63	Endangered
Gardenia erubescens	Gaude	30	3.15	Vulnerable
Guiera senegalensis	Sabara	210	22.8	Abundant
Holarrhena floribunda	Gamon saawa	20	2.1	Rare
Hyphaene thebaica	Goriba	2	0.21	Endangered
Lawsonia inermis	Lale	47	4.94	Frequent
Mimosa pigma	Gumbi	63	6.62	Abundant
Parkia bigolbosa	Dorowa	16	1.64	Rare
Piliostigma reticulatum	Kalgo	48	5.04	Abundant
Rogeria adenophylla	Loda	4	0.42	Endangered
Securinega virosa	Tsa	62	6.51	Abundant
Tamarandis indica	Tsamiya	3	0.31	Endangered
Vitellaria paradoxal	Kade	2	0.21	Endangered
Vitex doniana	Dumniya	15	1.57	Rare
Zizipus mauritiana	Magariya	57	5.99	Abundant

Source: 2017 field survey

Comparative Analysis of Tree Abundance Status in the Study Area.

The result of trees species endangerment classes (Rare; Vulnerable; Frequent and Abundant) in the three districts (Aliero; Dan Waray and Sabiyal district) is shown in figure 2. There is higher number (18) of endangered species in Aliero district than in Dan Waraidistrict(13) and Sabiyal district(12) and so also the number of abundant species in Aliero district (8) is higher than that of Dan Warai (7) and Sabiyal (6). Also rare species in Aliero district is higher than the other two remaining districts but for vulnerable and frequent species, Sabiyal district occupied higher numbers (4 and 3) than Aliero (1each) and Dan Warai (3 and 0) Districts.

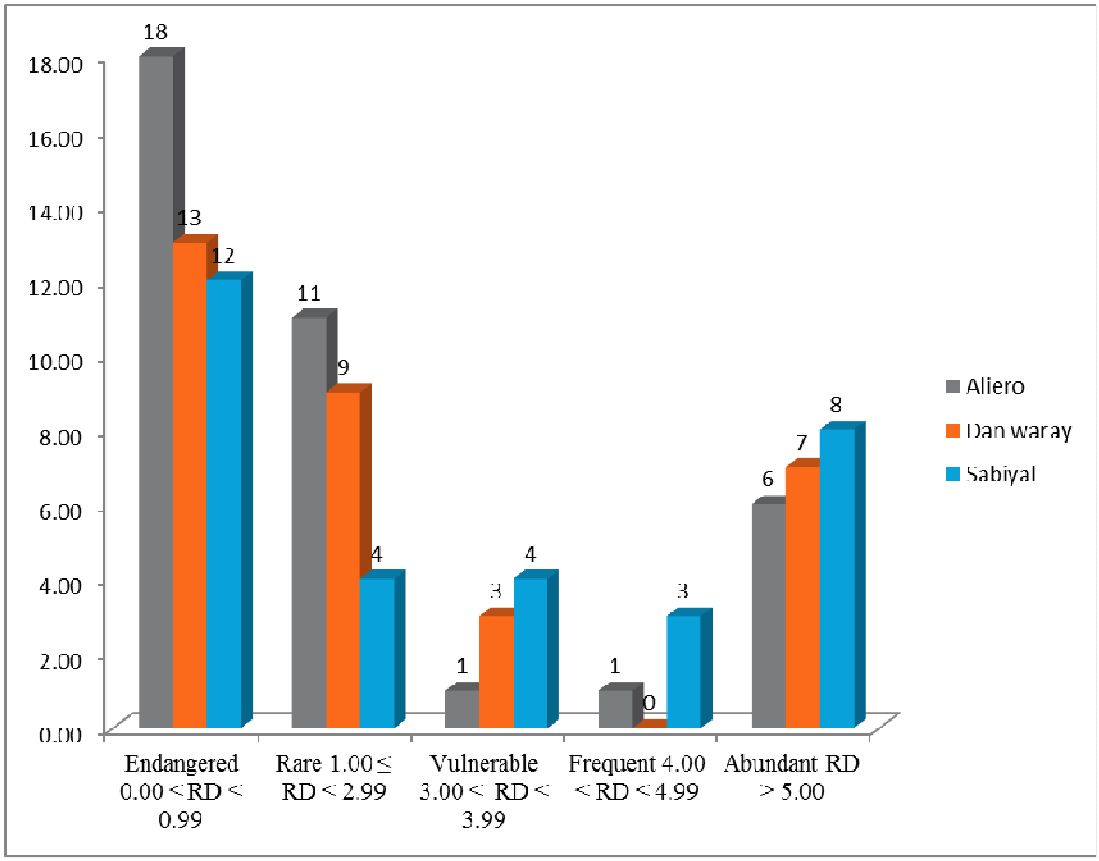

Figure 2:Comparative Analysis of Tree Abundance Status

Endangered Trees Species and Factors Responsible for Endangerment in the Study Area

Eleven (11) factors were found to be responsible for trees species endangerment in three (3) districts of Aliero local government namely: Agricultural Land Expansion (ALE); Firewood Extraction (FWC); Bush Burning (BB); Overgrazing (OG);Building Material (BM); Industrial Purposes (IP); Medicine (Mdc); Population Growth (PG); Natural Hazard (NH); Non-Timber Forest Product (NTFP) and Furniture (Fnt) referred to as F1 to F11 respectively.

Table 4 shows endangered trees species and factors responsible for endangerment in Aliero district. 18 species were found to be endangered by different factors of endangerment. Ten(10) out of 18 species (*Acacia nilotica,Albizia chevalieri, Bauhinia rufescens,Moerua crassifolia, Ximenia americana, Vitellaria paradoxa, Securidaca longepedunculata, Celtis zenkeri, Ficus sycomorus and Securinega virosa)* were found to be endangered by six (6)similar responsible factors (F1, F2, F3, F4, F5 and F7). Seven (7) species (*Rogeria adenomophlly; Ziziphus maritiana*; *Tamarandis indica*; *Painari macrophylla*; *Securidaca longepeduncula*; *Vitex doniana* and *Diospyros mespiliformis*) were affected by seven (7) similar responsible factors (F1, F2, F3, F4, F5, F7 and F10) and *Acacia albida*was foundaffected by F1, F2, F,; F4, F5, F7 factors in addition to Natural Hazard (F9).

Table 4: Endangered trees species and factors responsible for endangerment in Aliero district.

Scientific name of endangered trees species	Local Names	Factors responsible for trees species endangerment										
		ALE F1	FWC F2	BB F3	OG F4	BM F5	IP F6	Mdc F7	PG F8	NH F9	NTFP F10	Fnt F11	Total
Acacia albida	Gao	*	*	*	*	*		*		*			7
Acacia nilotica	Bagaruwa	*	*	*	*	*		*					6
Albizia chevalieri	Katsari	*	*	*	*	*		*					6
Bauhinia Rufescens	Jirga	*	*	*	*	*		*					6
Celtis zenkeri	Duckii	*	*	*	*	*		*					6
Diospyros mespilifotmis	Kaiwa	*	*	*	*	*		*			*		7
Ficus sycomorus	Baurai	*	*	*	*	*		*					6
Moerua crassifolia	Jiga	*	*	*	*	*		*					6
Parinari macrophylla	Gawasa	*	*	*	*	*		*			*		7
Rogeria adenomophylla	Loda	*	*	*	*	*		*			*		7
Secunega virosa	Tsa	*	*	*	*	*		*					6
Securidaca longepeduncula	Abi daji	*	*	*	*	*		*			*		7
Securidaca longepeduncula Fresen	Uwar magunguna	*	*	*	*	*		` *					6
Tamarandis indica	Tsamiya	*	*	*	*	*		*			*		7
Vitellaria paradoxa	Kade	*	*	*	*	*		*					6
Vitex doniana	Dumniya	*	*	*	*	*		*			*		7
Ximenia americana	Tsada	*	*	*	*	*		*					6
Ziziphus mauritiana	Magaria	*	*	*	*	*		*			*		7

Source: 2017 Field survey

*: Effected by factor of endangerment; F1- F11: Factors, ALE: Agricultural Land Expansion; FWC: Firewood Collection; BB: Bush Burning; OG: Overgrazing; BM: Building Material; IP: Industrial purposes; Mdc: Medicine; PG: Population Growth; NH: Natural Hazard; NTFP: Non-Timber Forest Product and Fnt: Furniture.

Table 5 shows endangered trees species and factors responsible for endangerment in Dan Warai district. Thirteen (13) species were found to be endangered by different factors of endangerment. Six (6) factors (F1, F2, F3, F4, F5 and F7) were found to be responsible for endangering six (6) species (*Prosopis africana*; *Combretum glutinosum*; *Combretum nigricans*; *Ficus sycomorus*; *Acacia Senegal* and *chloris robusta*). Seven (7) species (*Celtis zenkeri*; *Piliostigma reticulatum*; *Parkia biglobosa*; *Diospyros mespiliformis*; *Anogeissus leiocarpus* and *Vitex doniana*;) were found endangered by F1, F2, F3, F4, F5, F7 and F10; and only one(1) species (*Ceiba pentandra*) was endangered by eight(8) responsible factors (F1, F2, F3, F4, F5, F7, F10 and F11).

Table 5: Endangered trees species and factors responsible for endangerment in Dan Warai district.

Scientific name of endangered trees species	Common names	Factors responsible for trees species endangerment											
		ALE F1	FWC F2	BB F3	OG F4	BM F5	IP F6	Mdc F7	PG F8	NH F9	NTFP F10	Fnt F11	Total
Acacia Senegal	Farar kaya	*	*	*	*	*		*					6
Anogeissus leiocarpus	Marke	*	*	*	*	*		*			*		7
Ceiba pentandra	Rimii	*	*	*	*	*		*			*	*	8
Celtis zenkeri	Duckii	*	*	*	*	*		*			*		7
Chloris robusta	Katsari	*	*	*	*	*		*					6
Combretum micrantum	Taramnia	*	*	*	*	*		*					6
Combretum nigricans	Tsiriri	*	*	*	*	*		*					6
Diospyros mespiliformus	Kaiwa	*	*	*	*	*		*			*		7
Ficus sycomorus	Baurai	*	*	*	*	*		*					6
Parkia bigoblosa	Dorowa	*	*	*	*	*		*			*		7
Piliostigma reticulatum	Kalgo	*	*	*	*	*		*			*		7
Prosopis Africana	Kirya	*	*	*	*	*		*					6
Vitex doniana	Dumnia	*	*	*	*	*		*			*		7

Source: 2017 field survey

*: Effected by factor of endangerment; F1 – F11: Factors, ALE: Agricultural Land Expansion; FWC: Firewood Collection; BB: Bush Burning; OG: Overgrazing; BM: Building Material; IP: Industrial purposes; Mdc: Medicine; PG: Population Growth; NH: Natural Hazard; NTFP: Non-Timber Forest Product and Fnt: Furniture.

Table 6 shows endangered trees species and factors responsible for endangerment in Sabiyal district. Twelve(12) species were identified to be endangered by different factors of endangerment where five(5) factors (F1, F2, F5, F7 and F10) was found responsible for endangering species *Hyphaene thebaica*; six (6) factors (F1, F2, F3, F4, F5 and F7) were responsible for endangerment of *Bauhinia refescens; Acacia nilotica* was affected by seven 7 factors (F1, F2, F3, F4, F5, F7 and F10);*Tamarandus indica* was affected by 7 factors (F1, F2, F3, F4, F7, F9 and F10); *Celtis* zenkeri *and Ficus sycomorus* were affected by nine (9) factors (F1, F2, F3, F4, F5, F7, F8, F9 and F10); *Acacia albida* and *Chlorisrobusta* are affected seven (7) factors of endangerment (F1, F2, F3, F4, F5, F7 and F9); eight(8) factors (F1, F2, F3, F5, F7, F9 and F10) were responsible for the endangerment of *Vitellaria paradoxa*; *Ceiba pentandra*and *Rogeria adenophylla* were affected by nine (9) factors (F1, F2, F3, F4, F5, F7, F9, F10 and F11) respectively.

Table 6: Endangered trees species and factors responsible for endangerment in Sabiyal district.

Scientific name of endangered trees species	Common names	Factors responsible for trees species endangerment											
		ALE F1	FWC F2	BB F3	OG F4	BM F5	IP F6	Mdc F7	PG F8	NH F9	NTFP F10	Fnt F11	Total
Acacia albida	Gao	*	*	*	*	*		*		*			7
Acacia nilotica	Bagaruwa	*	*	*	*	*		*			*		7
Bauhinia rufescens	Jirga	*	*	*	*	*		*					6
Ceiba pentandra	Rimii	*	*	*	*	*		*		*	*	*	9
Celtis zenkeri	Duckii	*	*	*	*	*		*	*	*	*		9
Chloris robusta	Katsari	*	*	*	*	*		*		*			7
Cochlospermum planchoni	Rawaya	*	*	*	*			*		*			6
Ficus sycomorus	Baurai	*	*	*	*	*		*	*	*	*		9
Hyphaene thebaica	Goriba	*	*			*		*			*		5
Rogeria adenophylla	Loda	*	*	*	*	*		*		*	*		8
Tamarandis indica	Tsamiya	*	*	*	*			*		*	*		7
Vitelaria paradoxal	Kade	*	*	*		*		*		*	*		7

Source: 2017 field survey

*: Effected by factor of endangerment; F1 – F11: Factors, ALE: Agricultural Land Expansion; FWC: Firewood Collection; BB: Bush Burning; OG: Overgrazing; BM: Building Material; IP:Industrial purposes; Mdc:Medicine; PG: Population Growth; NH: Natural Hazard; NTFP: Non-Timber Forest Product and Fnt: Furniture.

Factors Responsible for Tree Species Abundance Status in the Study Area Combined

A comparison made among the factors responsible for tree species endangerment in the three district of Aliero local government is presented in Figure 3.The result shows that F1; F2; F3; F4; F5 and F7 were the most common factors responsible for the endangerment of trees species in all the three (3) Districts as shown in Figure 3. The remaining factors; F6, F8, F9, F10 and F11 were responsible for the endangerment of only few tree species (Fig. 3)

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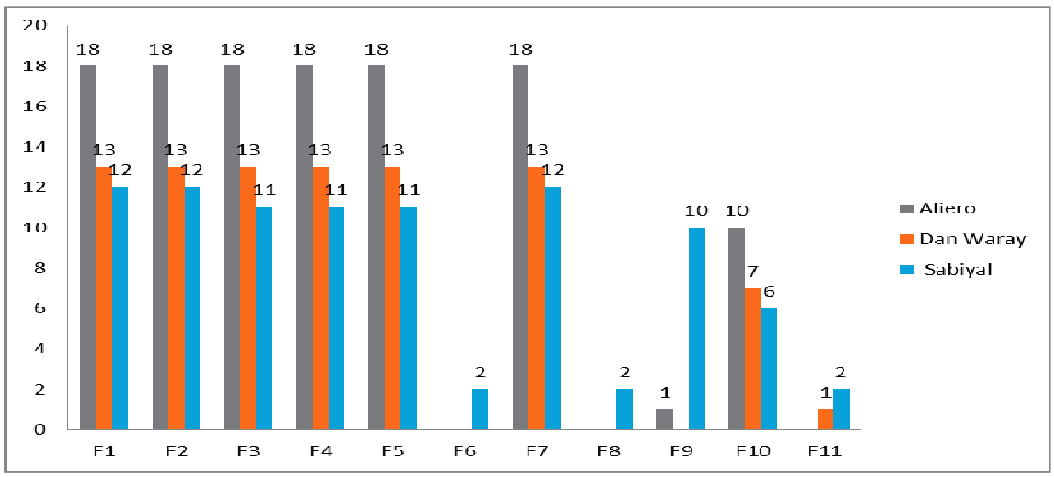

Figure 3: Factors responsible for tree species endangerment compared in Aliero local government
Source: 2017 field survey

Discussions

Tree species abundance status in the study area.

The tree species abundance status in Aleiro District is presented in Table 1., As shown in the table,*Guiera senegalensis* and *Cassia seiberiana* were identified to have highest frequency of 196 and 149 respectively and also the highest relative density of 17.89 and 13.61 respectively. This result agreed with that of Aliyu (2016) who also reported *Guiera senegalensis*, *Combretum niorense*, *Cassia sieberiana*, *Holorrhena floribunda* and *Combretum nigricans* ashaving the highest density, dominance and relative dominance values and considered as characteristic species of the Kebbi State University of Science and Technology (KSUSTA) environment in Aliero local government. In a related study by Ambursa (2015) in Kwari-kwasa forest reserve, *Guiera senegalensis* was reported to be the most frequent species. A total of 37 species were encountered in the district out of which eighteen (18) species were recorded endangered, eleven (11) rare, one (1) vulnerable, one (1) frequent and six (6) abundant. In a related study, Daniel *et al.*(2012) reported that out of one hundred and two (102) tree species that were encountered in Afi Mountain Wildlife sanctuary only *Afzelia bipidensis* (RD = 5.00) was rated as the only abundant species while rare and threatened / endangered species were represented by fifty-two (52) and forty-nine (49) tree species respectively. According to Malami *et al.* (1990), 17 species were identified to be abundant and 14 rare in old Sokoto state.

Table 2 indicated that in Dan Warai district *Calotropis procera* and *Mimosa pigma*are most abundant with the frequency of 120 and 101 and relative density of 17.09 and 14.38 respectively. This finding agreed with Aliyu (2016) in KSUSTA floristic composition study, where *Calotropis procera* was reported to be abundant with relative density of 7.72. In a related study, Wakawa *et al.* (2016) in Kano state university of science and technology tree species composition survey, recorded twenty seven (27) species in the area with *Diospyros mespiliformis* having highest frequency and relative density of 44and 0.53 respectively. Thirteen (13) species were recorded endangered, nine (9) rare, three (3) vulnerable and seven (7) abundant according to Daniel *et al.* (2012) ranking. According to Bello (2013), Kogo forest reserve in guinea savannah vegetation zone of Nigeria was quite rich in terms of tree species but some species were facing the threat of extinction.

The result in Table 3 shows that in Sabiyal district *Guierasenegalensis* appeared to be the most abundant with higher frequency and relative density of 210 and 22.08 respectively. In a related study by Ambursa (2015) in Kwari-kwasa forest reserve, eighteen (18) tree/shrub species were encountered with *Combretum nigricans* (Tsiriri) and *Guiera senegalensis* (Sabara) being the most dominant and abundant with frequency values of 50.1% and 40.3% respectively. Twelve (12) endangered species ($0.00 \leq RD \leq 1.00$) were recorded (Table 3) with *Ficussy comorus* (RD <0.63), *Hyphaenethebaica*(RD <0.12), *Tamarandis indica* (RD <0.31) and V*itellaria paradoxa* (RD <0.21) among species with lowest relative density. This findings agreed with Wakawa *etal.* (2016) in a studyof tree species composition in Kano state university of science and technology,where hereported *Ficussycomorus*(RD <0.01), *Hyphaenethebaica*(RD 0.03), *Tamarandisindica*(RD 0.67) and V*itellariaparadoxa*as have=ing the lowest relative density (RD = 00). Twelve (12) species were recorded Endangered, four (4) Rare, four (4) Vulnerable, three (3) Frequent and eight (8) Abundant. In a similar study, Daniel *et al.*(2012) confirmed one hundred and two (102) tree species encountered in Afi Mountain Wildlife sanctuary with only one (1) abundant species; there was no record of frequent and vulnerable species while rare and threatened / endangered species were

represented by fifty-two (52) and forty-nine (49) tree species respectively.

The result (Tables 1 – 3 and Fig. 2) shows that there are forty three (43) endangered tree species in Aliero LGA with Aliero district having 18, Dan Warai 13and Sabiyal 12 endangered species respectively. There were more Endangered and Rare species in all the three (3) districts than Abundant, Frequent and vulnerable (Tables 1, 2and 3). This finding agreed with Daniel *et al.* (2012) who reported that the Endangered and Rare tree species in both Afi Mountain Wildlife Sanctuary and Communal Forest were higher than Abundant, Rare and Vulnerable.

Factors responsible for Tree species endangerment in the study area

There are eight (8) factors found to be responsible for endangering 18 tree species in Aliero district(Table 4). Five (5) factors (Agricultural land expansion, Firewood collection, Bush burning, Overgrazing, and Building material) affected most species. This findings agreed with the observation of Barbier *et al*. (1994) who reported that anthropogenic activities are responsible for the extinction of most forest tree species. According to Panayotou *et al.* (1990) the agents of deforestation are slash and burn farmers, commercial farmers, ranchers, loggers, firewood collectors, infra-structure developers and others who are cutting down the trees which incidentally were found to be the most important factors of tree species endangerment in the study area

The result (Table 5) shows that in Dan Warai District eight (8) factors (Agricultural land expansion, Firewood collection, Bush burning, Overgrazing, and Building material, Medicine, Non-Timber Forest Product and Furniture) were found to be responsible for the endangerment of thirteen (13) species. Like other districts the most common factors that threatened tree species in Dan Warai District were Agricultural Land expansion, Firewood, Bush burning, Building material and medicine (Table 5). This findings agrees with the observation of Angelsen *et al*. (1995) who reported that smallholder production and the growing number of such producers notably shifting cultivators were the main cause of deforestation and loss of many important tree species. According to Betterton *et al.* (1996)demand for wood for construction, building, fuel, fishing industry and other uses, caused the removal of trees, shrubs, herbaceous plants and grass cover from the fragile land of the Sahel and accelerate the degradation of the soil to desert-like conditions with resultant loss of species.

Table 6 shows that there are eleven (11) factors (Agricultural land Expansion, Firewood collection, Bush burning, Overgrazing, Building material, Industrial purposes, Medicine, Population growth, Natural hazard, Non-Timber Forest Product and Furniture.) responsible for tree species endangerment in Sabiyal district. Eight (8) factors appeared to be the most frequent for the endangered species in the district namely Agricultural Land expansion, Firewood collection, Bush burning, Overgrazing, Building material, Medicine, Natural hazard, Non-Timber Forest Product. According to Gadzama *et al.* (1996) Bush burning is an agent of deforestation and owing to the low relative humidity of the semi-arid zone coupled with very dry harmattan wind, there is always a high incidence of bush fires every dry season. Oladipo *et al.* (1993) opined that Pastoralists contribute significantly to woodcutting as they cut foliage to feed their animals and use branches to build enclosures. Betterton *et al.* (1996) attributed demand for wood for construction, building, fuel, fishing industry and other uses, to increased removal of trees, shrubs, herbaceous plants and grass cover from the fragile land of the Sahel threatening trees species loss

From the comparison made in figure 3; there are more factors responsible for tree species endangerment in Sabiyal (11) than in Aliero and Dan Warai. Agricultural Land expansion, Firewood collection, Bush burning, Overgrazing, Building material and harvesting trees for Medicine are the most frequent in all

the three (3) districts which signified that anthropogenic activities are the most responsible factors for tree species endangerment in Aliero local government and threatening tree species extinction. This findings agreed with that of Barbier *et al.*(1994)who opined that, anthropogenic activities are the causes of deforestation. Barbier *et al.* (1994) term this as first level or proximate causes and are relatively easy to identify.

Conclusion and Recommendation

Most tree species found in Aliero local government area were threatened and have low relative density ranging ($0.00 \leq RD \leq 1.00$).The result obtained in this study showed that there are eleven (11) factors responsible for tree species endangerment from which Six (6) factors are the most responsible and include Agricultural land expansion , Firewood , Bush burning , Overgrazing , Building material and Medicine.

To ensure conservation of the already threatened tree species in the study area the following recommendations were made:

- Enactment of environmental laws associated with Conservation and preservation of woody species in the study area for sustainability.
- The promotion of alternative energy source for fuel wood in the study area in order to reduce the pressure on the already threatened tree species.
- Establishment of tree species nurseries to raise indigenous and exotic seedlings for planting out in the study area and sale to the general public.
- Government by way of policy should be strict in conserving forest tree species from illegal deforestation.
- NGOs and CBOs should be encouraged to take active part in community forestry activities in order to reduce the pressure on the forest tree species.
- Research into assessment of endangered tree species and strategies for conservation in the study area should be further conducted.

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