



## **A Comparative Woody Species Composition of a *Eucalyptus Camaldulensis* Plantation and an Adjacent Open Savanna at Bununu, Tafawa Balewa Local Government Headquarter Bauchi State Nigeria**

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### ***Abstract***

*The study accessed the woody species composition within the one-hectare Eucalyptus plantation and an adjoining open savanna located at Bununu Tafawa Balewa local government area of Bauchi state, Nigeria with the view of providing information on ecological impact of Eucalyptus camaldulensis on natural regeneration of indigenous species. Three quadrats of 10mx10m were selected in each of the two sides and total species count conducted. Results from the study shows that, there are 236 and 90 tree stands representing 18 and 12 tree species cutting across 10 and 7 families and 13 and 10 genera in the Eucalyptus plantation and the adjoining open savanna respectively. Eucalyptus camaldulensis and Combretum glutinosum recorded the highest frequency and percentage frequency of 98 and 39, and 41.53% and 43.3% in the plantation and open savanna respectively followed by Acacia ataxacanta and Piliostigma reticulatum with frequency and frequency percentage of 34 and 14% and 12 and 13.3% in the respective sides. In the plantation, Vitellaria paradoxa, Tamarindus indica, Paliostigma reticulata and Cassia singuriana have the least frequency and frequency percentage with 1 and 0.47% respectively. The family Fabaceae/Leguminosae recorded the highest frequency and percentage frequency of 5 and 45.45 while Myrtaceae, Sapotaceae, Apocynaceae, Ebenaceae, Oligocaceae and Zygophyllaceae recorded the lowest frequency of 1 and 1.23% each. In the*

*open savanna Acacia seyal and Zizipus mauritiana have the frequencies of 9 and percentage frequency of 10, Diospyros mespiliformis has frequency of 6 and percentage frequency of 6.7 species with lower frequency values in the open savanna include Dichrostachys cinerea with frequency of 4 and percentage frequency of 2.2, Combretum mole has frequency of 3 and frequency percentage of 3.3. Pakia biglobosa and Carrisa adolis have frequencies of 2 and percentage frequency of 2.2. the list frequency was recorded with Anogeissus leiocarpus and Acacia polyacanta with frequency of 1 and percentage frequency of 1.1. in the open savanna Combretaceae and Fabaceae have the highest frequency of 3 and frequency percentage of 3.3, Leguminaceae has frequency of 2 and frequency percentage of 2.2. Ebenaceae, Rhamnaceae, Apocynaceae and Zygopyllaceae all have the frequency of 1 and frequency percentage of 1.1. Although the introduced Eucalyptus species is the dominant species in the plantation, natural regeneration could be said to be fair probably caused by periodical harvesting of the Eucalyptus species.*

**Keywords:** *Tree species composition, Savanna, Indigenous tree species, Forest Conservation*

## ***Introduction***

Despite many uses of plantation forest, intensive monocultures of exotic plantations are widely viewed in a negative light in relation to biological diversity conservation (Carnus et al. 2003).

Among Eucalyptus, Pinus, and Tectona, which are the most commonly used species for plantation purpose throughout the world, Eucalyptus has attracted by far the most criticism (Evans 1992; FAO

2001), e.g. Eucalyptus spp. do not provide organic matter but deplete soil nutrients needed by agricultural crops, compete water resources with agricultural crops, suppress ground vegetation, and result in unsuitability to soil erosion control (Jagger and Pender 2000).

Some studies found that the number of seedlings, density of sapling, and the number of native species in Eucalyptus plantation forests were

higher than those in their adjacent disturbed natural forests (Michelsen et al. 1996; Eshetu 2001). Eucalyptus was also found as a succession catalyst that facilitates the recolonization of some native flora through their influence on understory microclimate and soil fertility, suppression of dominant grasses, and provision of habitats for seed dispersing animals (Lugo 1992; Loumeto and Huttlee 1997; Parrotta et al. 1997; Eshetu 2001; Feyera and Demel 2001; Feyera et al. 2002; Mulugeta and Demel 2004; Mulugeta et al. 2004). Generally, all Eucalyptus species may not have equal negative effects on the environment, undergrowth vegetation, and soil fertility, etc. Their effect may vary within different geographical areas, rainfall regimes and within species. The objectives of this study were to investigate the regeneration status of indigenous woody plants in *E. camaldulensis* plantation

## **MATERIALS AND METHODS**

Bununu the headquarters of Tafawa Balewa Local Government Area in Bauchi state lies on latitude  $9.89^{\circ}$  and longitude  $9.72^{\circ}$ . The climate is characterized into dry and wet season. The dry season usually starts from October – March, while the rainy season starts from April to September. Mean annual rainfall is about 937.9mm while mean annual temperature ranges between a maximum of  $33^{\circ}\text{C}$  and a minimum of  $19^{\circ}\text{C}$ . The vegetation is mainly savanna, climatically defined into Guinea savanna Northern guinea savanna is characterized by open woodland or brush with shorter grasses while the southern guinea savanna has taller grasses. common tree and shrubs found in this region includes; *Adansonia digitata*, *Vitex doniana*, *Diospyros mespiliformis*, *Tamarindus indica*, *Khaya senegalensis*, *Acacia senegal*, *Acacia nilotica*, *Acacia seyel*, *Faidherbia albida*, *Balanites aegyptiaca*, *Parkia biglobosa*, *Guiera senegalensis*, *Borassus aethiopum*, *Piliostigma thonningii*, *Ziziphus spina-christi*, *Hyphaene thebaica* and *Anogeissus leiocarpus*.

### **Sampling procedure and data analysis**

Enumeration of the total number woody tree species within the selected quadrates was conducted. Identification of tree species was done with aid of local inhabitants. The data was analyzed using descriptive statistics. Spreadsheet package (Microsoft Excel) was used to plot histogram.

## Results

The results obtained in the Eucalyptus plantation indicates that, there were two hundred and thirty-six tree stands (236) within the sampled area representing 17 woody species cutting across 10 families and 14 genera. In the open savanna however 90 stands were recorded within the sample area which cut across 12 species, 8 Families and 10 genera. (Table1)

Table 1: woody species diversity in Bununu Eucalyptus plantation and the adjacent open savanna

Side	Families	Genus	Species	Individual counted
plantation	10	14	17	236
Open savanna	8	10	12	90

Table 2: Woody species composition of Bununu *Eucalyptus camaldulensis* Plantation

	Species	Family	Life form	frequency	% Frequency
1	<i>Eucalyptus camaldulensis</i>	Myrtaceae	Tree	98	41.53
2	<i>Zizipus mauritiana</i>	Rhamnaceae	shrub	13	5.51
3	<i>Acacia ataxacantha</i>	Leguminosae	Tree	34	14.41
4	<i>Zizipus mucronata</i>	Rhamnaceae	Shrub	3	1.27
5	<i>Diospyros mespiliformis</i>	Ebenaceae	Shrub	10	4.24
6	<i>Vitellaria paradoxa</i>	Sapotaceae	Tree	1	0.42
7	<i>Zizipus spinochristi</i>	Rhamnaceae	Shrub	3	1.27
8	<i>Anogeissus leiocapus</i>	Combretaceae	Tree	11	4.66

9	<i>Acacia hebecloide</i>	Leguminosae	Tree	25	10.59
10	<i>Acacia siebriana</i>	Leguminosae	Tree	4	1.69
11	<i>Balanites egyptiaca</i>	Zygopyllaceae	Tree	11	4.66
12	<i>Tamarindus indica</i>	Fabaceae	Tree	1	0.42
13	<i>Combretum glutinosum</i>	Combretaceae	Tree	17	7.20
14	<i>Ximenia americana</i>	Olacaceae	shrub	3	1.27
15	<i>Guiera senegalensis</i>	Combretaceae	shrub	4	1.69
16	<i>Piliostigma reticulatum</i>	Fabaceae	shrub	1	0.42
17	<i>Carissa edulis</i> Vahl	Apocynaceae	shrub	6	2.54
			total	236	

Simpsons Index (D) = 0.2014

The highest frequency was recorded *Eucalyptus camaldulensis* (98) as well as percentage frequency 41.53%. *Acacia ataxacanta* has frequency of 34 and frequency percentage of 14%. *Acacia hebecloide* has frequency of 25 and frequency percentage of 10.59%. *Combretum glutinosum* have 17 frequencies and 7.20 frequency percentage. *Zizipus mauritiana* have 13 frequencies and 5.51 frequency percentage. *Anogeissus leiocapus* and *Balanites aegyptiaca* have frequencies and percentage frequencies of 11 and 4.66 respectively. *Diospyros mespiliformis* has frequency of 10 and percentage frequency of 4.24. *Carissa edulis* has frequency of 6 and percentage frequency of 2.54. *Guiera senegalensis* and *Acacia siebriana* have frequencies of 4 and percentage frequencies of 1.69. *Zizipus mucronata* and *Ximenia americana* have frequencies of 3 and percentage frequencies of 1,27. *Vitellaria paradoxa*, *Tamarindus indica* and *Piliostigma reticulatum* have frequencies of and percentage frequencies of 0.42

Table3 Woody species composition of Bununu open savanna

s/n	Species	Family	Life form	frequency	% Frequency
1	<i>Piliostigma reticulatum</i>	Fabaceae	Shrub	12	13.3
2	<i>Acacia seyal</i>	Leguminosae	Shrub	9	10
3	<i>Diospyros mespiliformis</i>	Ebenaceae	Tree	6	6.7
4	<i>Zizipus mauritiana</i>	Rhamnaceae	Shrub	9	10
5	<i>Anogeissus leiocarpus</i>	Combretaceae	Tree	1	1.1
6	<i>Combretum glutinosum</i>	Combretaceae	Tree	39	43.3
7	<i>Pakia biglobosa</i>	Fabaceae	Tree	2	2.2
8	<i>Carissa adolis</i>	Apocynaceae	shrub	2	2.2
9	<i>Combretum molle</i>	Combretaceae	Tree	3	3.3
10	<i>Dichrostachys cinerea</i>	Fabaceae	Shrub	4	2.2
11	<i>Acacia polyacanta</i>	Leguminosae	Tree	1	1.1
12	<i>Balanite aegyptiaca</i>	Zygopyllaceae	Tree	2	2.2
				90	

Simpson's index (D) = 0.2262

In the open savanna (table 3) the highest frequency was recorded with *Combretum glutinosum* 39 and the corresponding percentage frequency of 43.3%. *Anogeissus leiocarpus* and *Acacia polyacanta*

## Discussion

The regeneration of the native species is fair this may probably be due to the Forest management practice employed in the plantation. The spacing used for plantation species is 4m x 4m this helps in reducing the amount of energy that penetrate the plantation thereby shortening the seed dormancy/seed germination period of the native species especially at the center of the plantation this

confirms the finding of Kyereh et al. (1999), who reported that both germination percentage and speed of germination of many tropical forest tree species were adversely affected by high irradiance. Very high irradiances are very often confounded by many other adverse environmental factors such as high soil and air temperatures (Chazdon and Fetcher, 1984; Pritchett and Fisher, 1987; Brown, 1994) as well as rapid evaporation rates (Chazdon and Fetcher, 1984; Fetcher et al., 1985) on the forest floor. Other factors that may contribute in the paucity of native species saplings may include herbivores this is evident in the higher population of members of the genus *Acacia* as compared to other species. *Acacias* have a special peculiarity in possessing thorns which helps in resisting browsing pressure by ruminant. The lower frequency percentage of *Vitellaria paradoxum* could be attributed to its palatability to herbivores, competition and the trampling effects of animals: same apply to *Termarindus indica*. *Eucalyptus* is known to do well in an exotic location even under poor soil and low moisture condition and can compete vigorously with the native species because of these reasons and absence of its prevalent natural insect pest. The status of regenerating native species in Bununu *Eucalyptus* plantation may be said to be moderate but further studies on interaction of litter with seed germination process and effect of energy penetration on native species seed dormancy is highly recommended.

In the open savanna however, the diversity of species could be said to be relatively higher considering the number of individuals recorded 90 against 236. The Simpsons diversity index is higher in the open savanna despite herbivory pressure and anthropogenic activities. This indicates that *Eucalyptus* plantation has negative effect on regeneration of native species. *Combretum glutinosum* population is restrained under the plantation which could be caused by factors related to the *Eucalyptus* species. Only one stand of *Piliostigma reticulatum* was recorded under the plantation as against 12 in the open savanna

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