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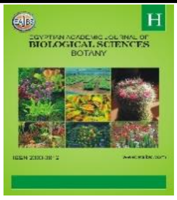

Assessment of Tree Diversity of Riparian Forest Fragments in Omo Biosphere Reserve, Ogun State, Nigeria

Olatidoye, O. Rebecca[1]; Yaduma, B. Zacharia[1]; Oyelowo O. Job[1]; Koyejo A. Olubunmi[2]; Ojekunle O. Opeyemi[3] and Adeniji I.Temitope[1]

[1]Forestry Research Institute of Nigeria, Ibadan, Nigeria.
[2]Forestry Research Institute of Nigeria, Humid Research Station, Umuahia.
[3]Department of Forestry and Wildlife, Federal University of Agriculture, Abeokuta, Nigeria.
[1]E-mail:olaremiolatidoye@gmail.com

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ABSTRACT

Frequently discontinuous landscapes are attributed to various unsustainable human activities all over the world. Increase in population, enclaves and livelihood activities carried out within the reserve over the years is alarming. This study was carried to have a better knowledge of the flora, diversity and ecology of the riparian forests. The study was randomly laid out on various sites of the stratified zone of the reserve namely: Core, Buffer and Transition. Thirty plots (25m ×25m) were selected from each of the zones. A total of 74 tree species belonging to 31 families and 65 genera were identified. The Sorensen index was 90.5%, the evenness of the riparian tree species was 0.056, and the Shannon index ranged from 2.17 to 3.036. Compared to the buffer (587) and transition zones (436), the Core zone (676) has the highest concentration of riparian and upland tree species. The most prevalent species in the core zone is *Diospyros dendo*. Along the major rivers, *Cleistopholis patens* is more prevalent in the buffer zone, whereas, *Theobroma cacao* is more diverse in the transition zone. Low intensity of water flow influenced the abundance of species along streams compared to major rivers. This study revealed that the frequency and intensity of human activities at various levels have an impact on the composition and structure of plant communities.

INTRODUCTION

Rapid land-use changes have resulted in the progressive loss and fragmentation of riparian forests, which offer rich soil for farming, irrigation opportunities, and habitat for a variety of rare and valuable plants and animals. Riparian forests have been degraded as a result of selective tree-cutting, hunting, and agricultural conversion. Moreover, due to inaccessibility to the landscape, riparian forests have frequently been overlooked or left out of general vegetation studies in favor of highland forests (Natta, 2003). Our understanding of riparian forest flora, particularly the richness, ecology, and spatial distribution of species within the forests is limited. Through land conversion and hydrological regime adjustment, human alterations have an impact on riparian vegetation, according to Chatzinikolaou *et al.*,(2011), barely 10% of Greece's riparian corridors are in nearly natural condition. The combined consequences of these changes and the additive effects of climate change seem to make riparian ecosystems particularly vulnerable (Perry *et al*., 2012). Urbanization, developed agriculture, fire regime modification, and grazing can all have direct effects on riparian cover, floristic composition, and/or the frequency and cover of non-native species. (Meek *et* *al*., 2010). The main factor influencing riparian forests' size and structural complexity over decades or centuries has been human activity, which has decreased their richness and drastically altered their terrain. Their abundant biological resources particularly plant species are disappearing before they are enumerated and evaluated. (Natta, 2000).The availability of valuable resources such as water, wood, and non-timber forest products in riparian forest mainly contributes to the exploitation of this vegetation. These resources are used by communities nearby to meet their basic needs and as a source of revenue. Hence the need to assess the current status of the riparian trees and provide conservative measures for its preservation and sustainable use before it’s over exploitation or total degradation.

MATERIALS AND METHODS

Study Area:

The research location, Omo Biosphere Reserve, is a globally recognized and distinctive environment whose landscape has been stratified to satisfy the requirements of a standard biosphere reserve due to biological population conservation.In the Ijebu area of Ogun State, southwest Nigeria, it extends north from latitudes 6^0 35^1 to 7^0 05^1 N and east from longitudes 4^0 19^1 to 4^0 40^1 E. (Fig.1).

The core zone has approximately 460 hectares in size; this was designated by UNESCO in 1971. The buffer which encircles the core zone with a size of 8,165 hectares and the transition zone, trans-borders the buffer zone, it spans 666,498.75 hectares. Forest roads, walkways, river streams, or enclaves partition each of these areas. The biosphere's riparian zones are made up of the flora that grows beside large rivers, streams, and wetlands. In each of the core, buffer, and transition zones, representative locations were selected along the Major River, streams, and upland.Fig 1 shows the map of Omo Biosphere Reserve.

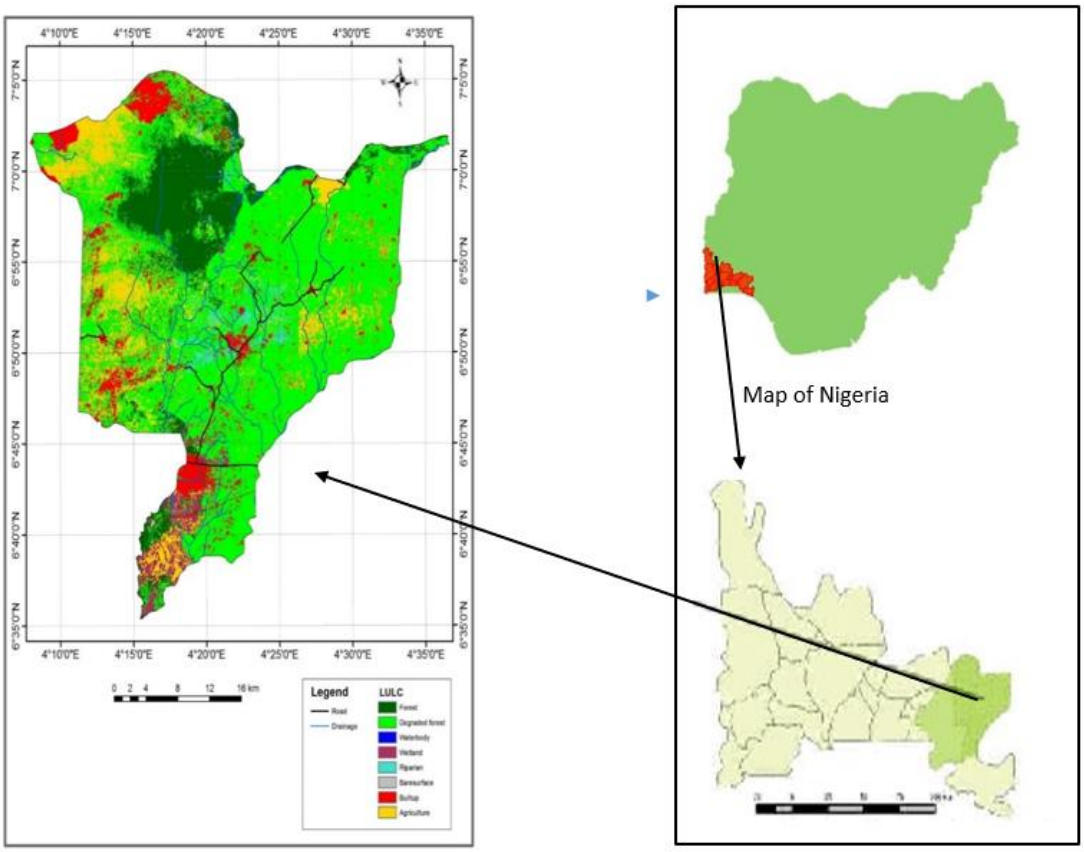

Fig. 1: Map of Omo Biosphere Reserve, Ogun State, Nigeria.

For the study, stratified random sampling was used. A total of 90 plots of 25 m by 25 m were chosen.In each zone, thirty plots each were sampled along the riparian vegetation of the core, buffer, and transition. Fifteen plots were sampled along the riparian forest and fifteen plots were sampled along the nearby upland vegetation for each zone. A taxonomist assisted in the identification, recording, and family placement for each tree species found in the plots.To classify tree species diversity, the species diversity (number of species in a family) was recorded. To determine values of timber volume and basal area, the diameter at breast height of trees (dbh≥10) at 1.3 meters above the ground was taken with a girth tape.Differences in site diversity index (Shannon), Equitability index (Pielou) and Sorensons diversity index were calculated.

Species Diversity Index: This was calculated using the Shannon-Wiener diversity index by Kent and Coker (1992): $H' = -\sum_{i=1}^{S} \text{pi} \ln(\text{pi})$

Where:
H' = Shannon-Weiner diversity index
S = Total number of species in the community
Pi= Proportion of S made up of the ith species
Ln=natural logarithm

Species Evenness in each community was determined using Shannon's equitability (E_H):

$$E_H = \frac{H'}{lnS} = \frac{\sum_{i=1}^{S} \text{p1} \ln(\text{p1})}{\ln S}$$

E_H is the Shannon diversity index,
S is the total number of species in the community,
pi is the proportion of a species to the total number of plants in the community and Ln is the natural logarithm.

Sorensen's Species Similarity Index (SI) was used to compare diversity across the three ecological zone.

$$SI = \left[\frac{2C}{A+B}\right] \times 100$$

C is the total number of common species;
while A is the number of species in community A
and B is the number of species in community B

Plant Community Diversity: The diversity of plant communities was assessed through the multivariate analysis of floristic data. Ordination analysis was carried out using Detrented correspondence analysis (DCA). TWINSPAN Software, decotwin 2012, (performs two-way indicator species analysis) version 1.2.

RESULTS

Floristic and Stand Characteristics of Riparian Forests Throughout Omo:

Twenty-nine (29) tree species (39%) occurred repeatedly along the riparian systems (major rivers and stream). These included *Diospyros dendo*, *Drypetes species*, *Cleistopholis patens*, *Strombosia postulata*, *Macaranga barteri*, *Musangacecropioides*, *Alstoniaboonei*, *Grewiapubescens*, *Bombax buonopozense*, *Margaritariadiscoidea*, *Pycnanthusangolensis*, *Sterculia rhinopetala*, *Celtiszenkeri*, *Homaliumaylmeri*, *Blighiasapida*, *Elaeisguineensis*, *Terminalia superba*, *Funtumiaelastica*, *Ricinodendronheudelotii*, *Ficusexasperata*, *Lecaniodiscuscupanioides*, *Nesodogorniapapaverifera*, *Bosqueiaangolensis*, *Rauvolvia vomitoria*, *Spondiasmombin*, *Dialliumguineense*, *Sterculia tragacantha*, *Pavettacorymbosa*, *Dilleniaindica*. Twenty-one (21) and twenty-three (23) tree species have been identified only along the major rivers and streams, respectively.In the 60 plots examined from the riparian system, *Diospyros dendo* had the highest overall occurrence, whereas *Pterocarpus osun* had the lowest occurrence (1). According to Table 1, *Trichilliagilgiana*(33.9 cm), *Aningeria* *robusta* (27 cm), and *Pterocarpus osun* (17 cm) had the lowest total diameter at breast height (dbh), while *Diospyros dendo* (2918 cm), *Drypetes species* (2384 cm), and *Cliestopholispatens*(2372 cm) had the highest diameter at breast height.*Zanthoxylumzanthoxyloides* (4.918), *Strombosiapostulata*(4.025), and *Cola nitida* (3.693) had the most basal area per hectare, whereas *Scotellia coriacea* (0.843), *Diospyros soubreana* (0.775), and *Annonidiummanni* (0.156) had the lowest. All tree species had a total volume of 2116.3 m^3 per hectare, with a total basal area of 164.68 m^2/ha.

Table 1: Tree Species Diversity in Omo Biosphere Reserve Riparian Zones

SPECIES NAME	Total occu	Freq.	T dbh(cm)	M dbh(cm)	Density	Dominance	R. Freq	R. den	R. Dom	IVI	BA/ha (m^3/ha)	Volume (m^3/ha)
Afzelia africana	7	5	71	25.6	0.011	0.0013	0.577	0.400	0.190	1.167	1.6	18.9
Albizia auxilary	3	3	64	28.2	0.005	0.0011	0.346	0.171	0.171	0.689	1.762	18.41
Albizia ferruginea	13	5	254.1	30.2	0.021	0.0045	0.577	0.743	0.680	2.000	1.887	24.52
Albizia zygia	4	4	101	28.8	0.006	0.0018	0.461	0.228	0.270	0.960	1.8	20.43
Alstonia boonei	35	22	895.6	28.4	0.056	0.0159	2.540	2.001	2.396	6.938	1.775	30.09
Amphimas tetracoides	3	3	64.2	31.5	0.005	0.0011	0.346	0.171	0.17	0.689	1.968	18.43
Aningeria robusta	2	2	27	33.1	0.003	0.0005	0.230	0.114	0.072	0.417	2.068	14.59
Annonidium manni	30	16	271.6	2.5	0.048	0.0048	1.847	1.715	0.726	4.289	0.156	24.81
Anthocleista djalonensis	10	7	439.3	37.8	0.016	0.0078	0.808	0.571	1.17	2.55	2.365	26.94
Anthocliesta vogelii	52	9	1270	23.7	0.083	0.0226	1.039	2.973	3.397	7.410	1.481	31.64
Anthonotha macrophylla	5	3	91	22.3	0.008	0.0016	0.346	0.285	0.243	0.875	1.393	19.97
Artocarpus communis	11	7	113.8	29.3	0.018	0.002	0.808	0.628	0.304	1.741	1.831	20.69
Bambusa vulgaris	7	6	1139	22.8	0.011	0.0202	0.692	0.400	3.047	4.146	1.425	31.16
Baphia nitida	6	5	85	21.5	0.01	0.0015	0.577	0.343	0.227	1.147	1.343	19.67
Blighia sapida	23	20	570.1	23.6	0.037	0.0101	2.309	1.315	1.525	5.150	1.475	28.1
Blighia unijigata	3	3	48	19	0.005	0.0009	0.346	0.171	0.128	0.646	1.187	17.4
Bombax buonopozene	27	14	443.6	18.2	0.043	0.0079	1.616	1.543	1.187	4.347	1.137	26.98
Bosqueia angolensis	7	5	193.6	22.2	0.011	0.0034	0.577	0.400	0.518	1.495	1.387	23.31
Brachystegia eurycoma	14	5	355.5	37.8	0.022	0.0063	0.577	0.800	0.951	2.329	2.362	26
Bridelia ferruginea	15	12	315	24.5	0.024	0.0056	1.385	0.8576	0.842	3.086	1.531	24.47
Carica papaya	2	2	38	17	0.003	0.0007	0.230	0.114	0.101	0.446	1.062	16.1
Cassia saimea	38	5	1088	19.7	0.061	0.0193	0.577	2.17	2.91	5.661	1.231	30.96
Ceiba pentandra	6	6	68.5	21.1	0.01	0.0012	0.692	0.343	0.183	1.219	1.318	18.71
Celtis zenkeri	39	27	613.3	23.6	0.062	0.0109	3.117	2.229	1.641	6.988	1.475	28.42
Chrysophyllum albidum	4	4	57	32.5	0.006	0.001	0.461	0.228	0.152	0.843	2.031	17.9
Cleistopholis patens	92	40	2373	26.5	0.147	0.0422	4.618	5.260	6.350	16.229	1.656	34.41
Cola acuminata	2	2	43.6	21.5	0.003	0.0008	0.230	0.114	0.116	0.461	1.343	16.71
Cola nitida	10	7	107	59.1	0.016	0.0019	0.808	0.571	0.28	1.666	3.693	20.69
Corynante pachycercus	3	3	320.6	48.5	0.005	0.0057	0.346	0.171	0.857	1.375	3.031	25.55
Diallium guineense	11	10	117.8	27.2	0.018	0.0021	1.154	0.628	0.315	2.098	1.7	21.11
Dillenia indica	2	2	62.7	29.4	0.003	0.0011	0.230	0.114	0.167	0.513	1.837	18.32
Diospyros dendo	233	50	2918	33.6	0.373	0.0519	5.773	13.3	7.809	26.90	2.1	35.32
Diospyros melistoformis	6	2	39.5	22.4	0.01	0.0007	0.230	0.343	0.105	0.679	1.4	16.28
Diospyros soubreana	6	3	58	12.4	0.01	0.001	0.346	0.343	0.155	0.844	0.775	17.98
Diospyros undebunda	1	1	32	32	0.002	0.0006	0.115	0.057	0.085	0.258	2	15.34
Drypetes species	154	39	2384	14.6	0.246	0.0424	4.503	8.805	6.379	19.68	0.912	34.43
Elaeis guineensis	37	16	1080	48.7	0.059	0.0192	1.847	2.115	2.888	6.851	3.043	30.92
Ficus exasperata	18	13	520.2	27.5	0.029	0.0092	1.501	1.02	1.392	3.922	1.718	27.69
Ficus macrophylla	26	8	726	22.6	0.042	0.0129	0.923	1.486	1.942	4.353	1.412	29.17
Funtumia africana	5	3	199	23.6	0.008	0.0035	0.346	0.285	0.532	1.164	1.475	23.44
Funtumia elastica	30	22	343.1	43.9	0.048	0.0061	2.540	1.715	0.918	5.173	2.745	25.85
Garcinia kola	7	6	92	21.2	0.011	0.0016	0.692	0.400	0.246	1.339	1.325	20.02
Gmelina arborea	22	10	581.3	17	0.035	0.0103	1.154	1.257	1.555	3.968	1.062	28.18
Grewia pubescens	28	12	719.8	16.9	0.045	0.0128	1.385	1.600	1.926	4.912	1.056	29.13

Harungana madagascariensis	7	5	169.9	16.9	0.011	0.003	0.577	0.400	0.454	1.432	1.056	22.74
Hexalobus crispiflorus	11	3	398.2	28.4	0.018	0.0071	0.346	0.628	1.06	2.041	1.775	26.51
Hildegardia barteri	3	3	78	28	0.005	0.0014	0.346	0.171	0.208	0.726	1.75	19.29
Holarrhena floribunda	6	5	89.5	36.9	0.01	0.0016	0.577	0.343	0.239	1.159	2.306	19.9
Homalium aylmeri	20	15	977.3	21.1	0.032	0.0174	1.732	1.143	2.615	5.491	1.318	30.48
Irvingia gabonensis	5	5	118.3	28.5	0.008	0.0021	0.577	0.285	0.316	1.179	1.781	21.13
Lecaniodiscus cupanioides	18	16	268.1	26.5	0.029	0.0048	1.847	1.02	0.71	3.594	1.656	24.75
Lonchocarpus ciliata	3	2	211.8	28.4	0.005	0.0038	0.230	0.171	0.566	0.969	1.775	23.71
Lonchocarpus cyanescens	3	3	29.3	27.7	0.005	0.0005	0.346	0.171	0.078	0.596	1.731	14.95
Macaranga barteri	38	12	1493	38.9	0.061	0.0265	1.385	2.17	3.996	7.554	2.431	32.36
Maesobotrya barteri	9	6	140	37.4	0.014	0.0025	0.692	0.51	0.374	1.582	2.337	21.88
Margaritaria discoidea	34	22	661.2	31.7	0.054	0.0118	2.540	1.943	1.769	6.253	1.981	28.75
Melacantha alnifolia	3	1	173.8	27.6	0.005	0.0031	0.115	0.171	0.465	0.752	1.725	22.84
Milicia excelsa	2	2	84	46	0.003	0.0015	0.230	0.114	0.224	0.570	2.875	19.62
Millettia thoningii	3	3	56.4	39.1	0.005	0.001	0.346	0.171	0.150	0.668	2.443	17.85
Mitragyna cilliata	10	3	102	19.5	0.016	0.0018	0.346	0.571	0.272	1.191	1.218	20.48
Monodora tenuifolia	7	4	185.5	57.2	0.011	0.0033	0.461	0.400	0.496	1.358	3.575	23.12
Musanga cecropioides	36	22	*892.2*	21.4	0.058	0.0159	2.540	2.058	2.387	6.986	1.337	17.66
Nauclea diderrichii	17	9	390.6	18.8	0.027	0.0069	1.039	0.971	1.045	3.056	1.175	30.08
Nesodogornia papaverifera	41	22	*388*	17	0.066	0.0069	2.540	2.344	1.038	5.922	1.062	26.42
Nothospondia staudtii	6	2	*199.5*	21.7	0.01	0.0035	0.230	0.343	0.533	1.107	1.356	23.45
Pavetta corymbosa	3	3	*66.8*	27.7	0.005	0.0012	0.346	0.171	0.178	0.696	1.731	18.6
Picralima nitida	34	12	1080	25.8	0.054	0.0192	1.385	1.943	2.88	6.218	1.612	30.92
Piptadeniastum africana	3	3	63.8	24	0.005	0.0011	0.34	0.172	0.170	0.688	1.5	18.4
Pterocarpus osun	4	4	17	30.5	0.006	0.0003	0.461	0.228	0.045	0.736	1.906	12.54
Pterocarpus santalinoides	9	3	304	36.8	0.014	0.0054	0.346	0.51	0.813	1.674	2.3	25.31
Pycnanthus angolensis	28	21	810.4	32	0.045	0.0144	2.424	1.600	2.168	6.194	2	29.65
Rauvolvia vomitoria	9	5	135.8	44	0.014	0.0024	0.577	0.51	0.363	1.45	2.75	21.74
Ricinodendron heudeloti	24	22	995.1	26.7	0.038	0.0177	2.540	1.372	2.66	6.575	1.668	30.56
Rinorea dentate	4	2	112	39.4	0.006	0.002	0.230	0.228	0.299	0.75	2.462	20.89
Rothmania hispida	2	2	44	17.9	0.003	0.0008	0.23	0.114	0.117	0.463	1.118	16.75
Scotellia coricea	31	13	82.6	13.5	0.05	0.0015	1.501	1.772	0.221	3.494	0.843	19.54
Spondias mombin	5	5	154	19	0.008	0.0027	0.577	0.285	0.41	1.275	1.187	22.3
Sterculia oblonga	2	2	107	43.4	0.003	0.0019	0.230	0.114	0.28	0.631	2.712	20.69
Sterculia rhinopetala	36	25	742.3	33.2	0.058	0.0132	2.886	2.058	1.986	6.931	2.075	29.26
Sterculia tragacantha	4	3	137.7	21.4	0.006	0.0024	0.346	0.228	0.368	0.943	1.335	21.81
Strombosia postulata	85	41	1682	64.4	0.136	0.0299	4.734	4.85	4.501	14.09	4.025	32.89
Terminalia superba	35	17	731.9	53.5	0.056	0.013	1.96	2.001	1.958	5.922	3.343	29.2
Tetrapleura tetraptera	2	22	73.9	16.6	0.003	0.0013	2.540	0.114	0.197	2.852	1.03	19.05
Theobroma cacao	38	15	50.8	31.2	0.061	0.0009	1.732	2.17	0.135	4.040	1.95	17.39
Trema orientalis	2	2	76.5	40.1	0.003	0.0014	0.230	0.114	0.204	0.5500	2.506	19.2
Trichilia gilgiana	3	3	33.9	26.7	0.005	0.0006	0.346	0.171	0.090	0.608	1.668	15.6
Trichilia monadelpha	31	14	703.4	32.1	0.05	0.0125	1.616	1.772	1.882	5.271	2.006	29.03
Uapaca heudelotii	7	6	237	35.1	0.011	0.0042	0.692	0.400	0.634	1.727	2.193	24.21
Zanthoxylum zanthoxyloides	5	5	375	78.7	0.008	0.0067	0.577	0.285	1.003	1.866	4.918	26.24
90	**1749**	**866**			**2.798**	**0.6643**	**100**	**100**	**100**	**300**	**164.68**	**2116.3**

Along the major river and streams, 74 tree species (dbh ≥ 10) from 65 genera were identified. The most abundant tree species are *Diospyros dendo, Drypetes specie, Cleistopholis patens, Strombosiapustulata, Macaranga barteri, Cassia siamea, Picralimanitida, Musangacecropioides, and Trichiliamonadelpha.* The 10 most significant species had roughly half (48.5%) while the remaining 64 tree species had 51.49% of the total proportion. The total of the remaining 64 tree species had a higher percentage of the total basal area (89.26%) than the 10 most significant species had only a small percentage (10.74%) (Table 2).

Table 2: Omo Riparian Forest's Stand and Floristic Characteristics.

Dominance of riparian forest tree species: population size and basal area of the ten most significant species					
SPECIES	**Absolute Abundance**	**Relative Abundance (%)**	**Total dbh (cm)**	**BA (m^2)**	**Relative Basal Area (%)**
Diospyros dendo	120	20.58	2918	669.01	28.25
Drypetes species.	106	18.18	2384.1	446.55	18.86
Cleistopholis patens	88	15.09	2372.8	442.07	18.67
Anthocliesta vogelii	52	8.91	1269.7	126.52	5.34
Strombosia postulata	45	7.71	1682.1	222.28	9.38
Macaranga barteri	38	6.51	1493.4	175.13	7.39
Cassia siamea	38	6.51	1088	93.00	3.92
Picralima nitida	34	5.83	1079.6	91.47	3.86
Musanga cecropioides	31	5.31	892.2	62.51	2.64
Trichilia monadelpha	31	5.31	703.4	38.83	1.64
Total of the 10 most important tree species	583	**48.50**	15883.3	2367.4	**10.74**
Total of the remaining 64 tree species	619	**51.49**	20302.7	19675.5	**89.26**
Overall total of the 74 tree species	1202	**100**	36186.0	22042.9	**100**

Table 3, illustrates that the main rivers and streams in the core, buffer, and transition zones have tree Shannon indices ranging from 2.17 to 3.036.Tree diversity was highest in riparian forests along streams (3.486), followed by major rivers (3.395) and uplands (3.253).The Pielou Equitability Index was 0.562, while the overall tree diversity of the riparian forest was 3.743. The core, buffer, and transition Sorenson similarity indices for the riparian system and upland are 36.7%, 26.9%, and 30%, respectively. All riparian systems and upland plots had an overall Sorenson index of 90%.

Table 3: Tree species diversity in the riparian region of Omo Biosphere Reserve**.**

Region	**Site**	**No of species**	**Abundance N**	**Shannon DiversityH^+**	**Evenness E**		**Margalef Simpson Index**	**Fisher Alpha**	**Sorensons index %**
CORE	Major river	26	267	2.773	0.615	4.304	0.906	6.78	36.7
	Stream	24	182	2.895	0.753	4.25	0.924	7.051	
	Upland	24	227	2.467	0.491	4.079	0.832	6.469	
	Major river	25	173	2.757	0.629	4.473	0.905	7.603	
BUFFER	Stream	33	221	3.036	0.631	6.647	0.995	15.57	26.9
	Upland	28	230	2.82	0.598	4.793	0.907	7.983	
	Major river	27	137	3.14	0.859	5.178	0.949	9.984	30
TRANSITION	Stream	14	209	2.17	0.626	2.250	0.847	3.078	30
	Upland	18	90	2.3	0.554	3.62	0.818	6.473	
All region	UPLANDS	54	548	3.253	0.479	11.67	0.9582	19.61	
All region	MAJOR RIVERS	53	583	3.395	0.561	8.037	0.9418	13.92	90.5
All region	STREAMS	52	619	3.486	0.616	7.792	0.9558	13.23	
Riparian Forest of Omo	**All major rivers and streams**	**75**	**1202**	**3.743**	**0.562**	**10.3**	**0.9625**	**17.44**	

The cluster analysis (Jaccard) of the 60 plots of important rivers and streams in the core, buffer, and transition zones is illustrated in Figure 2 shows similarities in relationships. Plots in the transition zone of the streams (STP8 and STP5) exhibited the highest similarity at 100% in the first group, while plots in the main rivers and streams of the core and buffer (MBP6 and SCP6; MBP2 and SCP2) exhibited greater similarities at 100% in the second group.

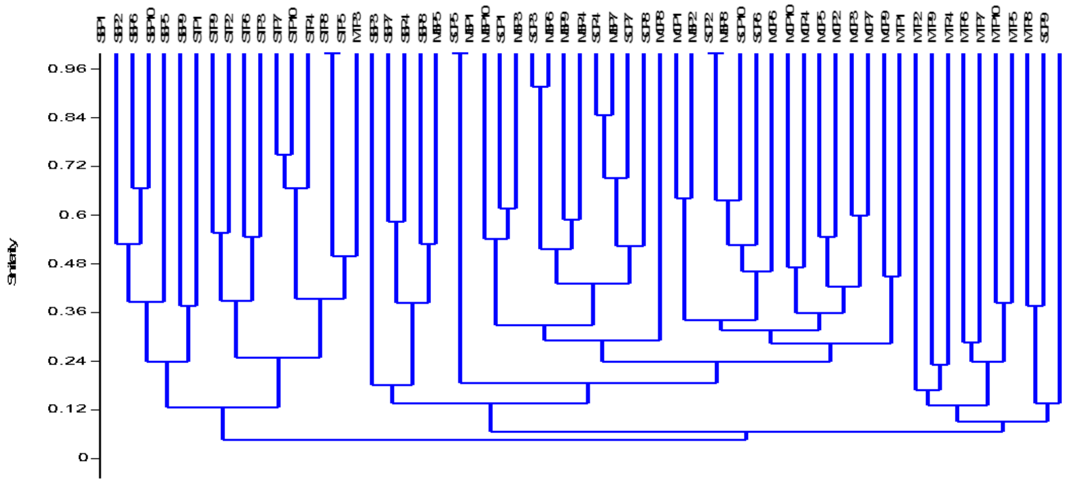

Fig. 2: Cluster of the Riparian Zones (Major Rivers and Streams) of Omo Biosphere Reserve.

Key: M = MAJOR RIVERS S = STREAM C = CORE B = BUFFER
T = TRANSITION P = PLOTS (1,2,3,4,5,6,7,8,9,10)

The three plant communities are depicted in Figure 3 according to the cluster in Figure 2. Due to their highest abundance within the community, the first community is representative of the *Cleistopholis patens* and *Anthocleistavogelii* community.These species are limited to the buffer and transition zones and are only found along the stream's riparian forest.SBP 1, SBP 2, SBP 6, SBP 10, SBP 5, SBP 9, STP 1, STP 9, STP 2, STP 6, STP 8, STP 7, STP 10, STP 4, STP 8, and STP 5 were the plots where they were most frequently found. The community of *Drypetes* species and *Diospyros dendo* species is represented by the second community. These species are limited to the core and buffer zones and have been identified in both major rivers and streams.They mostly appear in the plots listed below. These include SBP 3, SBP 7, SBP 4, SBP 8, MBP 5, SCP 4, MBP 5, MBP 1, MBP 10, SCP 1, MBP 3, SCP 9, MBP 6, MBP 9, MBP 4, SCP 4, MBP 7, SCP 8, MCP 8, MCP 1, MBP 1, SCP 2, MBP 8, SCP 10, SCP 6, MCP 10, MCP 4, MCP 5, MCP 2, MCP 3, MCP 7, MCP 9. The Community of *Afzeliaafricana*is the third community. These species are limited to the transition zones and are primarily found in the major rivers. Plots MTP 1, MTP 2, MTP 9, MTP 4, MTP 6, MTP 7, MTP 10, MTP 5, and MTP 8 contained them.

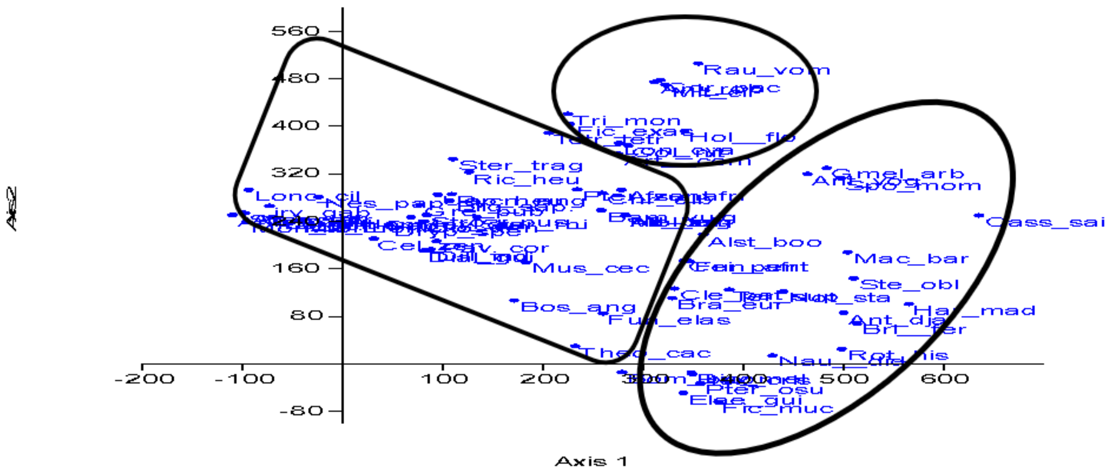

Fig.3:shows the three plant major groups in accordance with the cluster shown in Figure 2.

DISCUSSION

The 74 tree species from 31 families and 65 genera found in the riparian systems of Omo Biosphere Reserve represent a comparatively high area cover when compared to the 224 species from 120 families found in the riparian forest flora of the entire Benin Republic (Natta, 2003). Vallari *et al.*, 2009 noted that the variety of difficulties at varying levels, frequencies, and extents of human activities that limit species diversity have an impact on the composition and structure of plant communities.

The low intensity of the water flow, which permits flooding and supports seed settlement for germination, may be the reason species along the stream were more abundant than those along major rivers. High spatial and temporal variability in environmental circumstances, representing a substantial environmental gradient at many scales is often what sustains biodiversity in natural riparian regions (Ward*et al*., 2002).

Similar observation has been reported by Mubi(2012) who stated that *Diospyros dendo, Drypetes species., Cleistopholis patens, Strombosiapostulata, Macaranga barteri, Musangacecropioides, Alstoniaboonei, and Grewia pubescens* were among species found in Mayo Dam in Gashaka. Taraba State, Nigeria. In Omo forest reserve's riparian zones, *Diospyros dendo* was discovered to be the most prevalent tree species. The least common species was *Pterocarpus osun*, which is primarily found in savanna environments. Riparian woods frequently incorporate plants from different ecosystems.

Compared to the buffer and transition zones, the Core zone of the reserve has the highest concentration of riparian and upland tree species. This is due to the forest's undisturbed state as a strict nature reserve (SNR), which forbids manipulative research and has a well-protected environment that supports the preservation of species, ecosystems, landscapes, and genetic diversity. This may be explained by minimal or nonexistent human intervention in the natural forest. The structure of forests, species variety, the health of watershed ecosystems, and the sustainability of livelihoods are all significantly impacted by deforestation and other human activity. (Steffen *et al.*, 2015; Alcott *et al*., 2013).

The most prevalent species in the core zone is *Diospyros dendo*, found along the major river. This indigenous species is mostly found in relatively undisturbed natural ecosystem characterized in the core zone. *Cleistopholis patens* is the tree species more prevalent along the streams of the buffer zone; this species is frequently seen in marsh and disturbed riverine forests. The most common species in the transition zone is *Theobroma cacao*. This is a result of the residents' intensive agricultural practices which allowed them to make a livelihood from the sales of this valuable tree product. In essence, riverine landscapes are dynamic, ecologically and geographically complex, varied, and contribute to the diversity and function of aquatic and terrestrial ecosystems (Ward*et al*., 2002; Acker*et al.*, 2003).

The cluster analysis results are generally reinforced by the DCA results. The forest's floristic heterogeneity is indicated by the plots' high degree of dispersion inside the DCA diagram. In terms of ecology, the majority of the species found in the categories of rainforests under study are common features of most rainforests. Natta (2000) noted that the Republic of Benin riparian forest plant groups were divided by relief, topography, latitude, and environmental gradient, as well as the significance of waterways-riparian forest along streams and rivers. Species often exhibit strong preferences for particular environmental circumstances in this investigation, and plant communities are identified based on geographical variances. The primary cause of variation, which influences the differences in physical characteristics throughout forest communities, is typically geographic isolation.

CONCLUSION

The investigation on riparian species diversity in Omo forest Reserve is very important for biodiversity conservation. The study revealed that *Diospyros dendo, and*

Drypetes species are the most abundant species highly adapted to the core zone, *Cleistopholis patens* is more abundant in the buffer zone while *Theobroma cacao* is more abundance in transition zone of the riparian vegetation of Omo forest reserve. However, the overall biodiversity of tree species documented in this study requires adequate conservation of both prevalent and least abundant species. This is essential to the existence of their immense benefits. Hence, riparian ecosystems are vital multifunctional components of the global ecological network, and their preservation in Omo biosphere reserve is crucial.

Declaration:

Ethical Approval: No artificial models or subject were recruited directly for the study. No ethical considerations are required.

Conflict of Interest: No conflict of interest acknowledged by authors.

Authors' contributions: I thus attest that each of the authors listed on the title page has contributed significantly to the idea and planning of the research, we have carefully read the manuscript and verified the authenticity and correctness of the data and its interpretation. We therefore give our approval for its submission.

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