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FLORISTIC COMPOSITION AND TREE SPECIES DIVERSITY IN OMO BIOSPHERE RESERVE AND IITA FOREST RESERVE

***OJO, E.O.,[1] OLADOYE, A.O.,[1] OJEKUNLE, O.O.[1] AND ADEDEJI, O.H.[2]**
[1]Department of Forest Resources Management, College of Environmental Resources Management, Federal University of Agriculture, P. M. B. 2240, Abeokuta, Ogun State, Nigeria
[2]Department of Environmental Management and Toxicology, College of Environmental Resources Management, Federal University of Agriculture, P. M. B. 2240, Abeokuta, Ogun State, Nigeria
*Corresponding author: elizabetholuwafisayomi@gmail.com

Abstract
Adequate ecological information on forest status is essential for informed management decisions. This study assessed tree species diversity in Omo Biosphere Reserve and the International Institute of Tropical Agriculture (IITA) Forest in Ogun and Oyo States respectively. A systematic line transect method was used to establish twelve (12) sample plots (50 m × 50 m) in each forest. Trees with diameter at breast height (DBH) (1.3 m) of ≥10 cm were identified and measured in each plot for density, height, dbh and frequency. Detrended Correspondence Analysis (DCA), along with similarity and diversity indices, were applied using PAST software (version 3.0) to analyze the data. A total of 427 trees representing 57 species across 22 families were recorded in Omo, while 301 trees comprising 54 species and 22 families were documented in IITA. Euphorbiaceae (9 species), Apocynaceae and Meliaceae (5 species each) were the dominant families in Omo, while Fabaceae and Moraceae (8 species each) were the dominant families in IITA. Celtis zenkeri and Diospyros dendo had the highest frequency (92 %) each in Omo while Funtunmia elastica and Elaeis guineensis had the highest frequency of 90 % and 80 % respectively in IITA. Simpson's species similarity and diversity indices for all the plots in Omo ranged from 0 - 77 % and 64 - 93 % respectively while for all the plots in IITA ranged from 9 - 62 % and 78 - 93 % respectively. Dominance value for all the plots in Omo ranged from 0.07 - 0.36 while in IITA ranged from 0.07 - 0.22. High eigen value 116.50 % and 82.98 % in Omo and IITA respectively indicates a stable environment and nearly all the species were found on the positive side of the quadrant which implies high interaction within the sites. In conclusion, this study demonstrated that natural regeneration could be an effective strategy for restoration of tropical tree species.

Keywords: *Tropical forest, Biodiversity, Conservation, Natural regeneration, Ecology, Floristic composition*

Introduction

Tropical forests support variety of life forms, including humans who live in settlements in and around the forests (Wakshum *et al.,* 2018). The composition and diversity of the country's floral species were in danger because harvested trees were not always replaced as the state government had intended and because many state governments in Nigeria had all but given up on managing their forest reserves. The structure and composition of an ecosystem, which are its two most significant ecological features, can change in response to both environmental and anthropogenic causes (Shaheen *et al.,* 2012).

Species diversity determines how individuals of a species are distributed within their natural environment. Species variety is an essential component of communities because it frequently influences how communities function and their ability for change (Cadotte, 2011). The possibility that two randomly selected members of a community are from different species is known as diversity. Thus, two additional community traits richness and evenness have an effect on diversity. A medically relevant technique to evaluate alpha (α) diversity is species richness, which is commonly described as the number of species per sample unit (Meyer *et al*., 2017). Evenness is a term used to describe how evenly distributed a species' abundance is.

It is important to collect information on the features, classification, relationships, and distribution of plant communities in order to characterize the population dynamics of each species under investigation and their linkages to other species in the same community (Rao *et al.,* 2015). Understanding floristic vegetation characteristics and estimating the species richness and diversity that are present in the studied region are the goals of phytosociological analysis. In the International Institute of Tropical Agriculture (IITA) Forest Reserve and the Omo Biosphere Reserve, not much extensive research has been conducted. A few studies include the distribution and diversity of flora and fauna in IITA forest by Osunsina *et al*. (2012) and the composition and stand structure of a regenerating tropical rain forest ecosystem in south-west Nigeria by Oladoye *et al.* (2014). Therefore, the broad objective of this study was to investigate the floristic composition and tree species diversity in Omo biosphere reserve and IITA forest reserve, while the specific objectives were to (i) assess the floristic composition of the study areas (ii) to quantify the species diversity.

Study Area

This study was carried out in two forests in the South West of Nigeria, the forests are Omo Biosphere Reserve Area J4 Ijebu Ode, Ogun State and International Institute of Tropical Agriculture (IITA) Forest in Ibadan Oyo State.

Omo Biosphere reserve is located around 135 km northeast of Lagos and 80 kilometers (km) east of Ijebu Ode in Ogun State, Southwest Nigeria. The boundaries are located between latitudes 6°60′ and 7°40′ N and longitudes 4°18′ to 4°61′ E. IITA forest reserve is located between latitude 7°29′to 7°30′ N and longitude 3°52′ to 3°54′ E. It is situated on a 1,000-hectare parcel of land on the campus of the International Institute of Tropical Agriculture (IITA), north of Ibadan in Idi-Ose (Oladoye, 2012).

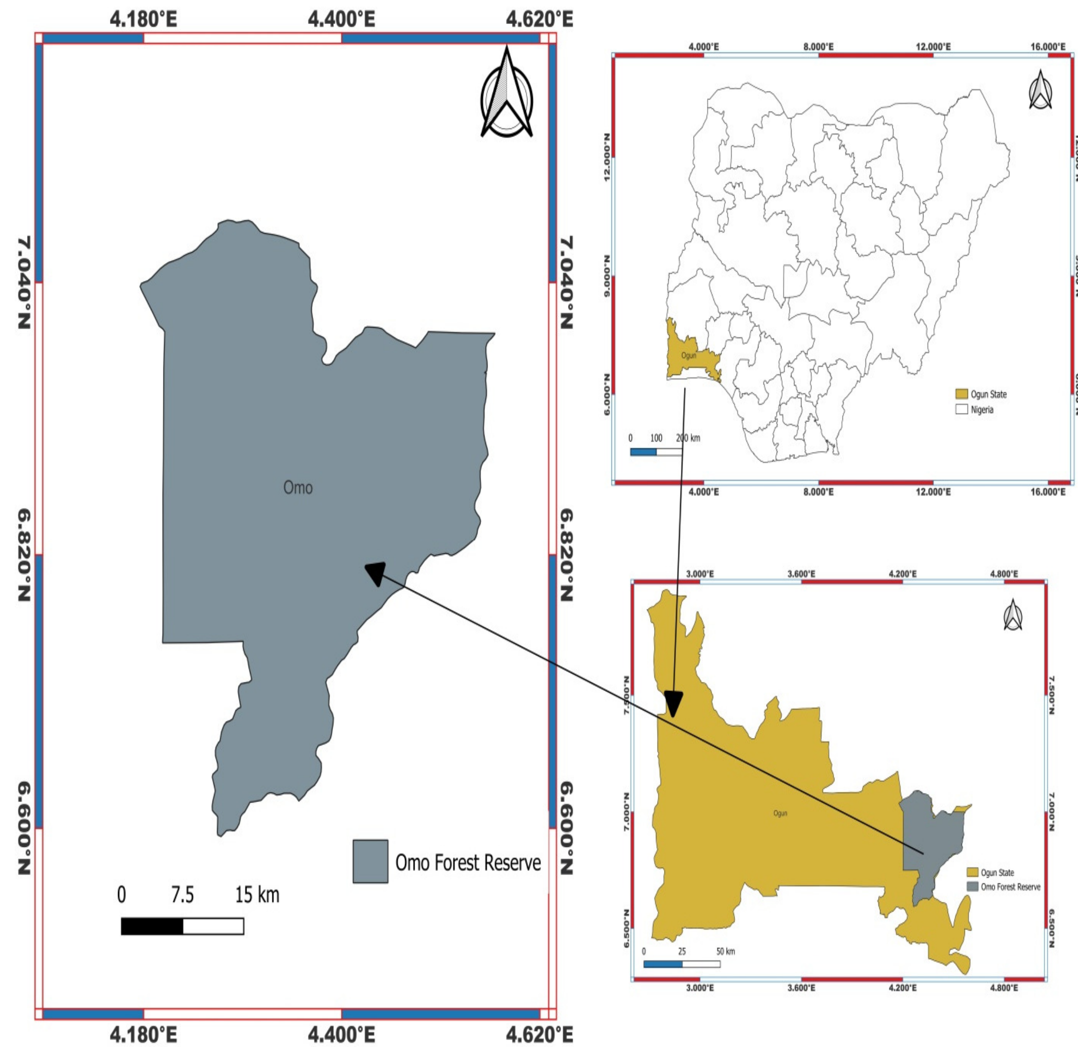

Fig. 1: Map of Omo Biosphere

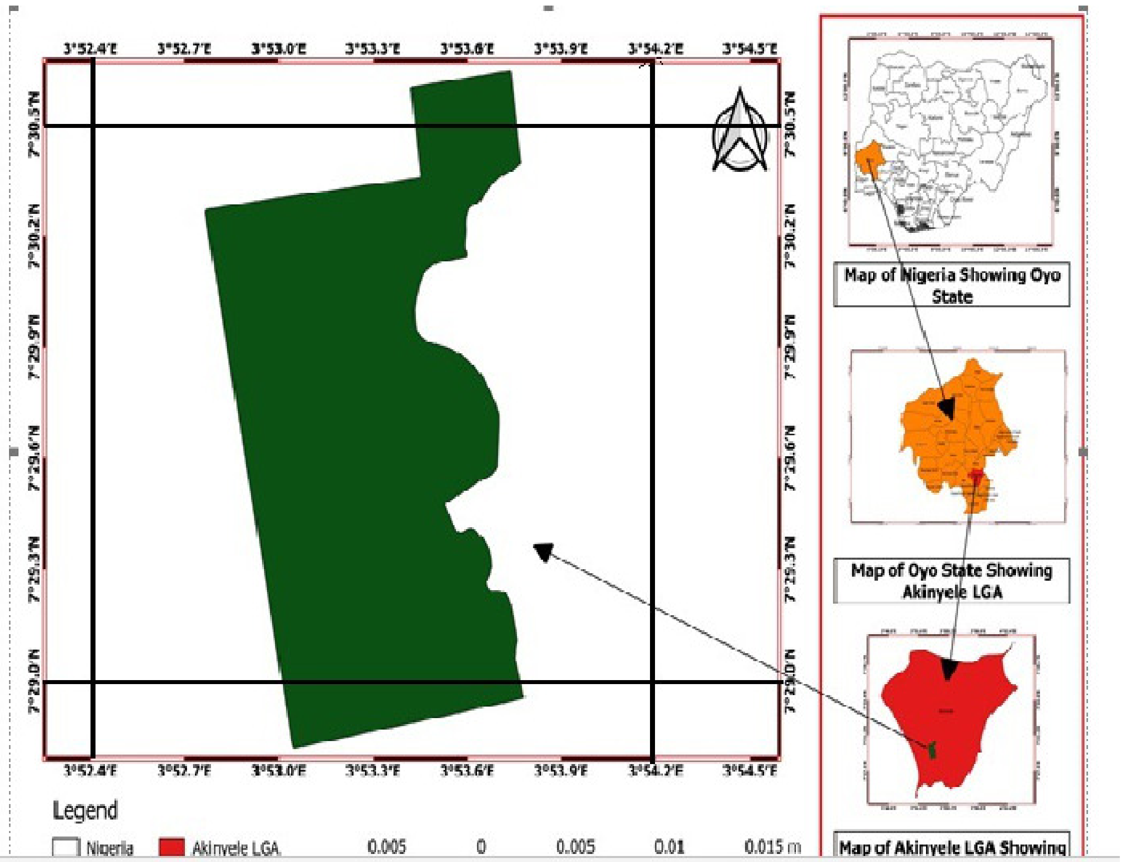

Fig. 2: Map of IITA Forest Reserve

Methodology

Data Collection

Data were collected from the two forests in South-Western Nigeria. Systematic sampling (line transect) technique was adopted for plot location in each of the two study sites: following (Ige *et al.* 2013). A distance of 200m from the forest boundary was measured to create the first transect. The starting point of each transect was determined with the aid of Geographic Positioning System (GPS). Three transects were cut in each of the locations. Four 0.25 ha (50 m x 50 m) plots were laid in alternate position along each transect at 100 m interval to make up 24 plots for the study. In each plot, all living trees with Dbh ≥10 cm were identified and measured using diameter tape and the height of the trees with the aid of Spiegel relascope (Ige *et al.*, 2013). Each tree on the field was recorded separately, including all stems eligible for inclusion in the sample plots (Ige *et al.*, 2013). The floristic compositions were determined using the following;

Volume = $\frac{\pi H\ (Db^2+4Dm^2+Dt^2)}{24}$................................eq 1

Where; Π= 3.142 (constant), Db= Diameter at the base, Dm= Diameter at the middle, Dt= Diameter at the top

Basal Area = $\frac{\pi D^2}{4}$...eq 2
Where; Π= 3.142, D= Diameter at breast height

Density= $\frac{Total\ number\ of\ individual\ od\ a\ specie\ in\ all\ quadrant}{Total\ number\ of\ quadrant\ studied}$..............eq 3

Relative Density= $\frac{Number\ of\ individual\ of\ the\ species}{Number\ of\ individual\ of\ all\ the\ species} \times 100$...........eq 4

Frequency (%) =$\frac{Number\ of\ quadrant\ in\ which\ the\ spp\ occured}{Total\ number\ of\ quadrant\ studied} \times 100$.......eq 5

Relative Frequency= $\frac{Number\ of\ occurence\ of\ the\ species}{Number\ of\ occurence\ of\ all\ the\ species} \times 100$..........eq 6

Relative Dominance= $\frac{Total\ basal\ area\ of\ the\ species}{Total\ basal\ area\ of\ all\ the\ species} \times 100$..................eq 7

Abundance= $\frac{Total\ number\ of\ individuals\ of\ a\ species\ in\ all\ quadrats}{Total\ number\ of\ quadrats\ in\ which\ the\ species\ occurred}$...........eq 8

Importance Value Index (IVI) for tree species will be the sum of RD, RF and R Do

Species diversity indices, evenness indices, richness indices, Simpson's dominance indices, and similarity indices were determined with the formula below:

Shannon Weiner Diversity Index - $\sum_{i=1}^{s} pi\ In\ (pi)$ (Nolan and Callahan, 2006) ....eq 9

Species Evenness Index - $\frac{H}{Hmax} = \frac{H}{logS}$ (Smith and Wilson, 1996) ....eq 10

Species Richness index (Margalef Index) - $D = \frac{S-1}{In\ (N)}$ (Magurran, 1988) ....eq 11

Simpson's Dominance Index - $D = \sum[\frac{n1(ni-1)}{N(N-1)}$ (Somerfield *et al*., 2008) ....eq 12

Similarity Index - Cs=[$\frac{2j}{a+b}$ 100] (Goodall, 1966) ....eq 13

Results

A total of 427 trees representing 57 species from 22 families were encountered during the study at DBH ≥10cm. The density of dominant tree species/ha in Omo Biosphere Reserve ranged from 1 to 27 trees/ha with their corresponding Relative Density (RD), *Diospyros dendo* had the highest RD of 16.56 followed by *Diospyros hybridus* (13.49), while *Adenopus breviflorus, Alstonia congensis, Brachystegia eurycoma, Buchholzia coriacae, Chrysophyllum albidum, Deypetes* *welwichii, Entandrophragma angolensis, Hylodendron gabonensis, Irvingia wombulu, Lovoa trichiliodes, Macaranga grandifolia, Malancantha alnifolia, Massularia acuminata, Mitagyna ciliate, Musanga cecropioides, Nesogordoniapa paverifera, Rauvolfia vomitoria* and *Tetraptera tetraplura,* had the lowest relative density of 1. The rate at which the tree species dominated the area was also calculated; *Celtis zenkeri* had the highest value of 6.17 followed by *Ceiba pentandra* (2.73), while *Cleistopholis patens* and *Xylopia aethiopica* had the lowest dominance value of 0.01 each. *Diospyros dendo* had the highest Importance Value Index (33.03) while *Rauvolfia vomitoria* had the lowest value of 0.97 (Table 2).

A total of 301 trees representing 54 species from 22 families were encountered and identified during the study at DBH ≥ 10cm. The density of dominant tree species/ha in IITA forest reserve ranged from 1 trees/ha to 12 trees/ha. For the Relative Density (RD), *Elaeis guineensis* had the highest RD of 8.22 followed by *Trilepisium madagascariense* (6.85), while *Bilghia sapida, Dialum guineensis, Ficus lutea, Ficus mucoso, Monodora tenuifolia, Morus mesozygia, Olax subscorpioidea, Pycnanthus angolensis, Ricinodendron heudelotti, Rothmannia longiflora, Solanum erianthum, Spathodea campanulata, Voacanga africana and Zanthoxylum leprieurii* had the least value (0.68). The rate at which the tree species dominate the area was also obtained; *Ceiba pentandra* had the highest value (4.14) followed by *Elaeis guineensis* (3.18), while *Bilghia sapida, Dialum guineensis,Olax subscorpioidea, Solanum erianthum* had the lowest dominance value (0.01 each). *Elaeis guineensis* had the highest value (25.27) for Importance Value Index (IVI) while *Olax subscorpioidea* had the lowest value (1.01) (Table 3).

Table 2: Density, Relative Density, Frequency, Relative Frequency, Dominance, Relative Dominance, Abundance and Importance Value Index (IVI) in Omo Biosphere Reserve

Species	Family	Density/ha	R.D	Frequency	R.F	Dominance	R.Do	IVI	Abundance
Adenopus breviflorus (Benth.)	Cucurbitaceae	1	0.61	8.33	0.69	0.18	0.45	1.38	0.23
Albizia ferruginea (Guill. & Perr.)	Fabaceae	1	0.61	25	2.07	0.07	0.17	2.94	0.7
Alstonia congensis (Engl.)	Apocynaceae	1	0.61	8.33	0.69	1.43	3.65	4.58	0.23
Brachystegia eurycoma (Harms)	Fabaceae	1	0.61	8.33	0.69	0.53	1.35	2.27	0.23
Buchholzia coriacea (Engl.)	Sterculiaceae	1	0.61	8.33	0.69	0.05	0.14	1.06	0.23
Canthium hispidum (Benth.)	Rubiaceae	1	0.61	25	1.38	0.12	0.31	2.39	0.7
Ceiba pentandra (L. Gaertn.)	Malvaceae	2	1.23	33.33	1.38	2.73	6.96	9.27	0.94
Celtis mildbraedii (Engl.)	Cannabaceae	1	0.61	8.33	0.69	0.09	0.22	1.61	0.7
Celtis zenkeri (Engl.)	Cannabaceae	21	12.88	91.67	7.59	6.17	15.75	37.86	14.52
Chrysophyllum albidum (G.Don)	Sapotaceae	1	0.61	8.33	0.69	0.21	0.54	1.47	0.23
Cleistopholis patens (Benth.)	Annonaceae	1	0.61	16.67	1.38	0.01	0.03	1.88	0.47
Cleistopholis philippensis(Benth.)	Annonaceae	2	1.23	33.33	2.76	0.81	2.07	6.24	1.41
Cola gigantean (Chevalier)	Sterculiaceae	1	0.61	16.67	1.38	0.98	2.5	4.58	0.7
Cordia millenii (Baker)	Boraginaceae	1	0.61	16.67	1.38	0.96	2.44	4.29	0.47
Desplatsia lutea (Burret)	Tiliaceae	6	3.68	41.67	3.45	1.31	3.33	10.53	3.75
Diospyros canaliculata (Benth.)	Ebenaceae	2	1.23	16.67	1.38	0.12	0.3	3.08	1.41
Diospyros dendo (Benth.)	Ebenaceae	27	16.56	91.67	7.59	2.72	6.94	33.03	18.5
Diospyros hybridus (Benth.)	Ebenaceae	22	13.49	50	4.14	2.42	6.18	25.77	15.46
Diospyros mespiliformis (Benth.)	Ebenaceae	3	1.84	41.67	3.45	0.53	1.36	6.92	2.11
Drypetes floribunda (Mull.Arg)	Euphorbiaceae	4	2.45	25	2.07	0.75	1.9	6.32	2.34
Drypetes gilgiana (Mull.Arg)	Euphorbiaceae	1	0.61	16.67	1.38	0.14	0.35	2.2	0.47
Drypetes gossweileri (Mull.Arg)	Euphorbiaceae	2	0.61	8.33	0.69	0.2	0.51	2.37	1.17
Drypetes welwichii (Mull.Arg)	Euphorbiaceae	1	0.61	8.33	0.69	0.07	0.17	1.1	0.23
Entadrophragma cylindricum (Sprague)	Meliaceae	1	0.61	16.67	1.38	0.3	0.76	2.61	0.47
Entandrophragma angolensis (Sprague)	Meliaceae	1	0.61	8.33	0.69	0.23	0.59	1.51	0.23
Fagara indica (VEU)	Rutaceae	1	0.61	25	2.07	0.51	1.29	4.06	0.7
Funtumia elastic (Preuss)	Apocynaceae	3	1.84	25	2.07	0.35	0.88	4.83	1.87
Hunteria umbellate (K.Schumann)	Apocynaceae	3	1.84	25	2.07	0.29	0.73	4.44	1.64
Hylodendron gabonensis (Osanga)	Fabaceae	1	0.61	8.33	0.69	0.07	0.18	1.1	0.23
Irvingia wombulu	Irvingiaceae	1	0.61	8.33	0.69	0.12	0.31	1.23	0.23
Khaya ivorensis (A.Chev)	Meliaceae	1	0.61	25	2.07	1.21	3.08	5.85	0.7

Lovoa trichiloides (Harms)	Meliaceae	1	0.61	8.33	0.69	0.03	0.08	1.01	0.23
Macaranga barteri (Mull.Arg.)	Euphorbiaceae	1	0.61	16.67	1.38	0.15	0.38	2.46	0.7
Macaranga grandifolia (Blanco)	Euphorbiaceae	1	0.61	8.33	0.69	0.3	0.76	1.69	0.23
Macaranga tanarius (Mull.Arg.)	Euphorbiaceae	1	0.61	8.33	0.69	0.03	0.09	1.24	0.47
Malacantha alnifolia (Baker)	Sapotaceae	1	0.61	8.33	0.69	0.14	0.35	1.28	0.23
Maranthes glabra (Oliv.)	Chrysobalanaceae	4	2.45	33.33	2.76	0.35	0.9	6.23	2.58
Massularia acuminata (G.Don)	Rubiaceae	1	0.61	8.33	0.69	0.03	0.08	1	0.23
Milicia excelsa (Welwitsch)	Moraceae	1	0.61	25	2.07	0.47	1.19	3.97	0.7
Mitragyna ciliata (Aubrev. & Pellegr.)	Rubiaceae	1	0.61	8.33	0.69	0.06	0.16	1.08	0.23
Musanga cecropioides (Tedlie)	Urticaceae	1	0.61	8.33	0.69	0.04	0.1	1.02	0.23
Nauclea diderichii (De Wild)	Rubiaceae	1	0.61	16.67	1.38	1.71	4.37	6.45	0.7
Nesogordonia papaverifera (A.Chev)	Malvaceae	1	0.61	8.33	0.69	0.02	0.05	0.97	0.23
Nisanga senegalensis (Baker)	Meliaceae	2	1.23	33.33	2.76	0.31	0.78	4.95	1.41
Picralima nitida (Abere)	Apocynaceae	1	0.61	16.67	1.38	0.16	0.41	2.49	0.7
Pterygota macrocarpa (K.Schum.)	Malvaceae	1	0.61	16.67	1.38	0.68	1.72	3.57	0.47
Pycnanthus angolensis (Welw.)	Myristicaceae	3	1.84	41.67	3.45	0.67	1.72	6.81	1.64
Rauvolfia vomitoria (Afzelius)	Apocynaceae	1	0.61	8.33	0.69	0.02	0.05	0.97	0.23
Ricinodendron heudelotii (Baill)	Euphorbiaceae	3	1.84	25	2.07	2.59	6.62	10.56	1.87
Sterculia rhinopatala (K.Schum.)	Sterculiaceae	5	3.07	50	4.14	2.5	6.38	14.03	3.51
Strombosia postulate (Oliv.)	Olacaceae	11	6.75	50	4.14	1.94	4.96	16.35	7.26
Terminalia superba (Engl. & Diels)	Combretaceae	1	0.61	16.67	1.38	0.83	2.12	3.96	0.47
Tetraptera tetraplura (Schum. &Thonn.)	Fabaceae	1	0.61	8.33	0.69	0.06	0.16	1.09	0.23
Treculia odorata (SIDA)	Moraceae	1	0.61	8.33	0.69	0.06	0.16	1.32	0.47
Trichilia monadelpha (Thonn.)	Meliaceae	1	0.61	16.67	1.38	0.03	0.07	1.91	0.47
Uapaca togoensis (Baill)	Euphorbiaceae	1	0.61	8.33	0.69	0.26	0.66	1.82	0.47
Xylopia aethiopica (Dunal)	Annonaceae	1	0.61	25	2.07	0.01	0.03	2.8	0.7
Total		163	100	1233	100	39	100	300	100

RD = Relative Density, RF= Relative Frequency, RDo= Relative Dominance, IVI= Importance Value Index

Table 3: Density, Relative Density, Frequency, Relative Frequency, Dominance, Relative Dominance, Abundance and Importance Value Index (IVI) in IITA Forest

Species	Family	Density/ha	R.D	Frequency	R.F	Dominance	R.Do	IVI	Abundance
Aidia genipiflora (Dandy)	Rubiaceae	1	0.68	20	1.31	0.3	0.86	2.84	0.66
Albizia ferruginea (Guill. & Perr.)	Fabaceae	2	1.37	30	1.96	0.5	1.44	4.4	1
Albizia zygia (J.F. Macbr.)	Fabaceae	2	1.37	30	1.96	0.3	0.9	3.86	1
Alchornea cordifolia (Schumach. & Thonn.)	Euphorbiaceae	2	1.37	20	1.31	0.2	0.54	2.84	1
Alstonia boonei (De Wild.)	Apocynaceae	2	1.37	10	0.65	0.6	1.8	3.78	1.33
Antiaris Africana (Engl.)	Moraceae	2	1.37	20	1.31	0.3	1.01	3.31	1
Antiaris toxicaria (J.F.Gmel.)	Moraceae	6	4.11	70	4.58	2.1	6.6	15.8	4.65
Baphia nitida (G.Lodd.)	Fabaceae	1	0.68	10	0.65	0	0.14	1.45	0.66
Blighia sapida (D. Koenig)	Sapindaceae	1	0.68	10	0.65	0	0.03	1.02	0.33
Bosquaiia angolensis (Ficalho)	Myristicaceae	2	1.37	20	1.31	0.4	1.11	3.75	1.33
Ceiba pentandra (L. Gaertn)	Malvaceae	4	2.74	60	3.92	4.1	13.12	20	2.99
Celtis philippensis (Blanco)	Cannabaceae	2	1.37	30	1.96	0.1	0.19	3.48	1.33
Celtis toka (Hepper & J.R.I Wood)	Cannabaceae	2	1.37	40	2.61	0.1	0.39	4.66	1.66
Celtis zenkeri (Engl.)	Cannabaceae	4	2.74	60	3.92	0.5	1.54	8.79	3.32
Chrysophyllum albidum (G.Don)	Sapotaceae	2	1.37	20	1.31	0.1	0.16	2.46	1
Cleistopholis patens (Benth)	Annonaceae	5	3.42	40	2.61	1.8	5.73	12	3.65
Cleistopholis philippensis (Benth)	Annonaceae	1	0.68	10	0.65	0.1	0.42	1.74	0.66
Cola millenii (K.Schum)	Sterculiaceae	3	2.05	40	2.61	0.3	0.94	5.88	2.33
Dialium guineensis (Hepper & J.R.I Wood)	Fabaceae	1	0.68	10	0.65	0	0.04	1.02	0.33
Diospyros monbuttensis (Gurke)	Ebenaceae	5	3.42	40	2.61	2	6.19	12.5	3.65
Elaeis guineensis (Jacq)	Arecaceae	12	8.22	80	5.23	3.2	10.07	25.3	9.97
Erythrina senegalensis (Benth)	Fabaceae	2	1.37	20	1.31	0.1	0.29	2.6	1
Ficus exasperata (Ficalho)	Moraceae	1	0.68	20	1.31	0	0.07	2.04	0.66
Ficus lutea (Ficalho)	Moraceae	1	0.68	10	0.65	0.1	0.17	1.15	0.33
Ficus mucoso (Ficalho)	Moraceae	1	0.68	10	0.65	1	3.01	3.99	0.33
Funtumia elastic (Preuss)	Apocynaceae	8	5.48	90	5.88	0.67	2.11	14.3	6.31
Holarrhena floribunda (G.Don)	Apocynaceae	3	2.05	40	2.61	0.43	1.37	6.31	2.33
Lecaniodis cuscupanioides (Benth)	Sapindaceae	5	3.42	50	3.27	0.61	1.93	9.19	3.99
Loncho carpussericeus (Benth)	Fabaceae	2	1.37	30	1.96	0.2	0.63	3.59	1
Maesopsis Emini (Engl.)	Rhamanaceae	2	1.37	20	1.31	0.69	2.19	5.16	1.66
Milicia excelsa (C.C.Berg)	Moraceae	2	1.37	10	0.65	0.13	0.41	2.06	1

Millettia griffoniana (Baill.)	Fabaceae	2	1.37	20	1.31	0.55	1.75	4.39	1.33
Monodora tenuifolia (Benth.)	Annonaceae	1	0.68	10	0.65	0.06	0.19	1.18	0.33
Morus mesozygia (Engl.)	Moraceae	1	0.68	10	0.65	0.16	0.5	1.49	0.33
Myrianthus arboreus (P.Beauv.)	Urticaceae	2	1.37	20	1.31	0.2	0.63	3.6	1.66
Newbouldia laevis (P.Beauv.)	Bignoniaceae	3	2.05	40	2.61	1.77	5.61	10.22	1.99
Olax subscorpioidea (Oliv.)	Olacaceae	1	0.68	10	0.65	0.01	0.02	1.01	0.33
Pouteria alnifolia (Baker)	Sapotaceae	2	1.37	30	1.96	0.06	0.19	3.15	1
Ptercapous soyausii (Baill.)	Fabaceae	2	1.37	10	0.65	0.28	0.9	2.55	1
Pycnanthus angolensis (Welw.)	Myristicaceae	1	0.68	10	0.65	0.02	0.05	1.04	0.33
Ricinodendron heudelotii (Baill.)	Euphorbiaceae	1	0.68	10	0.65	0.23	0.72	1.71	0.33
Rothmannia longiflora (De Wild)	Rubiaceae	1	0.68	10	0.65	0.03	0.09	1.08	0.33
Solanum erianthum (D.Don)	Solanaceae	1	0.68	10	0.65	0.01	0.03	1.02	0.33
Spathodea campanulata (P.Beauv.)	Bignoniaceae	1	0.68	10	0.65	0.08	0.25	1.24	0.33
Spondias mombin (Benth.)	Anacardiaceae	8	5.48	70	4.58	2.14	6.78	17.33	5.98
Sterculia setigera (Delile)	Malvaceae	3	2.05	30	1.96	0.31	0.98	4.93	1.99
Sterculia tragacantha (Lindl.)	Malvaceae	6	4.11	60	3.92	0.33	1.06	9.63	4.65
Trichilia megalantha (Harms)	Meliaceae	1	0.68	20	1.31	0.52	1.64	3.61	0.66
Trichilia monadelpha (Thonn.)	Meliaceae	4	2.74	50	3.27	0.19	0.59	7.18	3.32
Trilepisium madagascariense (Benth.)	Moraceae	10	6.85	70	4.58	3.14	9.93	22.48	7.97
Triplochiton scleroxylon (K.Schum)	Malvaceae	1	0.68	20	1.31	0.54	1.72	3.69	0.66
Voacanga africana (K.Schum)	Apocynaceae	1	0.68	10	0.65	0.03	0.08	1.07	0.33
Zanthoxylum leprieurii (Guill. & Perr.)	Rutaceae	1	0.68	10	0.65	0.08	0.25	1.24	0.33
Zanthoxylum zantoloides (Guill. & Perr.)	Rutaceae	3	2.05	20	1.31	0.19	0.59	3.89	1.99
Total		146	100	1530	100	31.6	100	300	100

RD = Relative Density, RF= Relative Frequency, RDo= Relative Dominance, IVI= Importance Value Index

Table 4: List of Tree Species Families and Abundance Common to both Omo Biosphere and IITA Forest

Species	Family	Number	Density/ha
Albizia ferruginea	Fabaceae	6	2.4
Ceiba pentandra	Malvaceae	13	5.2
Celtis zenkeri	Ulmaceae	72	28.8
Chrysophyllum albidum	Sapotaceae	4	1.6
Cleistopholis patens	Annonaceae	13	5.2
Cleistopholis philippensis	Annonaceae	8	3.2
Funtumia elastic	Apocynaceae	27	10.8
Milicia excelsa	Moraceae	6	2.4
Pycnanthus angolensis	Myristicaceae	8	3.2
Ricinodendron heudelotii	Euphorbiaceae	9	3.6
Trichilia monadelpha	Meliaceae	12	4.8

Table 5: Species Similarities (Simpson's Similarity Indices) between the Forest Reserves

	J4	IITA
J4	1	0.20
IITA	0.20	1

Table 6: Summary of Species Diversity for the two Forest Reserves

	J4	IITA
No of Species	56	54
Individuals	427	301
Dominance_D	0.09171	0.04076
Simpson_1-D	0.9083	0.9592
Evenness_e^H/S	0.366	0.6312
Equitability_J	0.7503	0.8846

Tree Species Correspondence for Tree Species in Omo Biosphere and IITA Forest

Figure 1 presented the results of Detrended Correspondence Analysis (DCA) of the two study areas. The length of the ordination analysis ranged from 0 to 180 with eigen value of 84.52 % from axis 1: 84.49 % and axis 2: 0.033 %. The ordination presented the species in IITA forest reserve at the upper end of the first quadrant, species in Omo Biosphere Reserve are located at the beginning of the quadrant. Species common to the study areas are distributed along the line within the quadrant. The tree species in the two study areas are on the positive side and are closely related though there is a higher degree of association or relationship as indicated by the variance with the plant resources of the study areas. Some of them exhibit stronger relationship with each other hence they are packed together in the same corner of the ordination space.

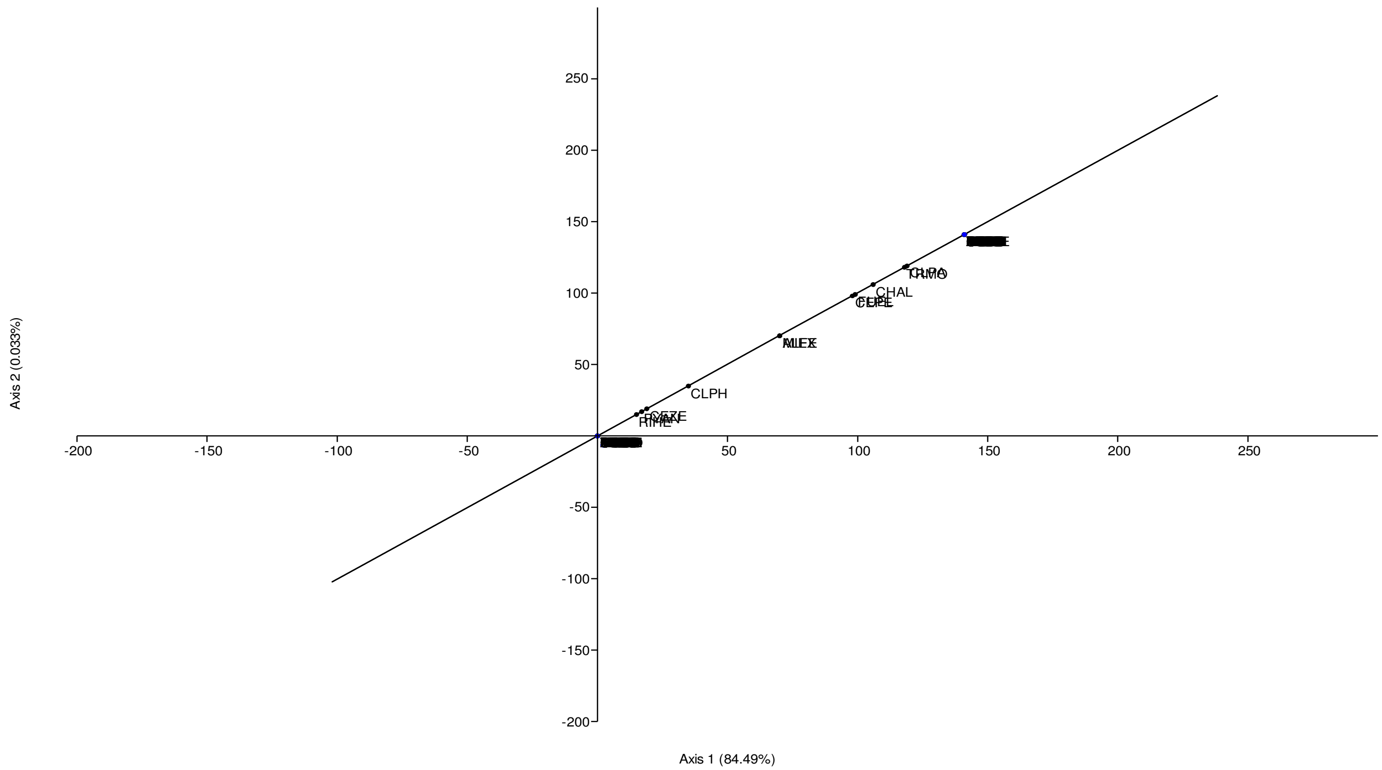

Fig. 6: Detrended Correspondence of the two Forests

Discussion

Natural Forest ecosystem has been under uncontrolled logging and other illegal activities over the years, which has led to loss of biodiversity, reduction in forests area and increasing global warming (Himshikha *et al.,* 2022). The number of species per unit area determines the species richness of a forest ecosystem; the higher the number of species per unit area, the higher the species richness (Liu *et al.,* 2018). Additionally, research on the species richness of plants and the changes they go through is crucial for supplying information on the floristic composition and structure of forests. This information can potentially be useful for management purposes and aid in understanding the forest and the ecosystem as a whole (Pappoe *et al.,* 2010). Euphorbiaceae, Apocynaceae and Ebenaceae are the most common families among the 22 families found in Omo Biosphere Reserve, while the most common families among the 22 families in IITA Forest Reserves are Moraceae and Fabaceae. Species with the highest number of density in Omo Biosphere Reserve includes; *Diospyros dendo* (26.33) from Ebenaceae family followed by *Diospyrous hybridus* (22.00) from Ebenaceae and *Celtis zenkeri* (20.67) from Cannabaceae while the species with highest density in IITA forest reserve is *Trilepsium madagascariense* (9.6) from Moraceae, *Funtumia elastica* (7.6) from Apocynaceae and *Spondia mombin* (7.2) from Anacardiaceae family. Species diversity depends on the adaptation of species and increase with the stability of community (Oladoye *et al.,* 2012).

In quantitative ecological studies, it has become customary to examine a planting community using the IVI (Importance Value Index), which combines relative density, relative frequency, and relative dominance into a single measure (Hartoyo *et al.,* 2025). Although there are a number of factors that can be used to define vegetation, such as frequency, density, and abundance, using any of these qualitative parameters could result in an oversimplification or underestimate of the state of the species (Kent, 2011).

The Importance Value Index (IVI) of the species shows the dominance and overall importance of some species in the study areas. The total IVI was 300, which is an acceptable value in computing for the index (Hartoyo *et al.,* 2025). The species with the highest IVI in Omo Biosphere Reserve were *Celtis zenkeri* (37.86), *Diospyros dendo* (33.03), *Diospyros hybridus* (25.77) while the species with the lowest IVI values were *Musanga cecropioides* (1.02), *Lovoa trichiliodes* (1.01) and *Massularia acuminate* (1.00). The species with the highest IVI in IITA forest reserve were *Elaeis guineensis* (25.27), *Trilepisium madagascariense* (22.48) and *Ceiba pentandra* (20.03) while the species with the lowest IVI values were *Blighia sapida* (1.02), *Dialium guineensis* (1.02) and *Olax subscorpioidea* (1.01). The low IVI implies that most of the species in the forest are rare in the distribution (Oladoye *et al.,* 2012).

The species similarity (Simpsons) between the plots in Omo Biosphere Reserve ranges from 0 % to 77 % for all the plots, while the similarity indices in IITA Forest Reserve ranges from 9 % to 62 %, which implies the higher the similarities indices between the plots the more related they are in floristic composition (Oladoye *et al.,* 2012).

Conclusion

The reduction and disappearance of the forest cover in the floristic components of the forest reserves are as a result of the alteration of the forest to other land use, because most of the forest reserves in this country are experiencing a high rate of anthropogenic disturbances due to the increase in the human population. The large decrease in dense forest to less dense forest as well as conversion less dense forest into built up was due to several anthropogenic activities and uncontrolled of human entry into the forest reserve. Many of the villagers found in and around Omo Biosphere Reserve derived their livelihood through illegal felling of trees for charcoal and other use, removal of some part of plant such as root, leaves, twig and barks for herbs could be injurious to the living plants thereby leading to the dead of such plant.

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