FLORAL DIVERSITY, SOIL PROPERTIES, AND BIOMASS DISTRIBUTION IN NATURAL, RIPARIAN AND PLANTATION FOREST ECOSYSTEMS IN EJIGBO, OSUN STATE, NIGERIA

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ABSTRACT
The assessment of biomass distribution, floral diversity and soil characteristics could assist ecosystem managers in the conservation of tropical ecological landscapes and enhance ecosystem function. This study investigated the floral diversity and biomass distribution in natural, riparian and plantation forest ecosystems in Ejigbo, Osun State, Nigeria. Growth variables such as diameter at breast height, total height, crown dynamics, and above and below-ground biomass were assessed. Diversity indices were computed, and the above and below-ground biomass were estimated using an allometric equation. A total of 116 plant species belonging to different life forms (trees, shrubs, herbs, and climbers) were identified. Riparian forests had higher tree species composition than natural forests, but the natural forest was more diverse. The organic carbon content in riparian forest soil was higher (37.8%) than in natural forest (29.07%). Riparian forest soil was less acidic (pH: 6.65) compared to the natural forest (6.47). The conservation and management of these habitats are critical for the mitigation of climate change and the maintenance of ecosystem services.
Keywords: Riparian forest, Diversity indices, Floristic composition, Ecosystem services

INTRODUCTION

Riparian zones are areas adjoining freshwater bodies such as rivers, streams, lakes and ponds. They host a remarkable number of plant species when compared to adjoining terrestrial ecosystems (Naiman *et al.,* 2005). Although flooding events represent a considerable disruption to riparian ecosystems, the available water supply contributes to the richness of riparian lifeforms (Onefeli *et al.*, 2013). Hence, species in riparian ecosystems are well adapted to changing climatic conditions. They store carbon above and belowground and help in the management of water flow and the transportation of nutrients in waterways. These are critical roles that these ecosystems play in promoting biodiversity and fundamental ecosystem functions (Levin *et al*., 2001). Unfortunately, riparian habitats, their functions and biodiversity have suffered from human-induced changes to the hydrology and vegetation.

Natural forest ecosystems are complex and self-regulating communities of trees, plants, animals, and microbes that have developed over time, with little to no major human intervention (Ogana *et al.,* 2021). These forests have diverse structures with high biodiversity and ecological functions (Onefeli *et al.,* 2022). They play a significant role in sequestering carbon dioxide from the atmosphere and mitigating climate change. Natural forest ecosystems provide essential resources, such as food and shelter, which considerably improve human well-being. The vegetative cover interacts with microbial communities and soils; filter air and water, and recycle nutrients and waste.

Floral diversity refers to the diversity of naturally occurring indigenous or native plants in a locality. The variety of plant species not only improves the environment but also help to control global temperatures by purifying the air through photosynthesis and other mechanisms (Onefeli, 2016; Onefeli *et al.,* 2023). Ecological diversity, on the other hand, refers to the degree of variation in living forms inside a particular ecosystem, biome, or over the entire world (Uno *et al*., 2001). It includes the broad range of animal species, plants, microbes, and the ecological processes that characterize their relationships. The decomposition of plants and animals produce soil organic matter, which is vital to soil fertility, nutrient availability and water retention in ecosystems. The continuous breakdown of organic materials in forest soils results in their mildly acidic pH levels. This soil acidity affects microbial activity and nutrient availability.

Information on species diversity and carbon pool in biomass are essential when mapping ecological health and ecosystem values of forests. However, these require reliable data on floral diversity and biomass. Consequently, plant species composition abundance in tropical forest has increasingly become important economically and socially as well as for biodiversity conservation (Houehanou *et al.,* 2013). This study investigated floral diversity and biomass distribution in the riparian and natural forest ecosystem of Ejigbo, Osun state, Nigeria. It estimated the aboveground and belowground biomass to provide baseline information on biomass stock and soil carbon content.

MATERIALS AND METHODS

Study Area

The study was carried out within Ejigbo town, Osun State, Nigeria. It is located at an altitude of 426 m above sea level. The area lies between latitude 9.49°81′88″–12.52°14′80″N and longitude 8.72°90′70″–11.02°32′73″E. The study area was approximately 35 km from the northeast of Iwo, 30 km from Ogbomosho in the North, and 24 km to the East. The average annual rainfall was 1,330 mm and the rainy season occurred from April to October.

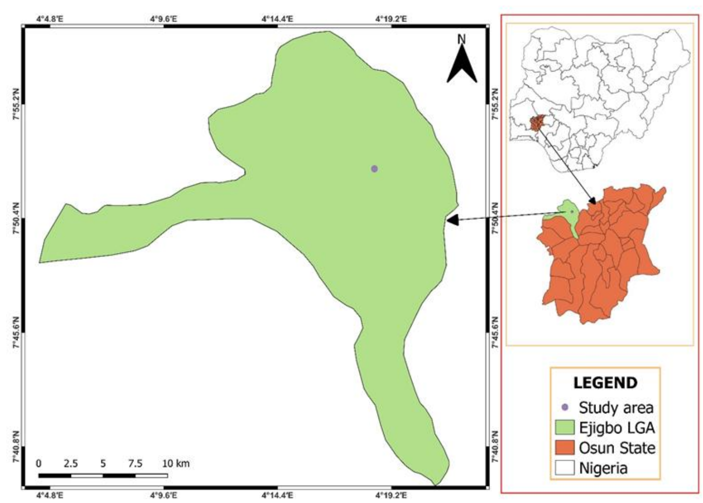

Figure 1: Map of Ejigbo local government area (inset: Maps of Osun state and Nigeria)

Field Data Collection

Systematic random sampling was used to establish sample plots in natural, plantation, and riparian forest ecosystems. A simple line transect of 80 m was used in the study. Four sample plots (30m x 30m) were laid at 20m intervals to the east and 10m intervals towards the south of the plot. To minimise edge effects, a 5m offset was measured at the beginning of each plot. All the plant species within each plot were identified and enumerated up to species level. In each plot, both stand variables and diversity indices were computed.

In the monoculture and mixed plantation, four sample plots (30m x 30m) were each laid alternately on a 200m line transect at 20m intervals. For the edge effect, 5m was measured at the beginning of the transect. The diameter of breast height (DBH), total height and crown diameter were taken for all the plant species identified. The heights of the plant species were measured using the Haga Altimeter, the crown diameter was taken with the metre tape and the DBH was measured using the diameter tape.

In the natural and riparian ecosystems, the relative frequencies (RF) of the tree species were calculated using equation 1;

$$RF = \frac{\text{Number of individuals of species}}{\text{Total number of all individuals}} \text{ .... (1)}$$

Evenness, Shannon Weiner index, and Simpson index of dominance were computed for each plot.

Simpson's Diversity Index

$$D = \frac{\sum n(n-1)}{N(N-1)} \text{ .... (2)}$$

Where; n = number of individuals of each species, N = total number of individuals of all species.

Shannon-Weiner Diversity Index (H')

$$H' = -\sum_{i=1}^{S} P_i \ln P_i \text{ .... (3)}$$

$$P_i = \frac{n}{N} \text{ .... (4)}$$

Where, P_i = proportion of individual species i to the total individuals

n = number of individuals of each species

N = total number of individuals of all species

Pielou Species Evenness Index

$$J' = \frac{H'}{\ln S} \text{ .... (5)}$$

Where; H' = Shannon diversity, S = number of species

Margalef Index (d)

$$d = \frac{S-1}{\ln(N)} \text{ ....(6)}$$

Where S = number of species in the sample.

N = total number of individuals in the sample

The generalised pan-tropical aboveground biomass equation (Chave *et al*., 2014) was used to estimate tree biomass. The aboveground and below-ground biomass were estimated using equation 7:

$$AGB_{est} = 0.0673 \times (\rho d^2 h)^{0.976} \text{ .... (7)}$$

Where; AGB_{est} = Estimated Aboveground biomass (Mg);

d = diameter at breast height (cm);

h = tree height (m)

ρ = wood density (g/cm^3),

For unidentified tree species, an average of 0.5 g/cm^3 was used (Ige and Silas, 2023)

Below-ground biomass (BGB) was calculated using equation 8.

BGB= exp (-0.804 + 0.823 × In AGB) .. (8)

Soil Collection

Soil samples were collected from the natural forest, riparian forest, monoculture and mixed plantations at 10cm depth using soil auger. The samples were collected at the centre of each plot and mixed to form composite samples. The soil samples were analyzed at the Soil Laboratory, Department of Agronomy, Osun State University, Nigeria.

Soil Physicochemical Parameters

The soil pH, organic carbon content, available phosphorus, total nitrogen, aluminium, calcium, magnesium, zinc, hydrogen ion concentration and acidity were determined.

Soil pH was determined in a 1:1 soil-water ratio. Total nitrogen was measured using the Kjeldahl method (Esor *et al.,* 2023) and available phosphorus was determined using the hydrochloride solution (Olorunfemi *et al.,* 2016). The hydrogen ion concentration was obtained from the soil pH values. The organic carbon content was determined using the Walkley and Black wet oxidation method. The calcium and magnesium in the soil were determined by using the ammonium acetate solution. Zinc was determined using DPTA solution.

Data were subjected to one-way analysis of variance, and the means were separated using Duncan Root Mean Square.

RESULTS

Plant species composition

A total of 68 and 47 plant species were enumerated in the riparian and natural forests, respectively. *Paullinia pinnata* was the highest occurring species in the natural forest, with 12 individuals, while *Alchornea cordifolia* (56 individuals) was common in the riparian ecosystem.

Three monocultures (*Cola nitida*, *Theobroma cacao* and *Senna siamea*) and one mixed plantation (*Theobroma cacao* and *Cola nitida*), were enumerated. The tree density of *Cola nitida*, *Theobroma cacao* and *Senna siamea* sampled in the plantations were 91, 67 and 112, respectively. There were 34 families in the riparian and 28 in the natural forest (Table 1). Fabaceae family was highly represented with 10 tree species, followed by Asteraceae (5 species) and Malvaceae (4 species). About 22 families, including Apocynaceae, Annonaceae, Solanaceae, Lamiaceae, were represented by one species. *Alchornea cordifolia* had the highest relative frequency (11.81%), followed by *Chromolaena odorata* (10.76%) in the riparian forest. In the natural forest, *Paullinia pinnata* (family Sapindaceae) had the highest relative frequency (9.91%) followed by *Combretum racemosum* (5.75%).

Plant Diversity in Riparian and Natural Forest Ecosystems

Simpson diversity index in riparian forests (0.96) was higher than the natural forest ecosystems (0.93). The riparian forest (0.96) had a greater abundance of species than the natural forest (Table 3). Also, the Shannon Wiener index for riparian forest was slightly higher (3.64) than the natural forest (3.60).

Discussion

Plant Growth Variables

In the natural forest, the mean DBH was 128.5cm, suggesting a mix of mature and younger trees, while it was 124.46cm in the riparian forest.

Table 1. Plant Species Composition in Riparian Forest, Ejigbo, Osun state, Nigeria

S/N	Plant Species	Common Name	Family	Frequency	Relative frequency
1	*Haldina cordifolia*	Temple Tree	Rubiaceae	11	2.32
2	*Afzelia Africana*	African mahogany	Fabaceae	25	5.27
3	*Albizia ferruginea*	West Africa Albizia	Fabaceae	1	0.21
4	*Albizia zygia*	West African walnut	Fabaceae	5	1.05
5	*Alchornea cordifolia*	Christmas bush	Euphorbiaceae	56	11.81
6	*Allophylus africanus*	African false currant	Sapindaceae	2	0.42
7	*Alstonia boonei*	Cheese wood	Apocynaceae	2	0.42
8	*Antennaria microphylla*	Pink pussytoes	Asteraceae	2	0.42
9	*Antiaris toxicaria*	Barkcloth tree	Moraceae	6	1.27
10	*Anthocleista djalonensis*	Cabbage Tree	Loganiaceae	2	0.42
11	*Anthocleista nobilis*	Cabbage palm	Loganiaceae	1	0.21
12	*Aspilia Africana*	Wild sunflower	Astraceae	4	0.84
13	*Azalea spp.*	Rhododendron	Ericaceae	4	0.84
14	*Baphia nitida*	African sandalwood	Fabaceae	5	1.05
15	*Calopogonium mucunoides*	Wild groundnut	Fabaceae	3	0.63
16	*Carpolobia lutea*	Cattle stick	Polygalaceae	1	0.21
17	*Ceiba pentamdra*	Silk cotton tree	Malvaceae	1	0.21
18	*Centrosema pubescens*	Butterfly pea	Fabaceae	6	1.27
19	*Chassalia kolly*	Kolly Chassalia	Rubiaceae	3	0.63
20	*Chromolaena odorata*	Bitter bush	Asteraceae	51	10.76
21	*Cissus quadrangularis*	Veldt grape	Vitaceae	13	2.74
22	*Cleistopholis patens*	Salt-and-oil Tree	Annonaceae	6	1.27
23	*Cnestis ferruginea*	Short pod	Connaraceae	7	1.47
24	*Cola millenii*	Monkey cola	Sterculiaceae	2	0.42
25	*Cola nitida*	Kola	Malvaceae	1	0.21
26	*Colocasia esculenta*	Cocoyam	Araceae	1	0.21
27	*Combretum racemosum*	Ragoon creeper	Combretaceae	13	2.74
28	*Commelina diffusa*	Spreading dayflower	Commelinaceae	10	10.76
29	*Crinum jagus*	Spider lily	Amaryllidaceae	15	3.16
30	*Desmodium adscendens*	Beggar's flower	Fabaceae	2	0.42
31	*Dianella nigra*	Blueberry	Asphodelaceae	2	0.42
32	*Diospyros mespiliformes*	African ebony	Ebenaceae	2	0.42
33	*Elaeis guinensis*	Oil palm	Arecaceae	12	2.53
34	*Pennisetum purpureum*	Elephant Grass	Poaceae	10	10.76
35	*Emilia coccinea*	Tassel flower	Asteraceae	7	1.47
36	*Entandrophragma angolense*	Tiama	Meliaceae	2	0.42
37	*Erythrina senegalensis*	Senegal coral tree	Fabaceae	3	0.63

S/N	Plant Species	Common Name	Family	Frequency	Relative frequency
38	*Ficus capensis*	Cape fig	Moraceae	4	0.84
39	*Gmelina arborea*	Gamhar	Lamiaceae	2	0.42
40	*Gossweilerodendron balsamiferum*	Nigeria cedar	Fabaceae	3	0.63
41	*Harungana madagascariensis*	Haronga	Hypericaceae	6	1.27
42	*Holarrhena floribunda*	False rubber tree	Apocynaceae	9	1.9
43	*Heeria insignis*	Tropical resin tree	Anacardiaceae	15	3.16
44	*Jatropha tanjorensis*	Catholic vegetable	Euphorbiaceae	5	1.05
45	*Kigelia Africana*	Sausage Tree	Bignoniaceae	1	0.21
46	*Lablab purpureus*	Hyacinth bean	Fabaceae	12	2.53
47	*Lecaniodiscus cupanioides*	Akika, Ukpo	Sapindaceae	3	0.63
48	*Mangifera indica*	Mango	Anacardiaceae	2	0.42
49	*Margaritaria discoidea*	Pheasant-berry	Phyllanthaceae	2	0.42
50	*Morus mesozygia*	African Mulberry	Moraceae	1	0.21
51	*Myrianthus arboreus*	Giant yellow mulberry	Urticaceae	1	0.21
52	*Nauclea diderrichii*	Aloma	Rubiaceae	2	0.42
53	*Palisota hirsute*	Dracena hirsute	Commelinaceae	25	5.27
54	*Paullinia pinata*	Tietie	Sapindaceae	23	4.85
55	*Pupalia lappacea*	Forest Burr	Amaranthaceae	15	3.16
56	*Phyllanthus urinaria*	Gripeweed	Phyllanthaceae	2	0.42
57	*Rubus hawaiensis*	Hawaiian raspberry	Rosaceae	1	0.21
58	*Sida acuta*	Wireweed	Malvaceae	12	1.27
59	*Smilax kraussiana*	Greenbriers	Smilacaceae	8	1.68
60	*Sterculia tragacantha*	Munone	Sterculiaceae	2	0.42
61	*Solanum toryum*	Turkey berry	Solanaceae	2	0.42
62	*Synedrella nodiflora*	Cinderella weed	Asteraceae	13	2.74
63	*Terminalia superba*	Afara	Combretaceae	1	0.21
64	*Trichilla monadelpha*	Otan nuru	Meliaceae	8	1.68
65	*Trichilia subcordata*	Natal mahogany	Meliaceae	1	0.21
66	*Tridax procumbens*	coat buttons	Asteraceae	12	2.53
67	*Uapaca togolensis*	Bassa	Phyllanthaceae	1	0.21
68	*Vicia americana*	American vetch	Fabaceae	1	0.21

Table 2. Plant Species in Natural Forest, Ejigbo, Osun state, Nigeria

S/N	Plant Species	Common Name	Family	Frequency	Relative frequency
1	*Afzelia africana*	African mahogany	Fabaceae	5	4.13
2	*Albizia ferruginea*	West Africa Albizia	Fabaceae	3	2.47
3	*Albizia zygia*	West Africa Walnut	Fabaceae	4	3.3
4	*Allophylus africanus*	African false currant	Sapindaceae	2	1.65
5	*Alstonia boonei*	Cheese wood	Apocynaceae	1	0.83
6	*Antennaria microphylla*	Pink pussytoes	Asteraceae	2	1.65
7	*Anthocleista nobilis*	Cabbage palm	Loganiaceae	2	1.65
8	*Anthonotha macrophylla*	African rosewood	Fabaceae	2	1.65
9	*Antiaris africana*	Bark cloth tree	Moraceae	3	2.47
10	*Aspilia africana*	Wildflower	Daisy family	3	2.47
11	*Azalea* spp.	Rhododendron	Rhodendron	2	1.65
12	*Baphia nitida*	African sandalwood	Fabaceae	3	2.47
13	*Bosqueia angolensis*	Aizen	Moraceae	2	1.65
14	*Calopogonium mucunoides*	Wild groundnut	Fabaceae	2	1.65
15	*Carpolobia lutea*	Cattlestick	Polygalaceae	1	0.83
16	*Cola gigantea*	Giant cola	Chlorophora	2	1.65
17	*Cola nitida*	Kola	Malvaceae	4	3.3
18	*Colocasia esculenta*	Cocoyam	Araceae	1	0.83
19	*Combretum racemosum*	Rangoon creeper	Combretaceae	7	5.75
20	*Commelina diffusa*	Spreading dayflower	Commelinaceae	5	4.13
21	*Crinum jagus*	Spider lily	Amaryllidaceae	6	4.75
22	*Desmodium adscendens*	Beggar's flower	Fabaceae	1	0.83
23	*Dianella nigra*	Blueberry	Asphodelaceae	1	0.83
24	*Diospyros mespiliformis*	African ebony	Moraceae	2	1.65
25	*Elaeis guineensis*	Oil palm	Ebenaceae	1	0.83
26	*Emilia coccinea*	Tassel flower	Asteraceae	3	2.47
27	*Entandrophragma cylindricun*	West Africa cedar	Arecaceae	1	0.83
28	*Erythrina senegalensis*	Senegal coral tree	Fabaceae	1	0.83
29	*Gmelina arborea*	Gamhar	Lamiaceae	1	0.83
30	*Harungana madagascariensis*	Orange-milk tree	Hypericaceae	3	2.47
31	*Holarrhena floribunda*	False rubber tree	Apocynaceae	4	3.3
32	*Jatropha tanjorensis*	Catholic vegetable	Euphorbiaceae	2	1.65
33	*Lablab purpureus*	Hyacinth bean	Fabaceae	6	4.75
34	*Lecaniodiscus cupanioides*	Africa oil bean	Sapindaceae	1	0.83
35	*Magnifera indica*	Mango	Meliaceae	4	3.30
36	*Margaritaria discoidea*	Pheasant-berry	Phyllanthaceae	1	0.83
37	*Morus mesozygia*	African Mulberry	Moraceae	1	0.83
38	*Myrianthus arboreous*	Giant yellow mulberry	Urticaceae	1	0.83

S/N	Plant Species	Common Name	Family	Frequency	Relative frequency
39	*Nauclea diderrichii*	Africa peach	Rubiaceae	1	0.83
40	*Paullinia pinata*	Tietie	Sapindaceae	12	9.91
41	*Pentaclethra macrophylla*	African oil bean	Anacardiaceae	2	1.65
42	*Pupalia lappacea*	Forest Burr	Amaranthaceae	6	4.75
43	*Trema orientale*	Indian charcoal tree	Meliaceae	1	0.83
44	*Trichilia subcordata*	Natal mahogany	Meliaceae	1	0.83
45	*Trichilla monadelpha*	One-stalked Mahogany	Mimosaceae	1	0.83
46	*Uapaca togolensis*	Bassa	Phyllanthaceae	1	0.83

Table 3. Diversity Indices of Plant Species in Riparian and Natural Forests, Ejigbo, Osun state, Nigeria

Diversity Indices	Riparian Forest	Natural Forest
Individuals	494	121
Dominance	0.042	0.067
Simpson_1-D	0.95	0.93
Shannon	3.64	3.6
Evenness/S	0.55	0.76
Margalef	10.96	9.8

In the monocultures, the mean DBH of *Theobroma cacao*, *Senna siamea,* and *Cola nitida* were 125.46cm, 76.41cm, and 111.41cm, respectively, while in mixed plantations of *Theobroma cacao* and *Cola nitida* the DBH was 119.48cm. In the natural forest, the mean tree height was 21.61m, while in the riparian forest it was 21.55m. The crown diameter was 9.82m in natural forest, and 5.07m in riparian forest. The crown diameter was 9.35m, 5.78m and 7.25m in the *Theobroma cacao, Senna siamea* and *Cola nitida* plantations, respectively. The mixed plantations had a mean crown diameter of 15.8m.

Biomass distribution

The aboveground biomass found in the riparian forest was estimated at 5049 Mg/ha, while belowground was 452.77Mg/ha. The mean aboveground biomass in natural forest was 11156.6 Mg/ha while belowground biomass was 181.22 Mg/ha. In the monocultures, *Theobroma cacao* had AGB of 7571.83Mg/ha, which showed it was a major contributor to above-ground biomass, whereas in mixed plantations, *T. cacao* and *Cola nitida* contributed 7455.78 Mg/ha. The variations in AGB reflected differences in tree density and biomass accumulation. For belowground biomass monocultures of *Cola nitida* and *Theobroma cacao* had similar BGB values of 135Mg/ha and 131.44 Mg/ha, respectively. In mixed plantations, *Theobroma cacao* and *Cola nitida* contribute more to belowground biomass, with 501.78Mg/ha.

Soil Physiochemical Properties

There were significant differences in pH levels of the different land use types (Table 6). *Senna siamea* plantation soils had the highest pH (6.81). Riparian forest soils had the highest organic carbon content (37.80g/kg). *Cola nitida* mono plantation soils had the highest nitrogen content (4.12g/kg) followed by the mixed plantation soils (3.17g/kg). There was no significant difference in phosphorus availability between monoculture and mixed plantation soils, with values ranging from 17.75 to 20.60 mg/kg, while the phosphorus availability in riparian and natural forests was lower. Riparian forest soil had higher exchangeable acidity (0.42cmol/kg) compared to natural forest (0.41cmol/kg). Riparian forest soil had a low hydrogen ion exchange (0.41g/kg), then natural forest (0.42g/kg). *Senna siamea* soil had the highest calcium (7.95cmol/kg), while natural forest had the lowest (2.28cmol/kg). There were no significant variations in the magnesium content of monocultures and riparian forest soils, unlike the natural and mixed plantation soils, which had the least magnesium (0.83cmol/kg and 0.23cmol/kg, respectively).

Potassium was high in the mixed (1.17cmol/kg) and *Theobroma cacao* plantations (1.14cmol/kg), while the natural forest (0.20cmol/kg) had the least. *Theobroma cacao* soil had the highest iron content (98.53mg/kg), while *Senna siamea* soil had the lowest (72.52mg/kg). Mixed plantations soils had the highest proportion of sand (820g/kg), while *Theobroma cacao* had the lowest (791g/kg), with no significant differences across land use types. Silt was high in monoculture plantations, followed by mixed plantations and low in natural forests (100g/kg). Mixed plantation soils had low clay content (61g/kg), while natural forest soil had higher amounts (100g/kg).

DISCUSSION

Flora species differ in composition, richness, evenness, and diversity across ecosystems. This influences the management, structure, function and soil properties. The land use types identified have different floristic compositions as a result of recurring human activities, the gradient of the land, nearness to the water body, and soil composition. The tree species diversity was higher than what was recorded by Ojo (2016), in which flora composition and diversity were higher in riparian forests than in natural forests.

The study showed that the pH of the soil ranged from extremely acidic to barely alkaline. Heavy rainfall, which causes a high rate of leaching of bases and is common in the humid tropics, probably contributed to the soil's acidic composition. The soil in riparian forests was more acidic, due to factors such as decomposition of organic matter, hydrological processes and vegetation types (Chude *et al.*, 2011; Giese *et al.,* 2014.

The organic carbon available in the natural forest was low due to the conversion of forests into agricultural lands. This limits the accumulation of organic matter in the soil. In these conditions, decomposition rates may exceed the input of organic matter, resulting in reduced organic carbon levels. Total nitrogen in the soil was found to be lower in natural than in riparian forests. This implies that nitrogen can be a limiting factor for tree growth in forests, and a lack of nitrogen may be due to leaching and losses characterized by high soil movement that leads to increased leaching of nitrogen compounds from the soil. The continued effect of human disturbances and land use change, threaten the soil integrity (Noma *et al.,* 2011).

Table 4. Tree Growth Variables and Biomass Distribution in Land Use Types in Ejigbo, Osun state, Nigeria

			Mono Plantation			Mixed Plantation
Variables	**Riparian forest**	**Natural Forest**	***Theobroma cacao***	***Senna siamea***	***Cola nitida***	***Theobroma cacao* and *Cola nitida***
DBH (cm)	124.46	128.5	125.13	76.41	111.41	119.48
H (m)	21.55	21.61	18.28	28.4	20.78	15.8
CD (m)	5.07	9.82	9.35	5.78	7.25	6.39
AGB (Mg/ha)	5049	11156.6	7571.83	1710.48	5108.22	7455.78
BGB (Mg/ha)	452.77	181.22	131.44	101	135	501.78
FB (g)	481.11	733.33	66.67	52.22	52.22	72.78

Table 5. Soil Physiochemical Properties in Land Use Types in Ejigbo, Osun state, Nigeria

			Mono Plantations			Mixed Plantation
Soil Properties	**Riparian forest**	**Natural Forest**	***Theobroma cacao***	***Senna siamea***	***Cola nitida***	***Theobroma cacao* and *Cola nitida***
pH (H_2O)	6.65± 0.03	6.47± 0.02	6.39±0.01	6.81±0.01	6.32± 0.02	6.37± 0.00
Organic Carbon (g/kg)	7.8± 0.02	29.07 ± 0.02	23.79± 0.02	31.36± 0.04	37.45± 0.05	28.82± 0.02
Total Nitrogen (g/kg)	3.16± 0.01	2.77± 0.02	2.59± 0.02	3.42± 0.03	4.12± 0.01	3.17±.02
Available Phosphorus(mg/kg)	6.29± 0.01	7.90± 0.01	18.03± 0.01	19.91± 0.01	20.60± 0.26	17.75± 0.03
Exch Acidity (cmol/kg)	0.42± 0.02	0.41± 0.01	0.61± 0.01	0.50±0.01	0.51± 0.005	0.57± 0.06
Exch H± (cmol/kg)	0.41± 0.01	0.42± 0.02				
Exch AL±±± (cmol/kg)	0.00± 0.00	0.00± 0.00				
Ca (cmol/kg)	4.19± 0.04	2.28± 0.00	5.55±0.05	7.95± 0.05	6.09±0 .03	5.47±0.10
Mg (cmol/kg)	1.35± 0.04	0.83± 0.04	1.63±0.01	1.42±0.01	1.23±0.04	0.23±0.00
K (cmol/kg)	0.22± 0.02	0.20± 0.01	1.14± 0.01	0.56±0.01	0.98±.01	1.17±0.01
Na (cmol/kg)	0.36± 0.02	0.28± 0.04	0.23±0.01	0.27± 0.00	0.21± 0.01	0.23±0.00
Mn (mg/kg)	67.71± 0.20	72.95± 0.34	257.64±0.04	211.01±0.01	186.56±0.00	217.83±0.01
Fe (mg/kg)	92.00± 0.01	88.17± 0.11	98.53±0.57	72.52± 0.03	90.84±.037	80.86±0.01
Cu (mg/kg)	1.39± 0.01	1.26± 0.01	1.99±0.12	2.6967±0.06	1.96±0.023	1.40±0.01
Zn (mg/kg)	2.66± 0.01	2.05± 0.01	7.30±0.12	6.75± 0.04	7.17±0.02	6.31±0.00
Sand (g/kg)	810± 0.00	800± 0.00	791±0.1	800±0.00	800.67± 1.15	820.67± 1.15
Silt (g/kg)	110± 0.00	100± 0.00	121± 1.0	131.33± 1.15	110.33±0.06	121.00± 1.0
Clay (g/kg)	80± 0.00	100± 0.00	90±0.00	71± 1.0	90.33± 0.58	61.33± 1.1

CONCLUSION

This study assessed floristic diversity in riparian and natural forests as well as mono and mixed species plantations. The soil physiochemical properties and distribution of biomass revealed high variability among plantations, riparian and natural ecosystems. The riparian and natural forests had high floral diversity, which could be due to the availability of moisture, limited human activities and unique ecological conditions. Plant diversity contributes to overall ecosystem resilience and stability.

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