Original Research Article

ATTRIBUTES AND ECOLOGICAL POTENTIALS OF DUMPSITE FLORA IN THE PERI-URBAN AREA OF IBADAN, NIGERIA

ABSTRACT

Dumpsites are spaces used disposal of urban and peri-urban wastes. Their public health concern has not made them to be adequately explored for positive potentials in Nigeria. This study investigated the the floristic structure and comparative potential of a dumpsite with arable farms for conservation and phytoremediation. The study was conducted at a 10-hectare peri-urban Lapite dumpsite (N 07^{o}34.121′, E 003^{o}54.857′) in Ibadan, Oyo State, Nigeria; and three arable farmlands (Control) located 200 m-300 m away from Dumpsite. Stratified sampling was conducted using 414 quadrats (each 1m^{2}) in five strata of dumpsite, and a systematic sampling of flora of farms with 263 quaddrats in 21 transects laid 5 m apart. Data were collected on species composition, abundance,density and frequency of occurence. They were subjected to analysis of Relative importance value (RIV), density, and multivariate analysis. Species with phytoremediation potentials were identified. Ninety one species of herbaceous flora in 33 families and 99 species in 38 families were enumerated on the dumpsite and farmlands respectively. *Solanium nigrum, Tridax procumbens, Amaranthus spinosus, Laportea aestuans, Acalypha fimbriata, and Lufa cylindrical* were the most dominant species on the dumpsite with RIVs of 8.40, 8.17, 7.54, 7.21, 6.38 and 5.79 respectively. *Talinum fruticosum, Tridax procumbens, Euphorbia heterophylla, Spermacoce ocymoides,* and *Tithonia diversifolia* were most dominant on farmlands with RIVs of 13.74, 7.05, 6.60, 6.07, and 5.57 respectively. Dumpsite flora had higher diversity (H`=3.501) than control plots (H`=3.294). The dominance value (0.0486) was low compared to the control farms (0.07131). The lora of the two sites were grouped by habitatt preference.Higher species diversity and pervasive presence of invasive T*ridax procumbens, Laportea aestuans,* and *Lufacylindrica* on dumpsite indicated potentials for phytoremediation, and candidacy as functional groups and bio-indicators of ecosystem health.

Keywords: Dumpsite, Species diversity, Phytoremediation, Relative Importance Value, Floristic structure

INTRODUCTION

A dumpsite is a piece of land where waste materials are deposited. Waste is anything - liquid, gas, or solid that has served its original intended purpose and is being thrown away or stored before being discarded. Local and national governemments are faced with enomous waste problems emanating from rapid increase in waste resulting from continuous economic growth, urbanization and industrialization [1]. Wastes are of various types. Solid waste is defined as any non-liquid and non-gaseous products of human activities, regarded as no longer being useful [2,3,4]. Solid wastes often of anthropogenic origin [5,6], consisting of daily consumables and disposed items such as textiles, containers, product packaging, food wastes, and other wastes from various sources like industries, residential, institutions, and commercial [7]. In Nigeria, agricultural activities are carried out on soils in dumpsites because of their fertility which boost yield [8] because they are regarded as composts.

A few studies reported dumpsites to dumpsites cause a decrease in vegetation abundance, deteriorate soil quality and also affect plants diversity and distribution patterns in the surrounding environment [9,10,11]. This position and the continuous accumulation of the urban solid waste containing heavy metals on dumpsites is a public concern [7,12]. In the long run, dumpsites are viewed as a serious threat to soil quality and fertility [13,14]. Heavy metals are accumulated in plants in various ways [15], and can be held in the soil or leached to the underground water, as contaminants whchi modify soil chemistry, with effects on other living organisms depending on the soil for sustenance [16].

Nevertheless, some plants thrive in contaminated conditions of dumpsites [17], with uniques structural and floristic changes. According to [18], the diversity, structure of vegetation, and composition are important factors for assessing the biological diversity of an ecosystem because they give vital information on plants' adaptation to changes in environmental conditions within or above their level of tolerance.

Many studies have examined the impacts of dumpsites on soil and vegetation diversity, for instance, [14,19] discovered significant modification in the soil properties of dumpsites, as a result of metals generated by wastes on dumpsites which disturbed the physicochemical properties of the soil and increase in soil pH. [20] reported that heavy metals generated on dumpsites affect the biodiversity of the surrounding environment. Also, research on ‘open dumping of municipal solid waste and its hazardous impacts on soil and vegetation diversity at waste dumping sites of Islamabad city, Pakistan [14] showed that vegetation and abundance of species on dumpsites are affected as a result of the direct penetration of the heavy metals and other contaminants to the soil.

However, the nature of flora distribution, diversity, and how they influence occurrence of invasive species have not been extensively studied in Nigeria. Therefore, this study investigated flora communities, their spatial distribution and presence or otherwise of invasive weed species on Lapite Dumpsite, Moniya, Ibadan. The potential of the dumpsite for identification of plant species for phytoremediation was also explored.

MATERIALS AND METHODS

STUDY SITE

The study was conducted in Lapite dumpsite in Moniya, Ibadan (Figure 1). The dumpsite is one of four government-designated public dumpsites by Oyo State Waste Management Authority (OYWMA) in 1998. It is situated in Akinyele Local Government area of Oyo State on N07^{o}34.121′, E003^{o}54.857′. It covers a land area of 10 hectares [21].

The study site is located sub-humid tropical climate of southwestern Nigeria with an estimated mean annual rainfall of 1270 mm and the mean maximum temperature of 32^{o}C. The climate is characterized by two seasons namely the rainy season (April through October) and dry season (November through March) and characterized by Harmattan with little or no rainfall. Most of the precipitation is received during the rainy season [21].

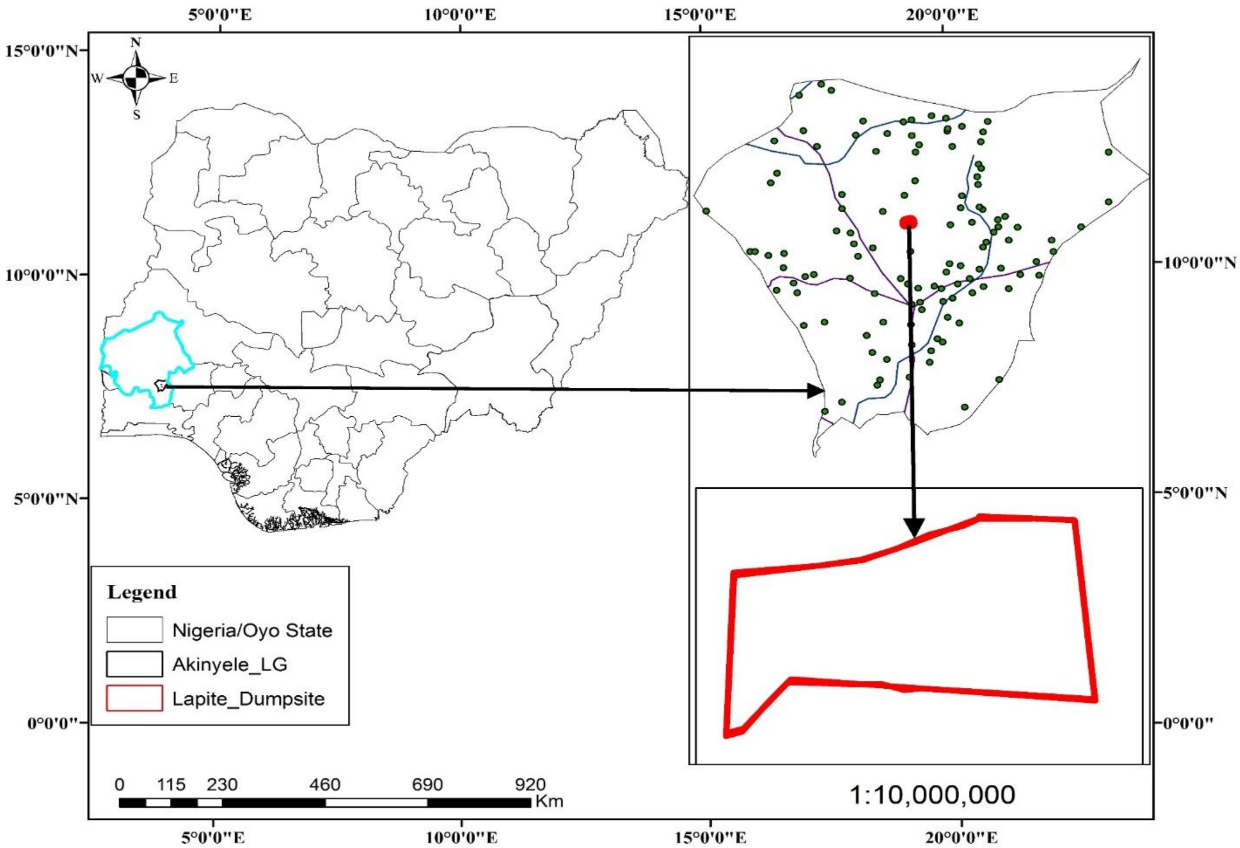

Figure 1: Location of Lapite Dumpsite at Akinyele Local Government, Moniya, Oyo State

Lapite dumpsite was divided into 5 strata (Table 1) based on the patches observed on Google Earth Map, and a reconnaissance trip to confirm them. A random sampling design was employed to account for the flora species on each stratum on the dumpsite. The size and configurations of flora patches were used to determine the number of quadrants that were laid on each stratum. Herbaceous flora in each stratum was enumerated using a wooden quadrant of 1m x 1m. A total of four hundred and fourteen (414) quadrats were laid on the dumpsite.

Control sites (Table 1) were three farmlands located between 200 m and 300 m north of the dumpsite. Each farm was sampled with a wooden quadrant of 1m x 1m dimension along seven transects laid in systematic fashion and perpendicular to Old Ibadan-Oyo road which formed a baseline for the sampling. In total, 263 quadrats were laid in the 21 transects with transect lengths ranging from 5 meters apart.

Herbaceous plants were identified in situ using relevant handbooks [22,23].

Table 1: Geo-location of flora-based strata of Lapite Dumpsite, Moniya, Oyo State in June-August, 2019

Strata	Geo-referenced Coordinates
1	N 07^{o}.34.093′ E 003^{o}.54.615′
2	N 07^{o}.34.149′ E 003^{o}.54.675′
3	N 07^{o}.34.166′ E 003^{o}.54.709′
4	N 07^{o}.34.186′ E 003^{o}.54.736′
5	N 07^{o}.34.234′ E 003^{o}.54.743′
6 (Control 1)	N 07^{o}.34.293′ E 003^{o}.54.612′
7 (Control 2)	N 07^{o}.34.268′ E 003^{o}.54.754′
8 (Control 3)	N 07^{o}.34.281′ E 003^{o}.54.778′

DATA ANALYSES

Floristic data collected were arranged in a species by attribute matrix and analyzed for species abundance, diversity (dominance, species richness/Simpson index, evenness index, and equitability index) and Relative Importance Values (RIV).

Species diversity was obtained from diversity indices using Paleontological statistics software (PAST 2.14) [24]. Multivariate analysis of floristic data was conducted using Paleontological Statistics (PAST) software version 2.14 The analyses consisted of stand ordination (Detrended Correspondence Analysis), cluster analysis to produce dendograms of floral relationships.

RESULTS

Floristic Composition and Relative Importance Value of Flora in Lapite Dumpsite

A total of 91 species of herbaceous flora belonging to 33 families were enumerated in the assessment of 414 quadrats on the dumpsite. Poaceae had the largest family of 20 followed by Fabaceae which had 10 species. Asteraceae had six species, Euphorbiaceae, Solanaceae and Tiliaceae had five species each. Commelinaceae had four species followed by Nyctaginaceae, Rubiaceae, and Convulvaceae with three species each. Cyperaceae, Amaranthaceae, Curcubitaceae, Urticacea, Malvaceae, Onagraceae, Lamiaceae, Portulacaceae, and Rubiaceae had two species each. The families with the lowest number of species are; Scrophulariaceae, Apocynaceae, Passifloraceae, Sapindaceae, Acanthaceae, Piperaceae, Connaraceae, Meliaceae, Hippocrateaceae, Icacinaceae, Aizoaceae, Asclepiadaceae, Boraginaceae, and Cleomaceae all had one species each (Table 3). However, the farmlands contained a 99 species of herbaceous flora belonging to 38 families in the 263 quadrats with Poaceae being the most dominant family.

Relative Importance Value of Herbaceous Flora

In the dumpsite, *Solanium nigrum* had the highest RIV (8.402), closely followed by *Tridax procumbens* with 8.170 and *Amaranthus spinosus* and *Laportea aestuans* with 7.542 and 7.214 respectively. Species with the least RIVs include *Triumfetta cordifolia, Ludwigia decurrens, Calopogonium mucunoides Mimosa pudica* with a value of 0.055 (Table 3).

The relative importance value analyses for herbaceous flora on the control sites indicated *Talinum fruticosum* with the highest RIV (13.745), followed by *Tridax procumbens*, *Euphorbia heterophylla, and Spermacoce ocymoides* with values of 6.604, 6.068, and 5.527 respectively. *Cyperus esculentus, Daniellia oliveri, Vernonia cinerea* had the least RIV (0.029) (Table 4). Fifty five herbaceous species were common to the dumpsite and farmlands (Table 5). While 36 plants were unique to the dumpsite, 42 species were encountered in farmlands only (Table 5).

Table 2: The Relative Importance Value (RIV) of species enumerated on the Lapite dumpsite, Moniya, Oyo State in June-August, 2019

S/N	Species	FAMILY	RIV
1.	*Solanium nigrum*	Solanaceae	8.402
2.	*Tridax procumbens*	Asteraceae	8.170
3.	*Amaranthus spinosus*	Amaranthaceae	7.542
4.	*Laportea aestuans*	Urticacea	7.214
5.	*Acalypha finbriata*	Euphorbiaceae	6.384
6.	*Lufa cylindrical*	Cucurbitaceae	5.788
7.	*Commelina africana*	Commelinaceae	5.586
8.	*Ipomea involucrata*	Convolvulaceae	5.252
9.	*Euphorbia hyssopifolia*	Euphorbiaceae	2.795
10.	*Cleome viscosa*	Cleomaceae	2.722
11.	*Alternanthera ficodea*	Amaranthaceae	2.467
12.	*Chromolaena odorata*	Asteraceae	2.099
13.	*Commelina diffusa*	Commelinaceae	1.503
14.	*Talinum fruticosum*	Portulacaceae	1.482
15.	*Oplismenus burmannii*	Poaceae	1.284
16.	*Senna obtusifolia*	Fabaceae	1.250

17.	*Platostoma africanum*	Lamiaceae	1.248
18.	*Digitaria nuda*	Poaceae	1.216
19.	*Trianthelma potulacastrum*	Aizoaceae	1.181
20.	*Phyllanthus amarus*	Euphorbiaceae	1.161
21.	*Portulaca oleracea*	Portulacaceae	1.139
22.	*Passiflora foetida*	Passifloraceae	1.128
23.	*Physalis angulate*	Solanaceae	1.127
24.	*Eleusine indica*	Poaceae	1.093
25.	*Brachiaria deflexa*	Nyctaginacea	1.029
26.	*Ageratum conyzoides*	Asteraceae	1.028
27.	*Lepistemon owariense*	Convolvulaceae	0.960
28.	*Pouzolzia guineensis*	Urticacea	0.907
29.	*Diodia samentosa*	Rubiaceae	0.840
30.	*Solanium lycopersicum*	Solanaceae	0.829
31.	*Commelina erecta*	Commelinaceae	0.797
32.	*Pueraria phaseoloides*	Fabaceae	0.797
33.	*Calotropis procera*	Apocynaceae	0.763
34.	*Mucuna pruriens*	Fabaceae	0.718
35.	*Commelina benghalensis*	Commelinaceae	0.707
36.	*Pennisetum purpureum*	Poaceae	0.686
37.	*Paulina pinnata*	Sapindaceae	0.630
38.	*Boerhavia coccinea*	Nyctaginaceae	0.619
39.	*Setaria pumila*	Poaceae	0.554
40.	*Setaria megaphylla*	Poaceae	0.509
41.	*Triumfetta rhomboidea*	Tiliaceae	0.508
42.	*Setaria batata*	Poaceae	0.398
43.	*Ludwigia abyssinica*	Onagraceae	0.386
44.	*Shrankia leptocarpa*	Fabaceae	0.354
45.	*Sida garckaena*	Malvaceae	0.353
46.	*Riccinus communis*	Euphorbiaceae	0.332
47.	*Combretum zenkeri*	Combretacea	0.276
48.	*Echinochloa pyramidalis*	Poaceae	0.265
49.	*Cochorus tridens*	Tiliaceae	0.254
50.	*Capsicum annum*	Solanaceae	0.243
51.	*Parquetina nigrescens*	Asclepiadaceae	0.243
52.	*Oldenlandia corymbosa*	Rubiaceae	0.221
53.	*Synedrella nodiflora*	Asteraceae	0.221
54.	*Citrullus lanatus*	Curcubitaceae	0.220
55.	*Solenostemon monostachyus*	Lamiaceae	0.211
56.	*Senna occidentalis*	Fabaceae	0.199
57.	*Cyperus iria*	Cyperaceae	0.177

58.	*Desmodium scopiorus*	Fabaceae	0.177
59.	*Sorghum bicolor*	Poaceae	0.177
60.	*Pennisetum violaceum*	Poaceae	0.176
61.	*Cnestis ferruginea*	Connaraceae	0.166
62.	*Boerhavia errecta*	Nyctaginaceae	0.155
63.	*Triumfetta cordifolia*	Tiliaceae	0.155
64.	*Icacina trichantha*	Icacinaceae	0.132
65.	*Assystasia gangetica*	Acanthaceae	0.121
66.	*Ipomea cordatotriloba*	Convolvulaceae	0.121
67.	*Cochorus olitorius*	Tiliaceae	0.110
68.	*Centrosema pubs*	Fabaceae	0.077
69.	*Digitaria horizontalis*	Poaceae	0.077
70.	*Leptochloa filiformis*	Poaceae	0.077
71.	*Panicum maximum*	Poaceae	0.077
72.	*Peperomia pellucida*	Piperacea	0.077
73.	*Azadiracta indica*	Meliaceae	0.066
74.	*Capsicum chinense*	Solanaceae	0.066
75.	*Cyperus rotundus*	Cyperaceae	0.066
76.	*Panicum laxum*	Poaceae	0.066
77.	*Reissantia indica*	Hippocrateaceae	0.066
78.	*Abutilon indicum*	Malvaceae	0.055
79.	*Alchornea cordifolia*	Euphorbiaceae	0.055
80.	*Andropogon tectorum*	Poaceae	0.055
81.	*Calopogonium mucunoides*	Fabaceae	0.055
82.	*Chrysanthellum indicum*	Asteraceae	0.055
83.	*Cynodon dactylon*	Poaceae	0.055
84.	*Heliotropium indicum*	Boraginaceae	0.055
85.	*Leptochloa caerulescens*	Poaceae	0.055
86.	*Ludwigia decurrens*	Onagraceae	0.055
87.	*Melanthera scandens*	Asteraceae	0.055
88.	*Mimosa pudica*	Fabaceae	0.055
89.	*Pannicum violaccuen*	Poaceae	0.055
90.	*Scoparia dulcis*	Scrophulariaceae	0.055
91.	*Sporobolus pyramidalis*	Poaceae	0.055

Table 3: The Relative Importance Value of species enumerated on the selected farmlands at, Moniya, Oyo State in June-August, 2019

S/N	Species	Family	RIV

1.	*Talinum fruticosum*	Portulacaceae	13.745
2.	*Tridax procumbens*	Asteraceae	7.051
3.	*Euphorbia heterophylla*	Euphorbiaceae	6.604
4.	*Spermacoce ocymoides*	*Rubiaceae*	6.068
5.	*Tithonia diversifolia*	Asteraceae	5.527
6.	*Spigelia anthelmia*	Loganiaceae	5.315
7.	*Marriscus alternifolius*	Cyperaceae	3.848
8.	*Laportea aestuans*	Uticaceae	3.730
9.	*Oldelandia lancifolia*	Rubiaceae	3.365
10.	*Merremia aegyptia*	Convolvulaceae	2.459
11.	*Phyllanthus amarus*	Euphorbiaceae	2.360
12.	*Celosia leptostachya*	Amaranthaceae	2.018
13.	*Synedrella nofiflora*	Asteraceae	1.990
14.	*Senna hirsute*	Fabaceaa	1.609
15.	*Schrankia leptocarpa*	Fabaceae	1.608
16.	*Commelina erecta*	Commelinaceae	1.571
17.	*Calopogonium mucunoides*	Fabaceae	1.556
18.	*Ageratum conyzoides*	Asteraceae	1.520
19.	*Desmodium scorpiurus*	Fabaceaa	1.517
20.	*Peperomia pellucida*	Piperaceae	1.500
21.	*Paullinia pinnata*	Sapindaceae	1.464
22.	*Brachiaria deflexa*	Poaceae	1.445
23.	*Centrosema pubesc*	Fabaceae	1.334
24.	*Commelina benghalensis*	Commelinaceae	1.275
25.	*Euphorbia hirta*	Euphorbiaceae	1.257
26.	*Euphorbia hyssopifolia*	Euphorbiaceae	0.986
27.	*Cromolaena odorata*	Asteraceae	0.887
28.	*Sida garckeana*	Malvaceae	0.803
29.	*Asystasia gangetica*	Acanthaceae	0.784
30.	*Mucuna pruriens*	Fabaceae	0.782
31.	*Alchornea cordifolia*	Euphorbiaceae	0.687
32.	*Commelina diffusa*	Commelinaceae	0.664
33.	*Senna obtusifolia*	Leguminosae	0.615
34.	*Albizia zygia*	Fabaceae	0.608
35.	*Pouzolzia guineensis*	Urticaceae	0.587
36.	*Achornea laxiflora*	Euphorbiaceae	0.581
37.	*Platostoma africanum*	Lamiaceae	0.548
38.	*Solanium nigrum*	Solanaceae	0.533
39.	*Ipomea involucrate*	Convolvulaceae	0.381
40.	*Panicum maximum*	Poaceae	0.378
41.	*Melanthera scandens*	Asteraceae	0.363
42.	*Boerhavia errecta*	Nyctaginaceae	0.358
43.	*Passiflora foetida*	Passifloraceae	0.344
44.	*Sida acuta*	Asteracear	0.324
45.	*Oplismenus burmannii*	Poaceae	0.291

46.	*Acalypha finbriata*	Euphorbiaceae	0.285
47.	*Pueraria phaseoloides*	Fabaceae	0.275
48.	*Solenostemon monostachyus*	Lamiaceae	0.271
49.	*Pennisetum purpureum*	Poaceae	0.257
50.	*Alternanthera ficodea*	Amaranthaceae	0.247
51.	*Sclerocarpus africanus*	Asteraceae	0.247
52.	*Combretum racemosun*	Combretaceae	0.222
53.	*Axonopus compresus*	Poaceae	0.208
54.	*Digitaria horizontalis*	Poaceae	0.208
55.	*Triumfetta rhomboidea*	Malvaceae	0.198
56.	*Ficus exasperate*	Moraceae	0.194
57.	*Marriscus fllabeliformis*	Cyperaceae	0.185
58.	*Cynodon dactylon*	Poaceae	0.184
59.	*Portulaca quadrifida*	Portulacaceae	0.184
60.	*Cochorus tridens*	Malvaceae	0.179
61.	*Emilia praetermissa*	Asteraceae	0.175
62.	*Amaranthus spinosus*	Amaranthaceae	0.174
63.	*Lepistemon owariense*	Convolvulaceae	0.174
64.	*Rottboellia cochinchinensis*	Poaceae	0.164
65.	*Triumfetta cordifolia*	Malvaceae	0.155
66.	*Combretrum hispidum*	Combretaceae	0.150
67.	*Physalis angulate*	Solanacae	0.150
68.	*Reissantia indica*	Celastraceae	0.150
69.	*Cleome viscose*	Cleomaceae	0.136
70.	*Parquetina nigrescens*	Asclepiadaceae	0.130
71.	*Eleusine indica*	Poaceae	0.116
72.	*Ipomea cordatotriloba*	Convolvulaceae	0.116
73.	*Combretum zenkeri*	Combretaceae	0.107
74.	*Typha orientalis*	Typhaceae	0.106
75.	*Ageratum houstonianum*	Asteraceae	0.103
76.	*Lufa cylindrical*	Cucurbitaceae	0.087
77.	*Piliostigma thoninngii* (Seedling)	Fabaceae	0.087
78.	*Setaria megaphylla*	Poaceae	0.078
79.	*Triathema portulacastrum*	Aizoaceae	0.078
80.	*Digitaria nuda*	Poaceae	0.077
81.	*Anielema beniniense*	Poaceae	0.068
82.	*Anthonotha macrophylla*	Fabaceae	0.068
83.	*Commelina africana*	Commelinaceae	0.068
84.	*Mimosa pudica*	Fabaceae	0.068
85.	*Senna occidentalis*	Fabaceae	0.063
86.	*Manniophyton fulvum*	Euphorbiaceae	0.058
87.	*Newbouldia laevis*	Bignoniaceae	0.058
88.	*Portulaca oleracea*	Portulacaceae	0.058
89.	*Solanium torvum*	Solanaceae	0.058

90.	*Oldenlandia corymbosa*	Rubiaceae	0.044
91.	*Cleome rutidosperma*	Cleomaceae	0.039
92.	*Desmodium tortuosum*	Fabaceae	0.039
93.	*Brachiaria lata*	Poaceae	0.034
94.	*Mariscus longibracteatus*	Cyperaceae	0.034
95.	*Paspalum scrobiculatum*	Poaceae	0.034
96.	*Cnestis ferruginea* (Seedling)	Connaraceae	0.029
97.	*Cyperus esculentus*	Cyperaceae	0.029
98.	*Daniellia oliveri* (Seedling)	Fabaceae	0.029
99.	*Vernonia cinerea*	Asteraceae	0.029

Table 4: Herbaceous flora exclusively encountered in Lapite dumpsite and control farmlands

S/N	Common Species	Species in Dumpsite	Species in Farmlands
1.	*Acalypha finbriata*	*Abutilon indicum*	*Achornea laxiflora*
2.	*Ageratum conyzoides*	*Andropogon tectorum*	*Ageratum houstonianum*
3.	*Alchornea cordifolia*	*Azadiracta indica*	*Albizia zygia*
4.	*Alternanthera ficodea*	*Boerhavia coccinea*	*Anielema beniniense*
5.	*Amaranthus spinosus*	*Calotropis procera*	*Anthonotha macrophylla*
6.	*Assystasia gangetica*	*Capsicum annum*	*Axonopus compresus*
7.	*Boerhavia errecta*	*Capsicum chinense*	*Brachiaria lata*
8.	*Brachiaria deflexa*	*Chrysanthellum indicum*	*Celosia leptostachya*
9.	*Calopogonium mucunoides*	*Citrullus lanatus*	*Cleome rutidosperma*
10.	*Centrosema pubscens*	*Cochorus olitorius*	*Combretrum hispidum*
11.	*Cleome viscosa*	*Cyperus iria*	*Combretum racemosun*
12.	*Chromolaena odorata*	*Cyperus rotundus*	*Cyperus esculentus*
13.	*Cnestis ferruginea*	*Diodia samentosa*	*Daniellia oliveri* (Seedling)
14.	*Cochorus tridens*	*Echinochloa pyramidalis*	*Desmodium tortuosum*
15.	*Combretum zenkeri*	*Heliotropium indicum*	*Emilia praetermissa*
16.	*Commelina africana*	*Icacina trichantha*	*Euphorbia heterophylla*
17.	*Commelina benghalensis*	*Leptochloa caerulescens*	*Euphorbia hirta*
18.	*Commelina diffusa*	*Leptochloa filiformis*	*Ficus exasperata*
19.	*Commelina erecta*	*Ludwigia abyssinica*	*Manniophyton fulvum*
20.	*Cynodon dactylon*	*Ludwigia decurrens*	*Mariscus longibracteatus*
21.	*Desmodium scopiorus*	*Panicum laxum*	*Marriscus alternifolius*
22.	*Digitaria horizontalis*	*Panicum maximum*	*Marriscus fllabeliformis*
23.	*Digitaria nuda*	*Pannicum violaccuen*	*Merremia aegyptia*
24.	*Eleusine indica*	*Paulina pinnata*	*Newbouldia laevis*

25.	*Euphorbia hyssopifolia*	*Pennisetum violaceum*	*Oldelandia lancifolia*
26.	*Ipomea cordatotriloba*	*Pouzolzia guineensis*	*Oplismenus burmannii*
27.	*Ipomea involucrata*	*Riccinus communis*	*Paspalum scrobiculatum*
28.	*Laportea aestuans*	*Scoparia dulcis*	*Paullinia pinnata*
29.	*Lepistemon owariense*	*Senna obtusifolia*	*Piliostigma thoninngii* (Seedling)
30.	*Lufa cylindrical*	*Senna occidentalis*	*Portulaca quadrifida*
31.	*Melanthera scandens*	*Setaria batata*	*Pouzolzia guineensis*
32.	*Mimosa pudica*	*Setaria megaphylla*	*Rottboellia cochinchinensis*
33.	*Mucuna pruriens*	*Setaria pumila*	*Sclerocarpus africanus*
34.	*Oldenlandia corymbosa*	*Solanium lycopersicum*	*Senna hirsuta*
35.	*Oplismenus burmannii*	*Sorghum bicolor*	*Senna obtusifolia*
36.	*Parquetina nigrescens*	*Sporobolus pyramidalis*	*Senna occidentalis*
37.	*Passiflora foetida*		*Setaria megaphylla*
38.	*Pennisetum purpureum*		*Sida acuta*
39.	*Peperomia pellucida*		*Solanium torvum*
40.	*Phyllanthus amarus*		*Spermacoce ocymoides*
41.	*Physalis angulate*		*Spigelia anthelmia*
42.	*Platostoma africanum*		*Tithonia diversifolia*
43	*Portulaca oleracea*		
44.	*Pueraria phaseoloides*		
45.	*Reissantia indica*		
46.	*Shrankia leptocarpa*		
47.	*Sida garckaena*		
48.	*Solanium nigrum*		
49.	*Solenostemon monostachyus*		
50.	*Synedrella nodiflora*		
51.	*Talinum fruticosum*		
52.	*Trianthelma potulacastrum*		
53.	*Tridax procumbens*		
54.	*Triumfetta cordifolia*		
55.	*Triumfetta rhomboidea*		

Results from the GIS indicated that 54.61% of Lapite dumpsite land area was covered with vegetation. Only 39.75% surface area of the entire land was being actively used as the dumpsite. The remaining areas were classified as 5.6% bare (Figure 3). The controlled plots had more species (99) than the dumpsite (91). The trend was also found in the total number of individuals enumerated (Table 5). While 10189 individuals were enumerated in the farms, 4502 individuals were enumerated in the dumpsite. Although generally low, dominance index was slightly higher in the farmlands. The diversity of plants in both sites were similar, with the dumpsite having a slightly higher diversity (3.501) irrespective of the lower number of individuals. than the control sites (farmlands) with a Shannon-Wiener value of 3.294. The diversity profile of the dumpsite was more natural with a normal curve, which indicated that the species are have become adapted to the soil of the site over time (Figure 4). The diversity curve of species of the farmlands however were skewed to the left, indicating that the oddurence of the species were influenced by mechanisms that are beyond innate responses of the plants to the soil alone. The contributions of a few of the plants, such as *Paspalum sp.* and *Axonopus sp.* to the overall diversity was low at the expense of *Combretum sp., Solanum sp., Spermacoceae sp. and Laportea sp.*

The classification of the herbaceous flora was according to their ecological preferences of species in relation to the similarities and/or dissimilarities of species. Species of both sites displayed unique patterns of associations. The flora of the two sites displayed similar associations. Known hardy species (Gold and Olubode, 2018) were displayed singly on either end of environmental gradient. Ruderals and species well adaptable to low pH and low soil fertility occupied one end, while agresters were displayed with varying pattern of association in the middle of the dendrogram (Figure 5). These include *Talinum fruticosum, Passiflora foetida* and *Phyllanthus amarun.* The third main group are those adapted to hydromorhic soils, *Ipomoea involucrata* and *Mariscus alternifolius.* The flora of the dumpsite were mainly classifies by dichotomy into ruderals, whih are also known to survive in stressed conditions, such as *Meremia aegyptica, Tridax procumbens,* and *Oplismenus burmanii.* There were also, species with high amount of fibers and those known to be good phytoremediators, such as *Cynodon dactylon, Pennisetum purpurreum,* and *Panicum sp.* The third group are varied combining agresters and hydrophyllic species (Figure 6)

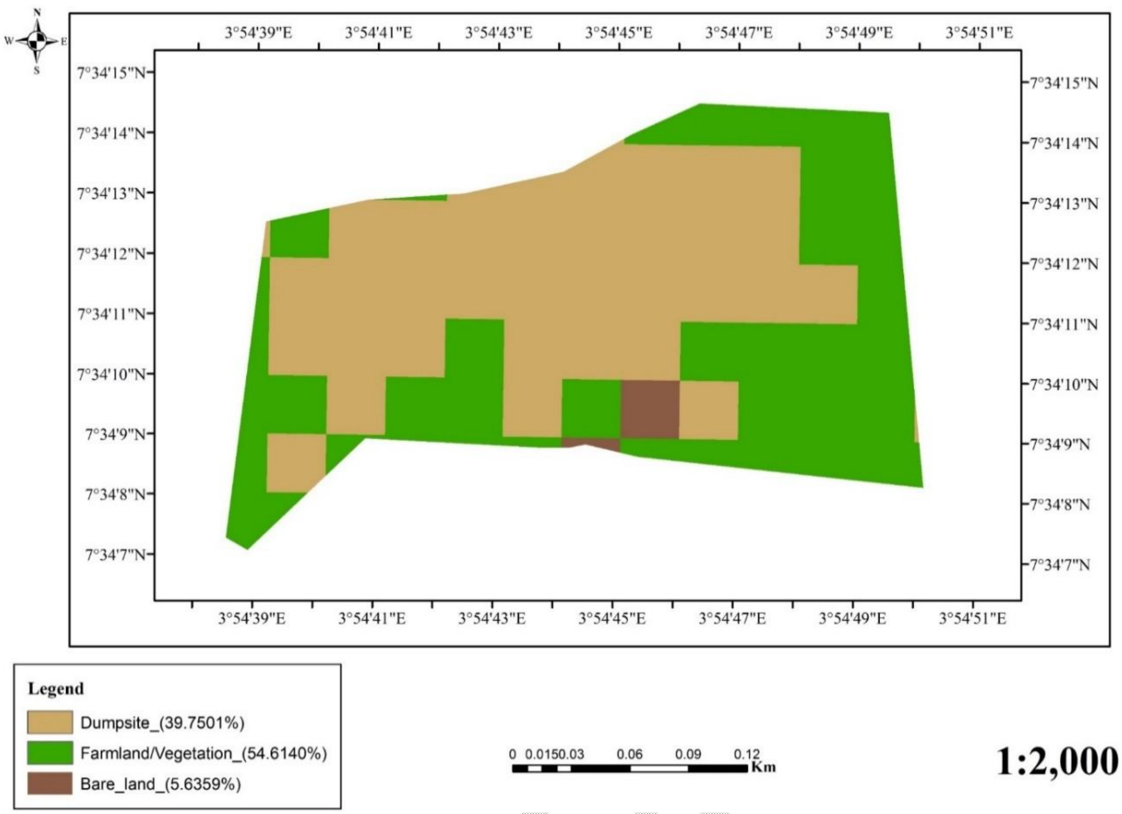

Figure 2: Land-use cover of Lapite dumpsite at Moniya, Ibadan, Oyo State, Nigeria

Table 5: Diversity indices of species enumerated at Lapite dumpsite and control farmlands in Lapite, Ibadan, Oyo State, Nigeria

Diversity Indices	Dumpsite	Farmlands (Control)
Taxa_S	91	99
Abundance	4502	10189
Dominance_D	0.0486	0.07131
Simpson_1-D	0.9514	0.9287
Shannon_H	3.501	3.294
Evenness_e^H/S	0.3526	0.2722
Equitability_J	0.7706	0.7168

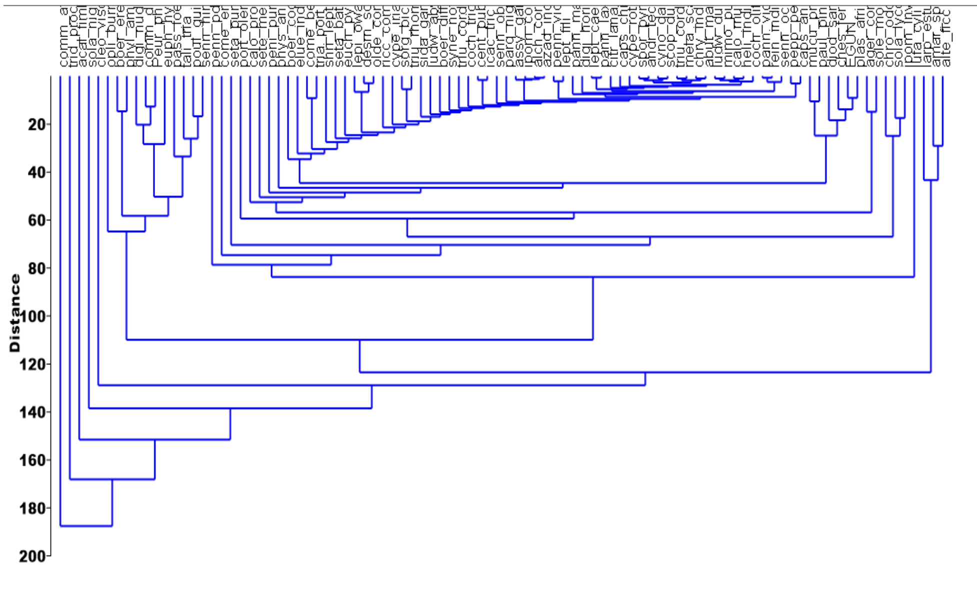

Figure 3:Dendrogram of species on Lapite dumpsite, Ibadan, Oyo State, Nigeria

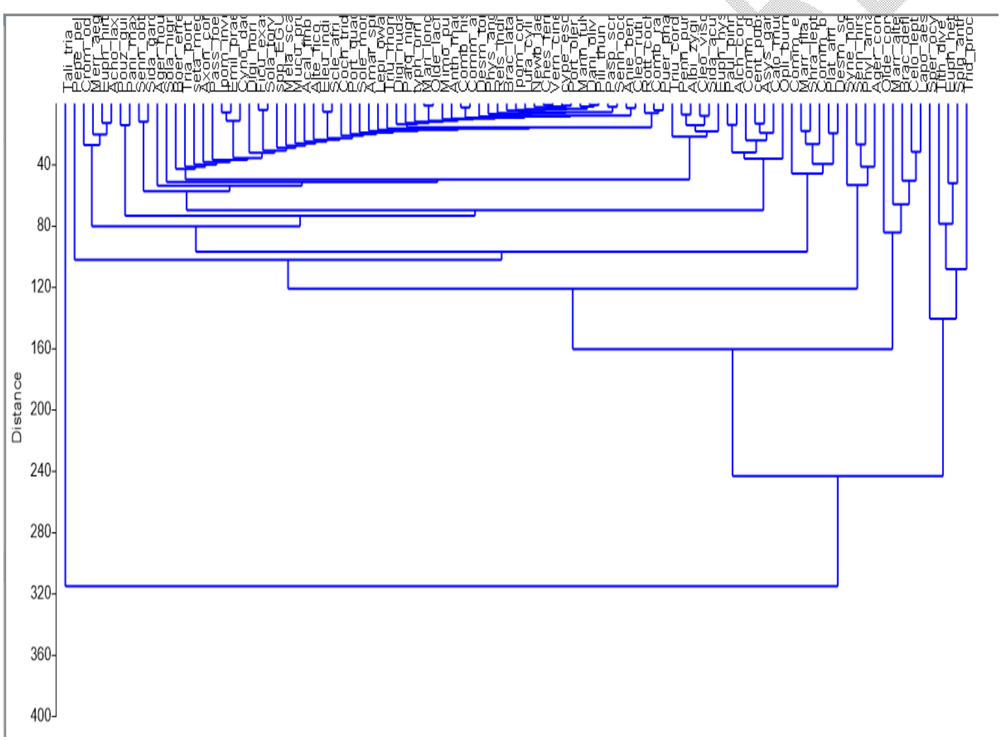

Figure 4: Dendrogram of species on farmlands (control), Ibadan, Oyo State, Nigeria

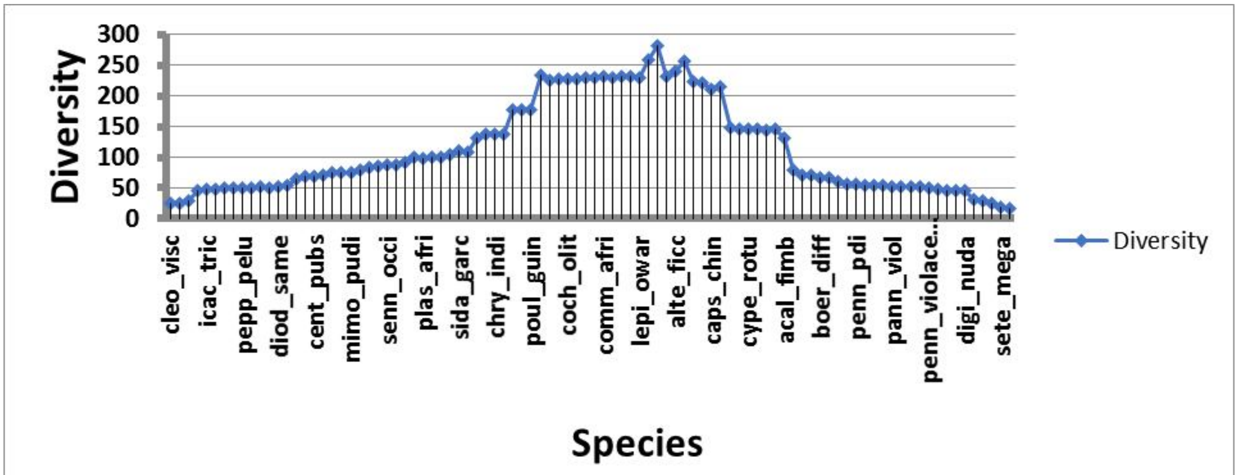

Figure 5: Diversity curve of species on the Lapite dumpsite, Moniya, Ibadan, Oyo State, Nigeria

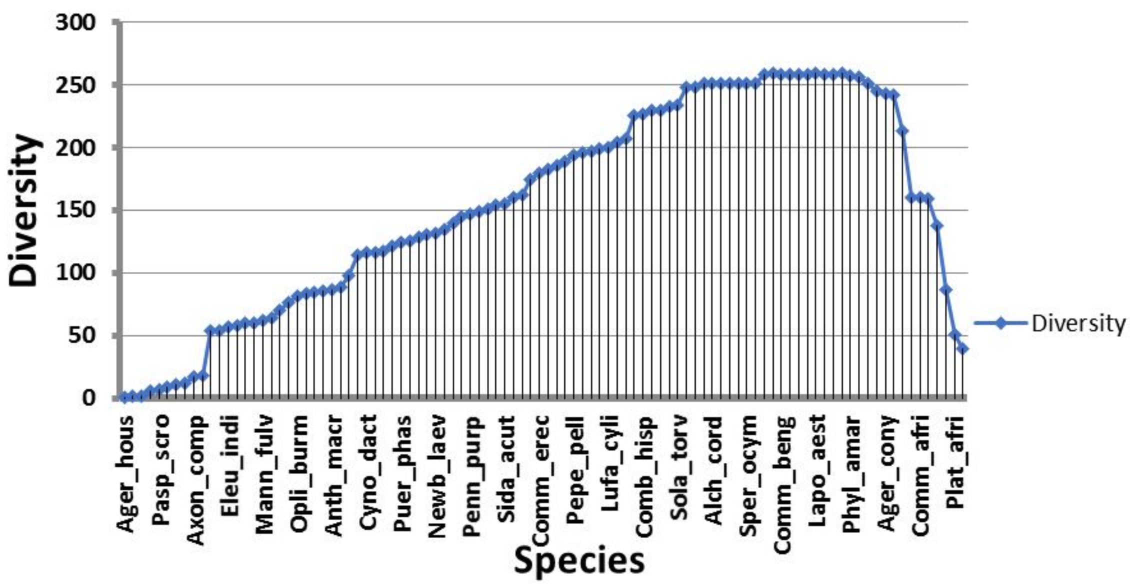

Figure 6: Diversity curve of species on farmlands (control), Ibadan, Oyo State, Nigeria

DISCUSSION

The result from this study shows that dumpsite is an in situ place for species that would not normally found extensively elsewhere to thrive. Though an anthropogenic formation like farmlands, the number of plant species uniquely associated with it are favourably comparable to the number exclusively found on farmlands. Between the two formations, a large number of plants are commonly encountered. The dumpsites showed a higher level of species diversity and species richness, and the nature of anthropogenic activities made in it to be slightly more diverse and more normally distributed. This result of this work corroborated the findings of other studies [25] on the abundance and distribution of species on dumpsites and landfills. The species were comparable in number and diversity, probably because of nutriend enrichment from wastes in the case of the dumpsite and application of soild amendments by farmers in the case of farmlands, and the various activities that introduce and encourage dispersal of herbaceous species. This supports the observation that nutrients are added to soils of dumpsite from decomposition of solid waste [26]. It was likewise reported [27] that most solid wastes has high organic matter content which when decomposed could add nutrients to the soil. The findings of this study were however contrary to report of [10] that vegetation, open dumpsites negatively impact plant diversity. It is also possible that some wastes may contain some viable dormant seeds of some species which when disposed at the dumpsite germinate and grow with other species present [28].

Lapite dumpsite encourage more populations of L. *cylindrical*, A. *spinosus*, L. *aestuans*, which were encountered in large populations ,and are known phytoremediators of heavy metals [29, 30].

Other plant species encountered on the study sites with phytoremediation potentials are: *Alternanthera sessilis* is a known phytoremediator of Cu, Zn, and Fe [31]. *Amaranthus spinosus* (Cd, Zn, and Fe) [32], *Cyperus rotundus* (Sn, and B) [33], *Eleusine indica* (Pb) [34], *Panicum maximum* (Pb) [35], and *Portulaca oleraceae* (Cu, and Zn) [36].

Conclusion and Recommendation

Dumpsites have positive potentials that are yet to be fully explored. This study has revealed that dumpsites are good repositories of plant species for conservation and utilization for phytoremediation. Lapite dumpsite has a high comparable use for conservation of wild plants with farmlands in Moniya area, and they could be utilized for positive purposes. Further phytosociological investigation of the dumpsite may give insight into other potentials of the species as functional groups and bio-indicators of ecosystem health.

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