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## ECOSON-Ibadan, 2022

Edited Conference Proceedings

**Theme:**

**Natural Ecosystem Sustainability  
in the 21st Century**

Sunday, May 15 — Thursday, May 19, 2022

VENUE

**University of Ibadan, Nigeria**

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- Biotechnology, Molecular Ecology and Ecosystem Sustainability
- Ecological Principles in Sustainable Agricultural Practices

### Keynote Speakers:

Prof. Augustine O. Isichei, Dept., of Botany, Obafemi Awolowo University, Ilefe, Osun State.

Prof. Joshua Oluwole Olowoyo, Dept. of Biological Sciences, Sefako Makgatho Health Science University, Pretoria, South Africa.



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**Chevron**



## LOSS OF BIODIVERSITY THROUGH DIFFERENT SOURCES OF POLLUTION

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## ABSTRACT

A major source of loss of plant biodiversity has been traced to anthropogenic factors, in which pollution is an important aspect. This necessitates establishment of facts on different polluted sites in Oyo, and Osun States in order to prevent the occurrence that further leads to loss of biodiversity of the affected ecosystems.

Descriptive research was carried out to assess the level of distortion done to the former stabilized environments. This was aimed at assessing the floral composition of two different spent oil and fertilizer polluted ecosystems using quadrat method of sampling. Relative densities, frequencies and Importance value of each plant in the study sites were carefully calculated.

The results informed that: the floral composition of the oil spent polluted sites when compared with their respective control sites and the other (2) fertilizer polluted sites, recorded less diverse plant species. There was increased in the density of monocotyledonous plant species such as: *Maximum panicum*, *Pennisetum pedicellatum*, *Eragrostis spp* and others. However, the fertiliser polluted sites are less reduced in plant species diversity when compared with their respective control sites. *Passiflora foetida* is the only plant species growing on the two (2) polluted sites but not in all control sites except that of fertilizer polluted control site. Oil spent polluted site, being the most vulnerable site to loss of plant species needs to be checked from continuity in order to guide against the worst occurrence that leads to climate change.

**Keywords:** Biodiversity loss, Pollution, spent oil, fertilizer, polluted sites and plant

## INTRODUCTION

Human activities (anthropogenic factor) could be well responsible for shift in species distribution and abundance. However, if no check is done to its excesses, it stands as climate change driver which usually advanced to a dreadful issue to the global world (Chen *et al.* 2011, Poloczanska *et al.*, 2013, Pecl' *et al.*, 2017). It then becomes a major concern of the whole world from region to region no matter the level of the species enriches the country is so as to be conscious of the global warming. Nigeria as a country is endowed with lots of natural resources in which petroleum is a principal one among others which includes arable land (The United Nations Agenda 21, 2012). However, the increasing effect of anthropogenic disorder has destabilized enriched species ecosystems (Burma, 2015). Although, oil upon dispersion continues to

undergo further compositional deviations due to weathering that makes it reduced toxic, more viscous, and more likely to coagulate (Mendelssohn *et al.*, 2012). Small quantity of refined or spent oil if spilt on terrestrial ecosystem has recorded very large negative effects on both flora and fauna components of the fragile ecosystems (Houghton, 2012). So also, there has been much pressure on farm land due to vast increase in human population. In an attempt to meet up with food demand of the large population, there is abuse use of fertilisers above the permissible level. The impact is well felt on the biotic components and was physically and observed firstly on the plant biodiversity.

This study is set to assess the contribution of human in the aspect of pollution to loss of

plant biodiversity. So also, it was set to evaluate the degree of contribution by different pollution sources which its continuity may finally dragged the entire world to global warming.

## MATERIALS AND METHODS

The study was carried out from two States (Osun and Oyo), Nigeria. Each of the fertiliser polluted sites was chosen for the research study due to the information gathered about them from the users of the plots. The two-mechanic workshops chosen for the study were chosen based on the confirmation of the length of period over ten (10) years. Three (3) soil samples were taken from each site including control, mixed together and sent for analysis. The result is garnished in table 1.

Vegetation survey was carried out on both spent oil contaminated sites for this study at: (Mechanic Workshop, LAUTECH Ogbomosolilorin Road and INEC office, Ogbomoso, Oyo

State and on both fertiliser polluted sites at: Ojo Aro, Ara-Ede road, Osun State and at: Vice Chancellors (VC) lodge, LAUTECH, Oyo State. Quadrat sampling was adopted by laying transect lines at both middle and diagonal sides of the measured plots of each studied site (10 m X 10 m). Quadrats were placed on the laid transects, plant species rooted in the quadrats were identified, counted and recorded. The Relative Importance Value (RIV) were calculated from the values of Relative Density and Relative frequency of each plant species as follows:  $RIV = (RD + RF) \div 2$ .

RD = The population density of each plant species in relation to the total population of all plant species recorded in the study site.

RF = The number of quadrats in which each plant species occurred in relation to the total number of quadrats laid in the study site.

## RESULTS

**Table 1:** Heavy metal contents of spent oil, fertiliser polluted soils and their corresponding control soil samples and the recommended safe levels of WHO, 2007; FAO, 2016 in soil

Soil Samples	Cu (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	Cd (mg/kg)	Pb (mg/kg)
Spent oil polluted soil and the corresponding control					
O-I Road	7.75 <sup>a</sup> ±	25.25 <sup>a</sup> ±0.42	25.75 <sup>a</sup> ±0.38	13.56 <sup>a</sup> ±0.24	10.9 <sup>a</sup> ±0.11
Control	2.80 <sup>c</sup> ±0.16	9.36 <sup>b</sup> ±0.42	6.22 <sup>c</sup> ±0.38	6±0.24	0.03±0.11
INEC Area	7.57 <sup>a</sup> ±0.16	24.3 <sup>a</sup> ±0.42	23.9 <sup>b</sup> ±0.38	11.8 <sup>b</sup> ±0.24	8.5 <sup>c</sup> ±0.11
Control	3.30 <sup>b</sup> ±0.16	7.42 <sup>c</sup> ±0.42	6.8 <sup>d</sup> ±0.38	5.2 <sup>d</sup> ±0.24	0.08 <sup>d</sup> ±0.11
WHO & FAO	4.4±0.16	12±0.42	8.4±0.38	6.4±0.24	4.5±0.11
Fertiliser polluted soil and their corresponding control					
FP Ojo aro	1.79 <sup>d</sup> ±0.16	9.11 <sup>b</sup> ±0.42	16.0 <sup>c</sup> ±0.38	5.8 <sup>c</sup> ±0.24	10.5 <sup>b</sup> ±0.11
Control	0.09 <sup>e</sup> ±0.16	4.8 <sup>d</sup> ±0.42	7.3 <sup>d</sup> ±0.38	5 <sup>d</sup> ±0.24	0.04 <sup>d</sup> ±0.11
FP VC lodge	1.80 <sup>d</sup> ±0.16	9.10 <sup>b</sup> ±0.42	15.8 <sup>d</sup> ±0.38	4.8 <sup>c</sup> ±0.24	10.7 <sup>a</sup> ±0.11
Control	0.05±0.16	4.2 <sup>d</sup> ±0.42	5.11 <sup>f</sup> ±0.38	4.9 <sup>c</sup> ±0.24	0.01 <sup>d</sup> ±0.11
WHO & FAO	4.4 <sup>c</sup> ±0.16	12±0.42	8.4±0.38	6.4±0.24	4.5±0.11

Plant species composition on Ilorin-Ogbomoso Road (I-O) spent oil polluted site recorded fifteen (15) reduced plant species, while their corresponding control sites recorded nineteen (19) table 2. So also, the plant density and frequency on the polluted soil (109 and 63) respectfully. The data explained the reduced plant population and poor plant species distribution on spent oil polluted site when

compared with the floral composition on control site with plant density (295) and frequency (179). Some plant species like: *Tridax procumbens*, *Gomphrena celosoides*, *Acanthospermum hispidum*, *Flueya aestuans* failed to grow on the polluted site but thrive well on the control site. *Sida corymbosa* recorded the highest density (22) and frequency (9) table 2.

**Table 2:** Floral Composition of Spent Oil Polluted and control Sites at (Mechanic Workshop: Ilorin Ogbomoso Road, LAUTECH, Ogbomoso, Oyo State)

Plant Spp.	Density		Frequency		Relative Density (RD)		Relative Frequency (RF)		RIV=RD+RF/2	
	Polluted	Control	Polluted	Control	Polluted	Control	Polluted	Control	Polluted	Control
<i>Sida acuta</i>	23	41	8	26	21	13.89	12.69	14.52	16.85	64.21
<i>Amaranthus hybridus</i>	12	35	8	18	21	11.86	11.11	10.05	16.06	10.96
<i>Tridax procumbens</i>	-	5	-	4	-	1.69	-	2.23	-	1.96
<i>Nicotiana tabacum</i>	1	4	1	4	0.9	1.36	1.59	2.23	1.25	1.80
<i>Chromolaena odorata</i>	15	24	7	15	13.76	8.14	11.11	8.38	19.32	8.26
<i>Syntherisma nudiflora</i>	6	20	2	16	5.50	6.78	3.17	8.93	4.34	7.86
<i>Passiflora foetida</i>	4	-	4	-	3.67	-	6.35	-	5.01	-
<i>Gomphrena celosoides</i>	-	8	-	5	-	2.71	-	2.79	-	4.11
<i>Euzakia montana</i>	8	15	5	12	0.9	5.85	7.94	6.70	4.42	6.28
<i>Sida corymbosa</i>	22	43	9	15	20.18	14.58	14.29	8.38	17.24	11.48
<i>Ageratum conyzoides</i>	2	38	2	21	1.83	12.88	3.17	11.73	2.5	12.31
<i>Sienna obtusifolia</i>	3	19	3	12	2.75	6.44	4.76	6.70	3.76	6.57
<i>Acanthospermum hispidum</i>	-	6	-	4	-	2.03	-	2.23	-	2.13
<i>Flueya aestuans</i>	-	2	-	2	-	0.67	-	1.12	-	0.90
<i>L. coromandelianum</i>	3	13	3	11	2.75	4.41	4.76	6.14	3.76	5.28
<i>Fanicum maximum</i>	1	8	1	5	0.9	2.71	1.58	2.79	1.24	2.75
<i>Faniculate</i>	7	10	5	7	6.42	3.39	7.94	3.92	7.18	3.66
<i>Kyllinga squamulata</i>	5	9	5	7	6.42	3.05	7.94	1.68	7.18	2.37
<b>Total Summation</b>	<b>109</b>	<b>295</b>	<b>63</b>	<b>179</b>	<b>107.98</b>	<b>102.44</b>	<b>90.27</b>	<b>73.71</b>	<b>110.11</b>	<b>152.89</b>

**Table 3: Floral Composition of Spent Oil Polluted and control Sites at (Mechanic Workshop -INEC Environment Ogbomosho, Oyo State)**

Plant Spp.	Density		Frequency		Relative Density (RD)		Relative Frequency (RF)		RIV=RD+RF/2	
	Polluted	Control	Polluted	Control	Polluted	Control	Polluted	Control	Polluted	Control
<i>Sida acuta</i>	21	43	8	26	13.29	10.02	7.07	9.35	10.18	9.69
<i>Cynodon dactylon</i>	13	34	10	27	8.23	7.92	8.85	9.71	8.54	8.82
<i>Mitracarpus villosus</i>	4	24	9	4	2.53	5.59	7.96	1.43	5.25	3.51
<i>Crotalaria retusa</i>	1	4	1	4	0.63	0.93	0.88	1.43	0.69	1.18
<i>Cyperus rotundus</i>	8	23	7	21	5.06	0.05	6.19	7.55	5.63	3.8
<i>Panicum maximum</i>	15	24	7	15	9.49	5.59	6.19	5.40	7.84	5.50
<i>Ficus exasperata</i>	1	6	1	5	0.63	1.39	0.88	1.80	0.76	1.60
<i>Kyllinga squamulata</i>	4	12	4	10	2.53	2.79	3.54	3.60	3.04	3.20
<i>Hypis suaveolens</i>	2	8	2	5	1.26	1.86	1.77	1.80	1.52	1.83
<i>Urena lobata</i>	8	15	5	12	5.06	3.49	4.42	4.32	4.74	3.91
<i>Passiflora foetida</i>	5	8	4	6	3.16	1.86	3.54	2.16	3.35	2.01
<i>Sida corimbosa</i>	22	43	9	15	13.92	10.02	7.96	5.40	21.88	7.71
<i>Ageratum conyzoides</i>	2	38	2	21	1.27	8.86	1.77	7.55	1.52	8.21
<i>Solanum nigrum</i>	3	19	3	12	1.20	4.42	2.65	1.08	1.93	2.75
<i>Sida cordifolia</i>	16	28	12	20	10.13	6.52	10.61	4.32	10.37	5.42
<i>Tridax procumbens</i>	16	35	12	33	10.13	8.15	10.61	11.87	10.37	10.01
<i>Nicotiana tabacum</i>	3	25	3	12	1.20	5.83	2.65	4.32	1.93	5.08
<i>Chromolaena odorata</i>	3	13	3	11	1.20	3.03	2.65	3.96	1.93	3.50
<i>Syntherisma nudiflora</i>	1	8	1	5	0.63	1.86	0.88	1.80	0.76	1.83
<i>Eleurya aestuans</i>	7	10	5	7	4.43	2.33	4.42	2.52	4.43	2.43
<i>Gomphrena celosioides</i>	5	9	5	7	3.16	2.20	4.42	2.52	3.79	2.36
Total Summation	158	429	113	278	99.14	94.71	99.91	93.89	110.45	94.35

**Table 4: Floral Composition of Fertiliser Polluted and control Sites at (Ojo ara, Ara-Ede Road, Osun State)**

Plant Spp.	Density		Frequency		Relative Density (RD)		Relative Frequency (RF)		RIV=RD+RF/2	
	Polluted	Control	Polluted	Control	Polluted	Control	Polluted	Control	Polluted	Control
<i>Celostia argentea</i>	6	27	6	25	3.14	5.01	4.05	5.92	43.54	5.47
<i>Manihot esculentum</i>	11	55	9	32	5.76	10.22	6.08	7.58	5.92	8.90
<i>Sienna obtusifolia</i>	21	34	11	30	11.00	6.31	7.43	7.11	9.22	6.71
<i>Dithonia diversifolia</i>	24	42	14	23	12.57	5.45	9.50	3.32	11.04	4.39
<i>Eleurya aestuans</i>	2	15	2	13	1.05	7.80	1.35	3.08	1.20	5.44
<i>Aspilia africana</i>	1	14	1	14	0.52	2.60	0.68	3.32	0.60	2.96
<i>Centrosema pubescence</i>	12	24	8	20	6.28	4.46	5.41	4.74	6.52	4.60
<i>Sida cordifolia</i>	13	26	10	22	6.28	4.83	6.76	5.21	6.52	5.02
<i>Tridax procumbens</i>	2	22	2	20	1.05	4.09	1.35	4.74	1.20	4.42
<i>Sida corimbosa</i>	4	12	4	11	2.09	2.23	2.70	2.61	2.40	2.42
<i>Euphorbia spp.</i>	3	14	2	14	1.57	2.60	1.35	3.32	1.46	2.96
<i>Physalis anguiculata</i>	1	12	1	11	0.52	2.23	0.68	2.61	0.6	2.42
<i>Pennisetum pedicellatum</i>	8	17	6	13	4.19	3.16	4.05	3.08	4.12	3.12
<i>Passiflora foetida</i>	8	6	5	6	4.19	1.12	3.38	1.42	3.64	1.27
<i>Phyllanthus amarus</i>	16	43	9	15	8.38	7.99	6.08	3.55	7.23	5.77
<i>Mahoeastrum coromandelianum</i>	2	8	2	6	1.05	1.49	1.35	1.42	1.20	1.46
<i>Hibiscus sabdarifa</i>	12	21	8	19	6.28	3.90	5.41	4.50	5.85	4.20
<i>Sida acuta</i>	3	11	12	8	1.57	2.04	8.11	1.90	4.84	1.97
<i>Spigelia anthelmia</i>	8	43	6	27	4.19	7.99	4.03	6.40	4.11	7.20
<i>Hypoglycophyllum</i>	3	13	3	10	1.57	2.42	2.03	2.37	1.80	2.40
<i>Passiflora foetida</i>	4	1	4	1	2.09	0.19	2.70	0.24	2.40	0.22
<i>Euphorbia peltata</i>	2	8	2	7	1.05	1.49	1.35	1.66	1.20	1.58
<i>Ocimum gratissimum</i>	3	8	2	8	1.57	1.49	1.35	1.90	1.46	1.70
<i>Cochlospermum alatum</i>	3	18	2	16	1.57	3.35	1.35	3.80	1.46	3.58
<i>Marsippospermum</i>	1	11	1	16	0.52	2.04	0.68	3.80	0.60	2.92
<i>Mirabilis jalapa</i>	3	8	2	6	1.57	1.49	1.35	1.42	1.46	1.46
<i>Carica papaya</i>	2	5	2	4	1.05	0.93	1.35	0.95	1.20	0.94
<i>Andropogon paniculatus</i>	11	20	10	18	5.80	3.71	6.76	4.27	6.28	3.99
<i>Heliotropism spp.</i>	2	8	2	7	1.05	1.49	1.35	1.66	1.20	1.60
Total summation	191	538	148	422	93.24	96.14	95.97	86.54	140.27	101.09

Table 5: Floral Composition of Fertiliser Polluted and control Sites at (VC's Lodge, LAUTECH, Ogbomosho, Oyo State)

Plant Spp.	Density		Frequency		Relative Density (RD)		Relative Frequency (RF)		RIV=RD+RF/2	
	Polluted	Control	Polluted	Control	Polluted	Control	Polluted	Control	Polluted	Control
<i>Pueraria spp.</i>	19	41	8	25	13.1	14.49	8.60	11.06	10.85	12.78
<i>Tithonia diversifolia</i>	12	35	9	20	8.28	12.37	9.68	8.85	8.57	10.60
<i>Iridax procumbens</i>	8	15	6	13	5.52	5.30	6.45	5.75	5.99	5.53
<i>Aspilia Africana</i>	1	14	1	14	0.69	4.95	1.08	6.19	3.44	5.57
<i>Centrosema pubescence</i>	15	24	7	20	10.34	8.48	7.53	8.85	8.94	8.67
<i>Sida cordifolia</i>	13	20	2	17	8.97	7.07	2.15	7.52	5.56	7.30
<i>Sida corymbosa</i>	4	12	4	11	2.76	4.24	4.30	4.87	3.53	4.56
<i>Pennisetum pedicellatum</i>	8	17	6	13	5.52	6.01	6.45	5.75	5.99	5.88
<i>Passiflora foetida</i>	8	1	5	1	5.52	0.35	5.38	0.44	5.45	0.40
<i>Phyllanthus amarus</i>	22	43	9	15	15.17	15.19	9.68	6.64	12.43	11.32
<i>Malvastrum coromandelianum</i>	2	8	2	6	1.38	2.83	2.15	2.65	1.77	2.74
<i>Hibiscus sabdarifa</i>	12	21	3	9	8.28	7.42	3.23	3.98	5.76	6.59
<i>Sida acuta</i>	-	6	-	4	-	2.12	-	1.77	-	1.95
<i>Spigelia anthelmia</i>	-	2	2	2	-	0.71	2.15	0.88	2.65	0.80
<i>Manihot esculentum</i>	3	13	3	10	2.07	4.59	3.23	4.42	2.65	4.51
<i>Passiflora foetida</i>	4	1	4	1	2.76	0.35	4.30	0.44	3.53	0.40
<i>Peperomia pellucida</i>	2	8	2	7	1.40	2.83	2.15	3.10	1.77	3.90
<i>Cochlosia alitorius</i>	3	18	2	16	2.07	6.36	2.15	7.08	2.11	6.72
<i>Celosia argentea</i>	-	11	-	16	-	3.89	-	7.08	-	5.49
<i>Mitralbills Jalapa</i>	5	4	5	3	3.45	1.41	5.38	1.33	4.42	1.37
<i>Carica papaya</i>	2	5	2	4	1.38	1.77	2.15	1.77	1.77	1.77
<i>Andrographis paniculate</i>	11	15	11	15	7.59	5.30	11.83	6.64	9.71	5.97
Total sumation	145	283	93	226	112.48	118.03	96.79	107.06	106.89	114.82

## DISCUSSIONS

Failure of many plant species to grow on spent oil polluted site could be due to the presence of the Polycyclic Aromatic Hydrocarbons (PAHs) in spent oil and which has been shown to have had indirect secondary effects like disruption of plant water-air relationship (Renault *et al.*, 2000). The study also observed that species diversities and densities of plants grown on the two (2) corresponding control sites (i.e adjacent sites to each of the used polluted sites in this study), outweighed those that grown on the two (spent oil and fertilizer polluted) sites. The reason for this may be due to the report given that spent oil affects biological, physical, chemical and microbiological components of the soil in various ways (Agbogidi and Ejemeta, 2005; Agbogidi, 2010) and thereby, affecting the growth, development, productivity and yield of plants (Osubo and Aniofo, 2003; Agbogidi, 2011). The severe loss of plant

biodiversity associated with the spent oil polluted site is corroborated by Bautista and Rahman (2016), as they concluded in their study that the death of several globally important wildlife species has been reported and another vast number of species severely affected by oil coating are the plant leaves and stem which are been covered by oil. *Passiflora foetida* species was observed present on all the studied polluted sites but found with less density on only one of the studied control sites.

## CONCLUSION

This study concluded that both pollution from spent oil and excess use of fertilizer contribute to loss of plant biodiversity. However, the severe loss was recorded from spent oil polluted site. *Passiflora foetida* species may possibly be a specific plant any polluted sites.

## Recommendation

Intermittent inspection must be carried out by the health practitioners to curb and guide them from: encroachment of extended vegetation plots by the mechanical Engineers and indiscriminate discharge of spent oil around. They must be lectured on the severe effect posed on different ecosystems. Regular action must be taken by the Extension agents in collaboration with the health practitioners to check, create awareness and campaign on the judicious use of fertilizer on food crop production. They must organize public lecture on the negative impact of this and the overall trembling results.

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