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DIVERSITY OF PLANTS AROUND REFINERY SITE IN WARRI, DELTA STATE

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ABSTRACT The aim of this study is to give an inventory on the flora diversity around Warri Refinery and Petrochemical Company, Warri, Delta State. Plant species present in and around the refinery were sampled using line transecting method. Direct observation of plants growing freely around the refinery was adopted and the collected plant samples were identified. Total of forty-five (45) plants species were encountered. Majority of the plants were shrubs with a total of eighteen (18) plants accounting for 40.0% of the total plants. This was followed by herbs with a total of seventeen (17) plants accounting for 37.8% of the total plants encountered. Tree recorded the least with a total of ten plants accounting for 22.2% of the total plants. From the survey of the plant diversity within the WRPC environs, a total of 45 plants which cut across twenty eight (28) families were encountered and documented. The result of the study has shown the rich nature and diverse plant species within the Warri Refinery and Petrochemical Company. The status of plant diversity within the refinery environment could be under threat due to refinery effluents and discharge. There is need for environmental management to sustain vegetation for future purposes.

Keywords: Plant biodiversity, Petroleum refinery, Warri, Delta State

INTRODUCTION

The flora diversity of urban areas has also been among the most severely affected by the introduction of crude oil refineries and petroleum based activities of related companies. Great effects on flora diversity in urban areas and industrial environment also can result from less direct sources, including many of the air- and water-borne pollutants that originate from refinery activities (Eneh and Agbazue, 2011). Toxic by-products of industrial production, such as polychlorinated biphenyls (PCBs), sulfur dioxide and oxidants as well as pesticides directed at noxious species, have been found to disrupt plants and natural ecosystems.

Flora and forest cover are very important from ecological point of view as it protects and stabilizes soils and local climates as well as hydrology (Akinnibosun and Omatsola, 2011). Plant flora plays an important role in economic development of developing countries such as Nigeria since they have developmental linkages with agricultural sector as well as supply raw materials for industries. Unfortunately, the reality of the situation is that these forests have been disappearing at alarming rates mostly due to human activities including crude oil refining (Owonubi and Otegbeye, 2004).Despite the capacity of vegetation for fast acclimation and certain stress tolerance mechanisms, vegetation usually responds to sudden short-term or long-term stressors with reduced cell activity and reduced plant growth or even plant mortality. The stress factors vary in their intensity and duration which can cause damage to plants (Arelano *et al.*, 2015) Different plant species respond differently to a particular stress. Furthermore, the nature, intensity and length of exposure are factors that influence the stress level on the vegetation (Collins and Jurgen 2008).

The higher the oil concentration in the environment, the more toxic the oil is to plants. Organic molecules from crude oil can penetrate living plants through their roots and leaves from where the hydrocarbon compounds can be transported into the plant vascular system and

intercellular spaces leading to cell and tissue damage. Cell injury can be the principal cause of photosynthetic inhibition because hydrocarbons tend to accumulate in the chloroplasts, which explains the reduced photosynthetic activity in vegetation affected by hydrocarbons (Smith *et al.*, 2011) It is therefore important to take inventory of flora species in industrial and polluted areas in order to evaluate the level of degradation caused by human activities as keep up to date with the rate of extinction in order to create avenue to reforestation or restructuring of activities to reduce the rate of flora degradation in order to have a safe and continuous ecosystem that can offer all full benefits to mankind.The environmental impact of oil exploration and exploitation is one of the inevitable consequences of economic development. Any oil spill would usually result in damage to soil properties and plant communities (Anoliefo *et al.*, 2003). Primary forests in Nigeria are disappearing at an alarming rate. There is virtually no forest that has not been impacted by human activities. Industrial development of a nation cannot be possible without the building of infrastructures which will necessitate the cutting down of trees and other plants. There is virtually no forest that has not been impacted by human activities. Owonubi and Otegbeye (2004) asserted that there is the need for sustainable forest management and that all the goods and services offered by the forests can only be sustained if the forests are allowed to remain in the landscape at or above a given threshold. The increase in the demand for petroleum oil as sources of energy and primary raw materials for petrochemical industries has resulted in a corresponding increase in the production, refining and distribution of its products (Bamidele and Agbogidi, 2000). The aim of this study is to give an inventory on the flora diversity around Warri Refinery and Petrochemical Company, Warri, Delta State.

MATERIALS AND METHODS

Description of the Study Area

The study was carried out in Warri Refinery and Petrochemical Company, Effurun, Delta State. Effurun is located in Uvwie Local Government Area of Delta State. The study area is bounded by Latitude 5^0 15' N and 6^0 N and Longitude 5^0 40' E and 6^0 25 E (Figure 1). They host different companies Refineries, Gas Company, Air and Sea Ports, fuelling stations, etc. and other automobile activities (Onwukeme and Etienajirhevwe, 2014).Apart from Warri, Effurun is the next busiest, industrial and highly commercial city in the state. In facts records shows that 60% of the companies that are stated to operate in Warri, actually have their base and operation in Uvwie (Okoro and Ikolo, 2007). From the national population commission, Uvwie Local Government Area has a total population of about 145,045 people with household capacity of about 34,099. The total geographical area of the local Government is 95.157 sq km with a population density of about 1524.

Collection of Plant Specimen

Extensive Field trips were conducted in this botanical survey to the study area within and surrounding the Warri Refinery and Petrochemical Company plant, from outside the refinery up to 13Km distance away. The locality was chosen randomly according to the availability of plant species. The location of the study sites were georeferenced with accuracy of one metre. The field was divided into grids and nine randomly selected sites were located and sampled (Akinnibosun and Omatsola, 2011).

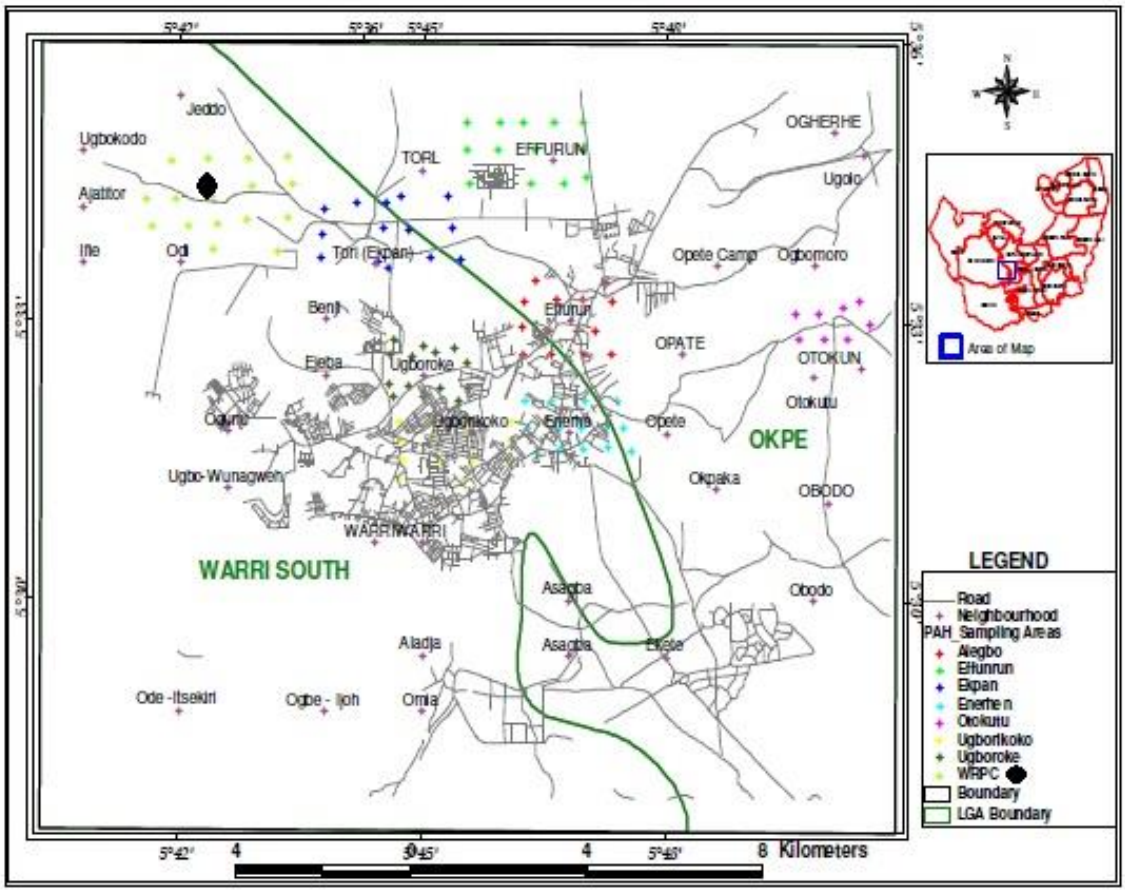

Figure 1. Map of the study area
Source: Okoro and Ikolo (2007).

Flora Survey

Plant species present in and around the refinery were sampled using line transect method. However, because of the arrangements of the facility where trucks and other vehicles were piled up and tents built all around for overnight and daytime relaxation, line transect method was not so effective for an accurate plant survey on the study area. Direct observation of plants growing freely around the refinery, most especially within the parks and environment within the residential area were therefore done to ensure a proper and more accurate plant survey.

Identification and Classification of Plants

The collected plant samples were identified in the Botany Laboratory, Department of Botany and the herbarium of the Department, Delta State University, Abraka. Scientific identification of the collected specimens to species level as well as into different life form/habits was done using textbook of Outlines and Pictures of Medicinal plants in Nigeria (Odugbemi, 2008) and Medicinal plants of Nigeria (West) by Durugbo *et al.*, (2012). Those which were not identified in the field were preserved in polyethylene bags and transferred to the Department of Botany, Delta State University, Abraka where they were eventually identified by a Plant Taxonomist.

RESULTS

From the result of the flora survey around the Warri Refinery and Petrochemical Company, a total of forty-five (45) plants species were

encountered. The plant cut across different life forms and families comprising of life forbgms such as trees, shrubs and herbs. The plants collected possess several economic and environmental benefits. It was observed that herbs accounted for a total of 17 of the plants while shrubs accounted for 18 and trees were the least encountered with a total of 10 plants. The scientific classifications of the plants encountered during the survey are presented in Table 1.

Distribution of life forms and families was also calculated. The life form of the plants encountered from the vicinity and environs of Warri Refinery and Petrochemical Company showed that majority of the plants were shrubs with a total of eighteen (18) plants accounting for 40.0% of the total plants. This was followed by herbs with a total of seventeen (17) plants accounting for 37.8% of the total plants encountered. Tree recorded the least with a total of ten plants accounting for 22.2% of the total plants (Figure 1).

Table 1. Scientific classification of plants within the Warri Refinery and Petrochemical Company, Warri, Delta State

	Common Name	Botanical Name	Family	Habit
1.	King of bitters	*Andrographispaniculata*	Acanthaceae	Herb
2.	Awolowo leaf	*Chromolaenaadorata*	Asteraceae	Herb
3.	Carry me seed	*Phylantusamarus*	Euphobiaceae	Herb
4.	False Gum	*Icacinatrichanthaoliv*	Icacinaceae	Herb
5.	Scent leaf(basil)	*Ocimumgratissimum*	Labiatae	Herb
6.	Water leaf	*Talinumtriangulare*	Hydrophyllaceae	Herb
7.	Butter pear leaf	*Persea Americana*	Lauraceae	Herb
8.	Okra	*Abelmoscusesculentus*	Malvaceae	Herb
9.	Alligator pepper	*Aframomiumdanielli*	Zingiberaceae	Herb
10.	Christmas bush	*Chromolaemaodorata*	Asteraceae	Herb
11.	Tassel flower	*Emilia coccinea*	Asteraceae	Herb
12.	African border	*Newbouldialeavis*	Solanaceae	Herb
13.	Bitter leaf	*Vernoniaamygdallina*	Asteraceae	Herb
14.	Aloe vera	*Aloe vera*(L) burm.f.	Aloaceae	Herb
15.	Sugarcane	*Saccharumofficinarum*	Poaceae	Herb
16.	Pepper	*Capsicum annuum*	Solanaceae	Herb
17.	Cocoyam	*Colocasiaesculenta*	Araceae	Herb
18.	Mallow jute	*Corchorus*	Malvaceae	Shrub
19.	Sidaacuta	*Sidaacuta*	Malvaceae	Shrub
20.	Bent grass	*Agrostiscanina*	Poaceae	Shrub
21.	Coat button	*Tridaxprocumbens*	Asteraceae	Shrub
22.	Bar wood	*Baphianitida*	Fabaceae	Shrub
23.	Globe Amaranth	*Gomphrenaserrate*	Amaranthaceae	Shrub
24.	Yellow bush	*Lupinusarboreus*	Fabaceae	Shrub
25.	Elephant grass	*Penniseptiumpurpureum*	Poaceae	Shrub
26.	Ringworm plant	*Sennaalata*	Asteraceae	Shrub
27.	Devils Trumpet	*Daturametel*	Bignoniaceae	Shrub

28.	Pattern wood	*Alstoniaboonei*	Apocynaceae	Shrub
29.	Lemon grass	*Cymbopogoncitratus*	Poaceae	Shrub
30.	Lime	*Citrus aurantitolia*	Rutaceae	Shrub
31.	Oil palm	*Elaeisguinensis*	Arecaceae	Shrub
32.	Cassava	*Manihotesculenta*	Euphorbiaceae	Shrub
33.	Sweet Potato	*Ipomoea batata*	Convolvulaceae	Shrub
34.	Garlic	*Allium sativum*	Amaryllidaceae	Shrub
35.	Life plant/ Air plant	*Bryophyllumpinnatum*	Crassulaceae	Shrub
36.	Avocado	*Persea Americana*	Lauraceae	Tree
37.	Rubber tree	*Heaviabrasilensis*	Euphorbiaceae	Tree
38.	Maize	*Zea mays*	Poaceae	Tree
39.	Drumstick tree	*Moringaolefera*	Moringaceae	Tree
40.	Neem	*Azadirachtaindica*	Meliaceae	Tree
41.	Guava	*Psidiumguajava*	Myrtaceae	Tree
42.	Mango	*Mangiferaindica*	Anacardiaceae	Tree
43.	Pawpaw	*Carica papaya*	Caricaceae	Tree
44.	Sandpaper tree	*Ficusexexasperate*	Moraceae	Tree
45.	False Rubber	*Holarrhena floribunda*	Euphobiaceae	Tree

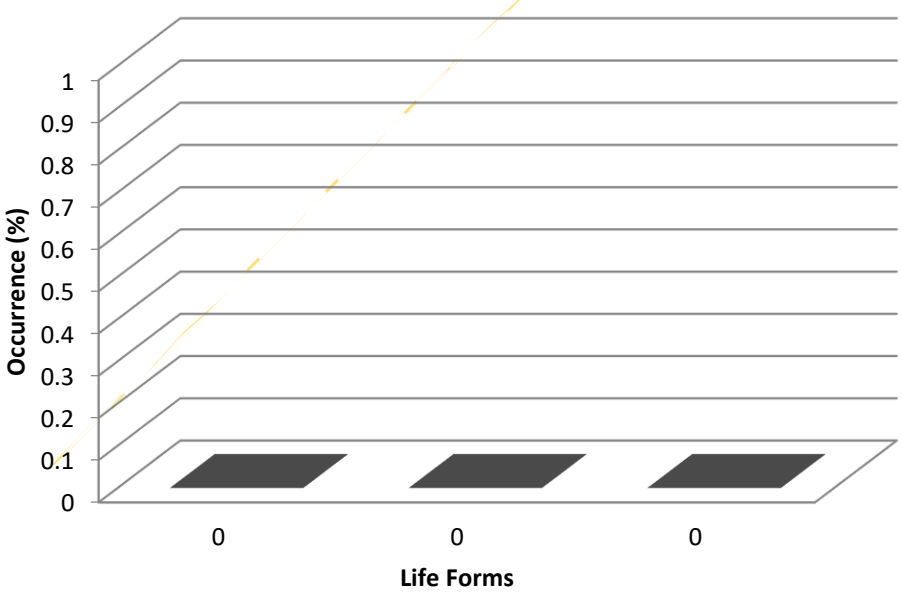

Figure 2. Distribution of life forms of plants encountered in the study

From the survey of the plant diversity within the WRPC environs, a total of 45 plants which cut across twenty eight (28) families were encountered and documented. The families recorded include Acanthaceae (1), Aloaceae (1), Amaranthaceae (1), Amaryllidaceae (1), Anacardiaceae (1), Apocynaceae (1), Araceae (1), Arecaceae (1), Asteraceae (7), Bignoniaceae (1), Caricaceae (1), Convolvulaceae (1), Crassulaceae (1), Euphorbiaceae (4), Fabaceae (2), Hydrophyllaceae (1), Icacinaceae (1), Labiatae (1), Lauraceae (2), Malvaceae (3), Meliaceae (1), Moraceae (1), Moringaceae (1), Myrtaceae (1), Poaceae (5), Rutaceae (1), Solanaceae (2) and Zingiberaceae (1).

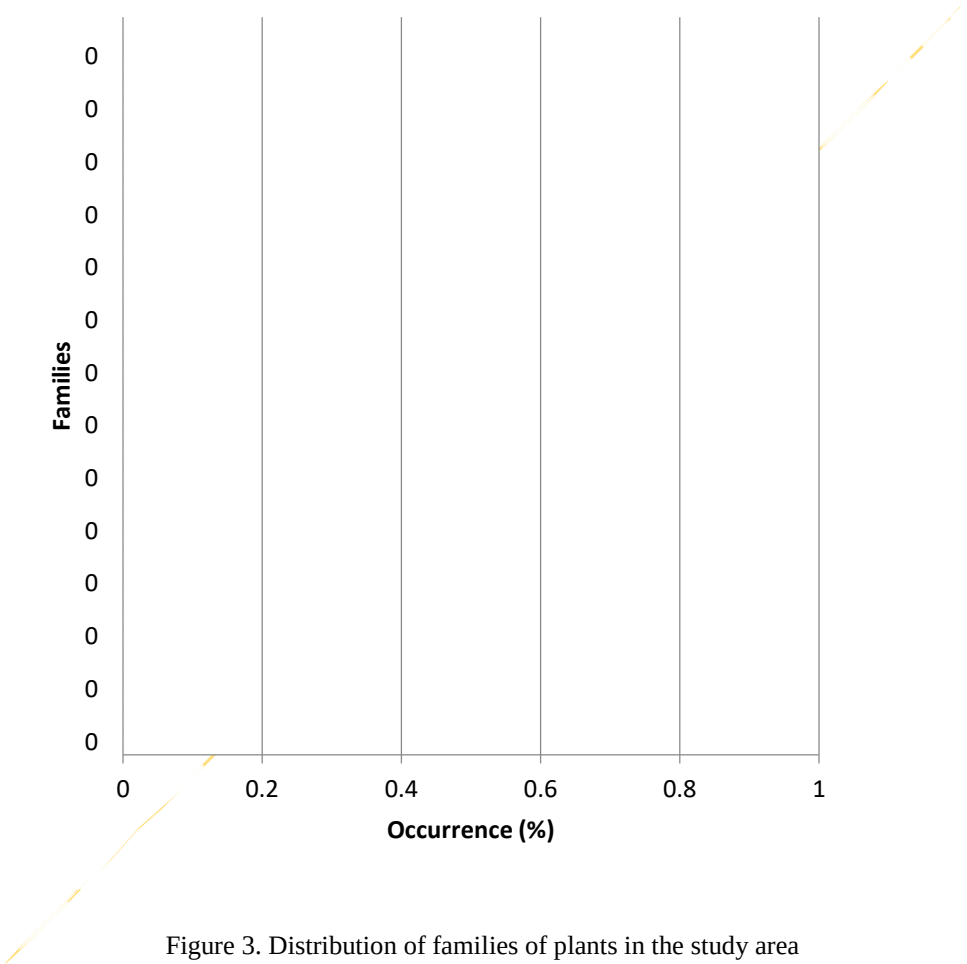

Figure 3. Distribution of families of plants in the study area

DISCUSSION

This study documented the rich flora in the vicinity and environs of the Warri Refinery and Petrochemical Company documenting with a total of fourty five (45) species which cut across different families and life forms. This study has shown that despite the activities of the Warri Refinery, there are still numerous species of plant growing within the area which is an indication of little effect of the activities of the refinery on the

diversity of plants.Crude oil production environment has previously been explored for its plant diversity in different regions. Study of Sawsan and Enas (2016) reported on the diversity of plants within petroleum refinery of the study area, Zarka (Jordan). The study documented a total number of 101 species belonging to 57 genera and 15 families recorded. Wild plants are also reported like: *Atriplexsemibaccata, Conyzabonariensis, Peganumharmala, Lamarckiaaurea, Hammadaeigii*, and others.

Similarly, Akinnibosun and Omatsola (2011) studied the diversity of plants within crude oil exploration field in Edo State. They documented a total of 112 species of plants belonging to 102 genera and 58 families to include *Chromolaenaodorata*(90%), dominance of *Setariabarbata*(60%), *Smilax anceps*(70%) and common presence of *Paspalumscrobiculatum*(50%), *Panicum maximum* (30%), *Andropogontectorum*(30%) and *Conyzasumatrensis*(30%). Poaceae family was the most diverse and highest occurrence species in the studied field.The study strongly supports the need to strike a fine balance between science and nature in order to integrate global and local perspective on the use of plants, biodiversity information and economic development with cultural and linguistic diversity as earlier pointed out by Agbogidi and Okonta (2009). It was however discovered that in places of busy activities such as the environment of the Warri Refinery where cars are parked and heavy duty vehicles are parked as well was able to account for appreciable diversity of plants.

The environmental impact of oil exploration and exploitation is one of the inevitable consequences of economic development. Any oil spill would usually result in damage to soil properties and plant communities (Anoliefo *et al*., 2003). Primary forests in Nigeria are disappearing at an alarming rate. There is virtually no forest that has not been impacted by human activities.In environment of anthropogenic activities such as sawmills, Bamidele*et al.* (2017) reported on flora survey and documented forty-three different plant species were observed. Five of these plant species (*Synedrellanodiflora, Sida acuta, Euphorbia hirta, Commelina benghalensis* and *Amaranthus spinosus*) occurred in all the study sawmills. Hence, the sawmill environments could be regarded as a complete and interacting biotic community.

Habitat under certain existing environment would permit plants adapted to the condition. It should however be noted that the impact of the loss of particular forms of biodiversity can, for the most part be determined by looking at the loss of its various forms (Idu*et al*., 2009). Science is discovering new uses for biological diversity in ways that relieve both human suffering and environmental destruction (Zabbey, 2004). The distribution of these species within the study area does not necessarily indicate that there is no damage caused by the activities of the refinery. If forests are indiscriminately depleted, various roles associated with trees would be lost; there will be prevalence of food insecurity, environmental problems would be increased as there will be heightened climate change resulting in reduced immunity and outbreak of various diseases leading to the death of organisms including the species called man as emphasized by (Agbogidi and Okonta, 2009).

Conclusion

The result of the study has shown the rich nature and diverse plant species within the Warri Refinery and Petrochemical Company. The status of plant diversity within the refinery environment could be under threat due to refinery effluents and discharge. There is need for environmental management to sustain vegetation for future purposes.

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