

## ENVIRONMENTAL IMPACT OF ILLEGAL REFINERIES ON THE VEGETATION OF THE NIGER DELTA, NIGERIA

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### ABSTRACT

*Beyond the economic considerations of crude oil theft in Nigeria, the environmental degradation associated with 'illegal oil refineries' require urgent attention. To examine the impact of illegal oil refineries in the Niger Delta, Nigeria, the floristic composition of the fresh water swamp forest at refining sites in two river systems and a brackish water system respectively, were compared with those of relatively undisturbed sites as control in three states of Nigeria (Delta, Bayelsa and Rivers). It is reported that the floristic composition of the natural freshwater swamp forest (within transects considered as control) had 23 tree species (diameter > 30cm dbh and above) out of which 73.91% and 82.61% of the taxa were lost at the refining sites in Delta and Bayelsa States respectively. In the brackish water ecosystem of Rivers State, five species of Mangroves and two species of grasses were encountered in the control stations. All the mangrove plants and marine grasses at the refining sites and within two kilometers along the river (upstream and downstream) the refining sites were dead. Similarly, a total of 32 non-wood species were recorded in the 2 control sites of the fresh water swamp. All the non-wood species at the refining site in the fresh water area (Delta and Bayelsa States) died. The activities of illegal refineries severely impacted biodiversity, aesthetic scenery of the forest, regeneration of plant species and destruction of wildlife habitat, disruption of water cycle and loss of medicinal plant species. Youth empowerment, through vocational training and environmental education can ameliorate the situation.*

**Keywords:** Environmental degradation, Illegal Refineries, Vegetation, Niger Delta

### INTRODUCTION

The Niger Delta environment is a highly sensitive ecological zone known for high biodiversity and the rural people of the oil rich delta region depend on these resources for their livelihood. The Niger Delta vegetation consists mainly of rainforests, fresh water swamp, brackish swamp forests and mangrove forests. The intertidal zones of the tidal brackish and tidal fresh water are noted for organisms that depend on the diurnal tidal cycle. Most of the flora and fauna are either mobile or sedentary. Over the years the Niger delta environment has suffered degradation due oil and gas exploration and exploitation activities (Kadafa, 2012). When oil crude petroleum spill into tidal waters, mobile organisms are able to swim away from the polluted environment, but the substrate of sedentary organisms are smeared with oil carried by incoming tidal water. By this means the oil is spread across the width of the intertidal zone as well as up and down stream limits of the tide along the river course, depending on the time and point of spill within the tidal regime.

Oil attenuates Oxygen in the water column and coat breathing apparatus of aquatic organisms. Specifically it starves mangroves of Oxygen by coating the breathing roots of the mangroves and scotch the tender structures of aquatic macrophytes of tidal fresh water vegetation. The people of the oil rich Niger Delta region of Nigeria have agitated against the degradation of their environment as a result of the environmental impact of oil and gas exploration and exploitation (Asimiea, 2010). The agitation came to a climax with open arm

confrontation against the Federal Government of Nigeria between 1999 and 2009 (Peel, 2011). As a way out of the situation the government pacified the militants by granting amnesty to those who dropped their arms, while the non-violent and unemployed youths who were not rehabilitated resorted to boiling crude oil in metal containers (drums) to distil petroleum products; this is the origin of 'illegal refineries' in the Niger Delta. All known principles of environmental protection in refining crude petroleum are ignored as they empty the residue after boiling the crude, into the nearby rivers, creeks and other water bodies. Kadafa, Adati Ayuba (2012)

The economic impact of oil theft associated with these illegal refineries are widely reported (Oredein, 2013), however the impact of the operations of these refineries on the highly sensitive environment of the Niger Delta is scarcely reported (Hammadina and Anyanwu, (2012). This creates the need for this paper. The aim of this paper is to highlight the effect of illegal refineries on the floristic composition and its impact on vegetation of Niger Delta and to create awareness of the need to re-visit the issue of amnesty in the light of the current assault on the Niger Delta environment.

## **METHODOLOGY**

### **The Study Area**

The study sites are located in the freshwater ecosystem in Delta and Bayelsa State and brackish water ecosystem in Rivers State of Nigeria. Three of the major River systems that drain the Niger Delta into the Atlantic Ocean were used as transects. They are;

- (i) A tributary of River Forcados (between the coordinates 5° 26' N, 5° 39' E and 5° 22' N, 5° 35' E - Delta State),
- (ii) A tributary of the Nun River (Between 4° 40' N, 6° 05' E and 4° 36' N, 6° 04' E - Bayelsa State). (iii) A tributary of New Calabar River ( between 4° 32' N, 6° 54' E and 4° 28' N, 6° 55' E - Rivers State)

### **Sampling Method**

Visual observation was made along the Rivers to identify illegal refinery stations. Ten refinery sites were chosen randomly along each river system for vegetation study. The floristic composition of the vegetation was studied in each of the ten stations identified along each River course. Three transects of 100m were laid in each study site. Along each transect a 10 x 10m sample plot was laid in alternate position at every 20m point, given a total of 15 sample plots. Similarly, 15 (5 x 5m) sample plots were used for sedges, grasses and other herbaceous plants along transects located in the fresh water swamp area.

All tree species within each sample plot that are 30cm and above in diameter at breast height (dbh) were identified into species using Trees of Nigeria (Keay, 1989) and Flora of West tropical Africa (Hutchison and Dalziel, 1958). All the herbs and grasses were identified using a Handbook of West African weeds (Akobundu and Agyakwa, 1987). A control plot exhibiting natural and relatively undisturbed area was established along a 100m transect per study site. The floristic composition of the woody species above 30cm dbh as well as the grasses and herbs were recorded using the same method described above for the sample plots. Percentage loss of taxa at the refinery sites was calculated as stated below:

Number of taxa at the natural undisturbed freshwater ecosystem = y

Number of taxa lost at illegal refinery sites = x

% lost taxa =  $x \div y \times 100$

## RESULTS

### Woody Plant Species

A total of 23 woody species were recorded in the 2 fresh water swamp control sites. Large trees conspicuous in the forest are listed in table 1.

Table 1. Floristic Composition of Tree Species at the 3 Control Sites.

S/No	Tree Species (>30cm gbh)
1	<i>Alchornea cordifolia</i> (Schum and Thonn)
2	<i>Alstonia congensis</i> (Engl.)
3.	<i>Anthosterna aubryanum</i> (Bail)
4.	<i>Berlinia auriculata</i> (Benth)
5.	<i>Bombax buonopozense</i> (Linn)
6.	<i>Spondias mombin</i>
7	<i>Ceiba pentandra</i> (Linn)
8	<i>Cleistopholis patens</i> (Benth)
9	<i>Elaeis guinensis</i> (Jacq)
10	<i>Ficus trichopoda</i> (Bak)
11	<i>Grewia coriacea</i> (Mast)
12	<i>Harungana madagascariensis</i> (Lam.ex poir)
13	<i>Lophira alata</i> (Banks ex Gaertn)
14	<i>Lonchocarpus sericeus</i> (Poir) Kunth
15	<i>Musanga cecropioides</i> (R. Br. Ex. Tedlie)
16	<i>Mitragyna Giliata</i> (K. Krause)
17	<i>Nauclea pobeguinii</i> (Pellegr)
18	<i>Raphia hookeri</i> (Mann and Wendlavy)
19	<i>Spondianthus pruesii</i> (Engl.)
20	<i>Symphonia globulifera</i> (Linn.) f.
21	<i>Macaranga staudtii</i> (Pax)
22	<i>Pentaclethra macrophylla</i> (Benth)
23	<i>Uapacca species</i> (Pax)

Due to the effect of the illegal refineries, only 6 and 5 different tree species were observed in Delta and Bayelsa States and none in Rivers State (table 2).

Table 2. Floristic composition of tree species at the illegal refining sites.

Delta	Rivers	Bayelsa
<i>Bombax buonopozense</i>		<i>B. buonopozense</i>
<i>Elaeis guineensis</i>		<i>Symphonia species</i>
<i>Reaphia hookeri</i>		<i>Macaraga barteri</i>
<i>Uapacca species</i>		<i>Anthosperma</i>
<i>Ceiba pentandia</i>		<i>Aubryanum</i>
<i>Alstonia cengensis</i>		

### **Floristic Composition of the Sedges, Grasses and Herbs in Control plot of Freshwater Swamp Forest**

The large aroid *Cyrtosperma senegalense* merge with *Vossia cuspidata*, and several species of fern such as *Diplazium sammattii* Kuhn. In addition, *Azolla africana* Desy. *Ipomoea aquatica* Frsk, *Cyperus difformis* Linn, *Cyperus haspan* Linn, *Cyperus iria* Linn., *Fimbristyllis feruginea* Linn, *Fimbristyllis littoralis* Gaudet, *Fuirea ciliaris* Linn, *Fuirea umbelata* Rottb, *Kyllinga bulbosa* Beav, *Kyllinga erecta* Schumach, *Kyllinga pumila* Michx, *Kyllinga squamulata* Thonn exvaly, *Mariscus longibracteatus* Cherm, *Pycneus lanceolatus* Poir, *Rhynchospora corymbosa* Linn, *Hydrolea glabra* Schum and Thonn, *Dissotis erecta* Guill and Perr, *Neptunia oleracea* Lour, *Nymphaea lotus* Linn, *Nymphaea maculate* Schum and Thonn, *Paspalum vaginatum* SW, *Polygonium lanigerum* R. Br., *Eichornia natans* P. Beauv., *Clappertonia ficilolia* (Willd). *Pistia stratiotes* and *Impatiens* species abound in the forest. Climbing Palms such as *Calamus*, *Ancistrophyllum* and *Eremospatha* form an almost impenetrable under growth. A total of 32 non-wood species were recorded in the 2 fresh water swamp control sites. None of sedges, grasses and herbs at the refining site survived the impact of crude oil.

### **Floristic composition of the mangrove forest at illegal refining site in Rivers state**

The vegetation in the brackish water area studied in the tributary of New Calabar river is basically mangrove. Five species of mangrove known to inhabit the West African coastal waters are represented within the control sites of the study area. These are namely *Rhizophora racemosa*, *Rhizophora harrisonii*, and *Rhizophora mangle* (Red mangroves). Others are *Avicennia africana* (white mangrove) and *Laguncularia racemosa* (the black mangrove). Other species of plants observed are the marine grass and fern, *Paspalum vaginatum* and *Acrostichum aureum*, respectively. All the mangrove plants at the refining sites and two kilometres along the river (upstream and downstream) the refining sites were all dead (See plates 1 and 2)



Plate 1: Effect of refining on mangrove plants.



Plate 2: Breathing roots of Mangrove trees coated with oily waste at refinery site.

## DISCUSSION

The magnitude of the damage experienced on mangrove vegetation is related to the sensitivity of its pneumatic roots ‘the breathing roots’ to petroleum waste (Asimiea, 2011). The spread along the river course is due to tidal effects in the area. The floristic composition of woody plants at the impacted sites showed heavy mortality of merchantable trees as a result of the wastes discharged from illegal refining of petroleum products. The mean taxa diversity at the impacted sites was 6 and 4 for Delta and Bayelsa States respectively. The vegetation at the sites of illegal refineries could be described as heavily disturbed when compared to the relatively undisturbed control sites. There was total loss of the non-wood plant species in all refinery sites and wood plants in all the brackish water area. Also, the diverse communities of the intertidal mud flats of the brackish water system along the river are wiped out.

As the wastes from these refining sites are released without any form of treatment into the river they spread upstream and downstream the river course. Untreated crude oil waste discharged indiscriminately into aquatic systems cause the destruction of medicinal plant which is the ‘ware house’ for traditional health care delivery. As the plants die and decay, the soil stabilization properties of the roots are lost, leading to coastal erosion. The loss of vegetation drastically hampered the regeneration of species in the forest as seeds and saplings on the forest floor are contaminated. Crude oil transports heavy metal species of the formation reservoir from which they are mined and illegal refineries waste causes the contamination of the ecosystem. One very important effect of the discharge of illegal refineries waste is the loss of vegetation which provide food and shelter for both vertebrates and invertebrates, this leads to fragmentation of wildlife habitat, alteration of local water cycle, since trees play important role in water cycling and disruption of air purification role of trees due to reduced carbon sequestration and aggravation of climate change (Umechuruba, 2005).

## CONCLUSION AND RECOMMENDATIONS

The impact of illegal refineries on the Niger Delta environment has raised questions of great concern in the minds of the inhabitants in the region. The people of the region have suffered polluted air, contaminated environment, degraded forests, biodiversity loss and high atmospheric temperatures. The declining natural resource base of the people in the Niger

Delta has resulted in wide spread protests and unemployment leading to destruction of oil installation by the youths. In other to halt the continual environmental degradation of the Niger Delta, the following deliberate intervention measures to compensate the people are recommended:

- (i) Youth empowerment through vocational training.
- (ii) Environmental education for people in the region
- (iii) Cleaning of degraded sites
- (iv) Afforestation and reforestation of degraded sites
- (v) Free education for all the youths and children in the region

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