*Science World Journal Vol 6 (No 1) 2011*
www.scienceworldjournal.org
*ISSN 1597-6343*



# BASELINE STUDIES OF THE FLORAL BIODIVERSITY OF A PROPOSED CRUDE OIL EXPLORATION FIELD IN EDO STATE, NIGERIA.

*AKINNIBOSUN, H. A.[1] & OMATSOLA, M. E.[2]

[1]Department of Plant Biology and Biotechnology, Faculty of Life Sciences, University of Benin, P. M. B. 1154, Ugbowo, Benin City, 300001, Edo State, Nigeria.
[2]Industrial Safety and Environmental Engineering Department, Petroleum Training Institute, P. M. B. 20, Effurun, Delta State.
*hakinnibosun@yahoo.co.uk

**ABSTRACT**
**As part of an environmental impact assessment (EIA) requirement for a development project such as an oil company, baseline documentation of the flora and fauna of such area on which the project is to be sited is of great importance. This paper, one of such in a series of studies carried out by the authors presents the baseline documentation of the vegetation composition and flora diversity of Utesi East field; a proposed crude oil exploration field in Edo State, Nigeria. The study revealed the occurrence of 112 species of plants belonging to 102 genera and 58 families. In addition to the floristic composition, habitat types, the economic uses, status, habit and percentage frequency of occurrence of the plant species encountered in this field were also reported.**

***Key words*:** Vegetation composition, environmental studies, development project, deforestation, petroleum oil, crude oil.

## INTRODUCTION

Crude oil and refined petroleum products are extremely complex mixtures of thousands of organic hydrocarbons and related compounds (Azad, 2005). Oil exploration covers over a million hectares of forested land. Mining activities and petroleum exploration involves deforestation and apart from the effects of deforestation on the environment, the frequent cases of oil spillage from oil exploration centres pollute the environment and often make almost impossible plant growth and development in affected areas (Owonubi & Otegbeye, 2004).

Economic growth and industrial development are dependent on the availability of adequate energy. The main sources of energy are coal, natural gas and mineral oil. World's energy sources are fast depleting, putting the world in the grip of energy crises today (Mahapatra & Baishya, 2005). 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 & Agbogidi, 2000). The environmental impact of oil exploration and exploitation is one of the inevitable consequences of economic development (Amadi, *et al*.,1993). 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 (Oke & Olisa-Emodoh, 1998).

Forest cover is very important from ecological point of view as it protects and stabilizes soils and local climates as well as hydrology (Owonubi & Otegbeye, 2004). Forests play 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 (Oke & Olisa-Emodoh, 1998;Owonubi & Otegbeye, 2004;).

A statutory requirement for all categories of petroleum exploration and production (EP) development projects as well as some non oil and gas projects in Nigeria is Environmental Impact Assessment (EIA). This was made mandatory by a number of legislations including the Petroleum Act of 1969 and EIA Act No. 86 of 1992 (SPDC, 2000; Akinnibosun & Odiete, 2007; Akinnibosun & Odiete, 2008a; 2008b). As part of the EIA study, the flora documentation is necessary. This study was carried out with the aim of documenting the floristic diversity of Utesi East field, Edo state, Nigeria to serve as a baseline record of the proposed oil field.

## MATERIALS AND METHODS

**The Study Area:** Utesi East field is located in Edo State of Nigeria between longitude 05˚ 40' 52" E - 05˚ 43' 00" E and latitude 06˚ 11' 10" N - 06˚ 12' 44" N. The temperature range during the period of study was between 27˚ C - 33.2˚ C and the elevation of the area between 39-56 m above sea level. Table 1 shows the characteristics of the study sites.

**Field survey:** This was carried out during both wet and dry seasons. Information on the vegetation of the field was gathered by establishing study sites within various habitats that were identified in the study area. The location of the study sites were georeferenced with a Magellan Sport Trak Global Positioning System (GPS) with accuracy of one metre. The field, which measured 4 x 5 km$^2$ was divided into grids and nine randomly selected sites were located and sampled. Belt transects were laid where observations were made as outlined by Kershaw (1977) and Sutherland (1997).

**TABLE 1. HABITAT, ELEVATION AND COORDINATES OF THE STUDY SITES.**

| Site No. | Habitat | Longitude | Latitude | Altitude (m) |
|---|---|---|---|---|
| 1 | Secondary successional plot/ Agricultural plot | 05˚ 40' 52" E | 06˚ 12' 44" N | 39 |
| 2 | Secondary successional plot/ Agricultural plot | 05˚ 41' 08" E | 06˚ 11' 46" N | 47 |
| 3 | Agricultural plot | 05˚ 41' 45" E | 06˚ 11' 10" N | 45 |
| 4 | Secondary successional plot/ Agricultural plot | 05˚ 42' 16" E | 06˚ 11' 20" N | 54 |
| 5 | Secondary successional plot/ Agricultural plot | 05˚ 43' 00" E | 06˚ 11' 28" N | 50 |
| 6 | Primary successional plot | 05˚ 42' 11" E | 06˚ 12' 26" N | 56 |
| 7 | Secondary successional plot/Agricultural plot | 05˚ 42' 35 " E | 06˚ 12' 11" N | 51 |
| 8 | Secondary successional plot/Agricultural plot | 05˚ 41' 40" E | 06˚ 12' 11" N | 43 |
| 9 | Secondary successional plot/ Agricultural plot | 05˚ 41' 46" E | 06˚ 11' 40" N | 52 |
| 10 | Agricultural plot | 05˚ 41' 24" E | 06˚ 12' 30" N | 46 |

Identification of vegetation at the various observation point along the transect were carried out to species level, documented and characterized using 100 $m^2$ frame quadrat. The nomenclature of trees and weed species were confirmed with appropriate literatures (Keay, 1989; Lowe & Soladoye, 1990; Akobundu & Agyakwa, 1998). Unidentified species were collected, pressed and mounted in plant press and taken to the herbarium for proper identification. Voucher specimens of collected samples were deposited at the University of Benin Herbarium.

**RESULTS**

112 species of plants belonging to 102 genera and 58 families were encountered in this study (Table 2). Medicinal plants make up 39% of the total plant species, weeds 26%, edible fruits, food crops, oil crops and fibre crop 31% while timber trees make up 4% of the total 112 plant species encountered in this proposed field of crude oil exploration.

**TABLE 2. FLORA DIVERSITY OF UTESI EAST, EDO STATE, NIGERIA.**

| Botanical Names and Families of Plants | Economic use | Habit | Status | % Frequency |
|---|---|---|---|---|
| **Acanthaceae** | | | | |
| *Asystasia gangetica* (Linn.) T. Anders | Medicinal | Herb | R | 10 |
| **Agavaceae** | | | | |
| *Dracaena arborea* (Wild.) Link | Medicinal | Tree | R | 20 |
| *Dracaena mannii* Bak. | Medicinal | Tree | R | 10 |
| **Amaranthaceae** | | | | |
| *Achyranthes aspera* Linn. | Medicinal | Herb | R | 20 |
| **Anacardiaceae** | | | | |
| *Anacardium occidentale* Linn. | Edible fruit | Tree | R | 10 |
| *Mangifera indica* Linn. | Edible fruit | Tree | R | 10 |
| *Spondias mombin* Linn. | Medicinal | Tree | C | 30 |
| **Annonaceae** | | | | |
| *Annona muricata* Linn. | Edible fruit | Tree | R | 10 |
| *Cleistopholis patens* (Benth.) Engl. & Diels | Weed | Tree | R | 10 |
| *Dennettia tripetala* Bak. f. | Edible fruit | Tree | R | 20 |
| *Xylopia aethiopica* (Dunal) A. Rich. | Spice/ Medicinal | Tree | R | 10 |
| **Apocynaceae** | | | | |
| *Alstonia boonei* De Wild. | Medicinal | Tree | R | 20 |
| *Funtumia elastica* (Preuss) Stapf. | Medicinal | Tree | R | 20 |
| *Rauvolfia vomitoria* Afzel. | Medicinal | Tree | D | 80 |
| **Araceae** | | | | |
| *Anchomanes difformis* Engl. | Medicinal | Herb | C | 50 |
| *Cercestis afzelii* Schott | Fibre/ Medicinal | Herb | C | 30 |
| *Xanthosoma mafaffa* Schott | Edible crop | Herb | C | 30 |
| **Arecaceae** | | | | |
| *Cocos nucifera* Linn. | Edible fruit | Tree | R | 10 |
| *Elaeis guineensis* Jacq. | Oil/multipurpose | Tree | C | 40 |
| **Asteraceae** | | | | |
| *Ageratum conyzoides* Linn. | Medicinal/Weed | Herb | R | 10 |
| *Aspilia africana* (Pers.) C. D. Adams | Weed/Medicinal | Herb | R | 10 |
| *Chromolaena odorata* (L.) R. M. King & Robinson | Weed/Medicinal | Herb | A | 90 |
| *Conyza sumatrensis* (Retz.) Walker | Weed | Herb | C | 30 |
| **Bignoniaceae** | | | | |
| *Newbouldia laevis* (P.Beauv.)Seeman ex Bureau. | Medicinal | Tree | R | 20 |
| *Spathodea campanulata* P.Beauv. | Timber | Tree | R | 10 |
| **Bolanophoraceae** | | | | |
| *Thoningia sanguinea* Vahl. | Medicinal | Herb | R | 10 |
| **Bombacaceae** | | | | |
| *Ceiba pentandra* (Linn.) gaertn. | Medicinal | Tree | C | 30 |
| **Bromeliaceae** | | | | |
| *Ananas comosus* (Linn.) Merr. | Edible fruit | Herb | R | 10 |
| **Burseraceae** | | | | |
| *Dacryodes edulis* (D.Don ) Lam. | Edible fruit | Tree | R | 10 |

**Table 2 cont.**

| | | | | |
|---|---|---|---|---|
| **Caesalpiniaceae** | | | | |
| *Anthonotha macrophylla* P.Beauv. | Weed | Tree | C | 30 |
| *Berlinia grandiflora* (Vahl) Hutch. & Dalz. | Weed | Tree | R | 20 |
| *Dialium guineense* Willd. | Edible fruit | Tree | C | 40 |
| **Caricaceae** | | | | |
| *Carica papaya* Linn. | Edible fruit | Tree | R | 10 |
| **Combretaceae** | | | | |
| *Combretum zenkeri* Engl. & Diels. | Weed | Liana | R | 20 |
| **Commelinaceae** | | | | |
| *Commelina benghalensis* Linn. | Weed | Herb | R | 20 |
| *Palisota hirsute* (Thunb.) K. Schum. | Medicinal | Herb | D | 80 |
| **Connaraceae** | | | | |
| *Cnestis ferruginea* DC. | Medicinal | Shrub | D | 70 |
| **Convolvulaceae** | | | | |
| *Ipomoea batatas* Linn. | Food crop | Herb | R | 10 |
| *Ipomoea involucrata* P.Beauv. | Weed | Herb | R | 10 |
| **Cucurbitaceae** | | | | |
| *Momordica charantia* Linn. | Medicinal | Herb | C | 30 |
| **Cyperaceae** | | | | |
| *Fuirena umbellate* Rottb. | Weed | Herb | R | 10 |
| **Davalliaceae** | | | | |
| *Nephrolepis biserrata* | Weed | Herb | R | 10 |
| **Dioscoreaceae** | | | | |
| *Dioscorea alata* Linn. | Food crop | Liana | R | 10 |
| *Dioscorea bulbifera* Linn. | Food crop | Liana | R | 10 |
| *Dioscorea cayenensis* Lam. | Food crop | Liana | C | 30 |
| *Dioscorea rotundata* Poir. | Food crop | Liana | C | 40 |
| **Ebenaceae** | | | | |
| *Diospyros crassiflora* Hiern | Medicinal/Timber | Tree | R | 10 |
| **Euphorbiaceae** | | | | |
| *Alchornea cordifolia* (Schum. & Thonn.) Muell. Arg. | Medicinal | Shrub | D | 60 |
| *Drypetes gilgiana* (Pax) Pax & K.Hoffm | Edible fruit | Shrub | R | 10 |
| *Hevea brasiliensis* (A. Juss.) Muell. Arg. | Rubber latex | Tree | D | 80 |
| *Maesobotrya barteri* (Baill.) Hutch. | Edible fruit | Tree | R | 20 |
| *Manihot esculenta* Crantz | Food crop | Shrub | D | 60 |
| *Manniophyton fulvum* Mull. Arg. | Weed | Liana | R | 20 |
| *Phyllanthus amarus* Schum. & Thonn | Medicinal | Herb | C | 30 |
| *Tetrorchidium didymostemon* (Baill.) Pax & K. Hoffm. | Medicinal | Tree | R | 10 |
| **Gutiferae** | | | | |
| *Allanblackia floribunda* Oliv. | Medicinal | Tree | C | 40 |
| **Hydrophyllaceae** | | | | |
| *Hydrolea corymbosa* | Weed | Herb | R | 10 |
| **Hypericaceae** | | | | |
| *Harungana madagascariensis* Lam. ex Poir | Medicinal | Shrub | R | 10 |
| **Irvingiaceae** | | | | |
| *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill. | Edible Fruit | Tree | R | 10 |
| **Lauraceae** | | | | |
| *Persea Americana* Miller. | Edible Fruit / Medicinal | Tree | R | 10 |
| **Loganiaceae** | | | | |
| *Anthocleista vogelii* Planch. | Medicinal | Tree | C | 30 |
| **Malvaceae** | | | | |
| *Abelmoschus callei* ( A. Chev.) Stevels | Food crop | Shrub | R | 10 |
| *Sida acuta* R.E. Fries | Medicinal | Shrub | C | 50 |
| *Urena lobata* Linn. | Medicinal | Shrub | R | 20 |
| **Marantaceae** | | | | |
| *Thalia geniculata* Linn. | Weed | Herb | R | 10 |
| *Thaumatococcus danielii* Bth. | Wrapping leaves | Herb | D | 60 |
| **Melastomataceae** | | | | |
| *Heterotis prostrata* (Sm.) Jac.-Fél | Weed | Herb | R | 20 |
| **Mennispermaceae** | | | | |
| *Cissampelos mucronata* A. Rich. | Weed | Herb | R | 20 |
| **Mimosaceae** | | | | |
| *Albizia adianthifolia* ( Schum.) W.F.Wight | Timber/Medicinal | Tree | D | 60 |
| *Albizia zygia* (DC.) J. F. Macbr. | Timber | Tree | D | 60 |
| *Entada africana* Guill. & Perr | Weed | Tree | R | 10 |

**Table 2 cont…**

| | | | | |
|---|---|---|---|---|
| **Moraceae** | | | | |
| *Musanga cecropioides* R. Br. | Medicinal | Tree | R | 10 |
| *Myrianthus arboreus* P. Beauv. | Edible leaves | Tree | C | 40 |
| **Musaceae** | | | | |
| *Musa paradisiaca* Linn. | Edible fruit | Pseudo-tree | D | 80 |
| *Musa sapientum* Linn. | Food crop | Pseudo-tree | D | 60 |
| **Myristaceae** | | | | |
| *Pycnanthus angolensis* (Welw.) Warb. | Medicinal/timber | Tree | C | 40 |
| **Myrtaceae** | | | | |
| *Psidium guajava* Linn. | Edible fruit / Medicinal | Tree | R | 10 |
| **Olacaceae** | | | | |
| *Olax subscorpioidea* Oliv. | Medicinal | Tree | R | 10 |
| **Papilionaceae** | | | | |
| *Calopogonium mucunoides* Desv. | Forage/ Cover crop | Herb | R | 20 |
| *Centrosema pubescens* Benth. | Forage/ Cover crop | Herb | R | 20 |
| *Pentaclethra macrophylla* Benth. | Oil Crop/ Medicinal | Tree | D | 60 |
| **Poaceae** | | | | |
| *Andropogon tectorum* Schum. & Thonn. | Weed | Herb | C | 30 |
| *Bambusa vulgaris* Linn. | Building/ Stakes | Tree | R | 20 |
| *Oplismenus burmannii* (Retz.) P. Beauv. | Weed | Herb | R | 10 |
| *Panicum maximum* Jacq. | Weed | Herb | C | 30 |
| *Paspalum scrobiculatum* Linn. | Weed | Herb | C | 50 |
| *Setaria longiseta* P.Beauv. | Weed | Herb | D | 60 |
| *Sporobolus pyramidalis* P.Beauv. | Weed | Herb | R | 10 |
| **Polypodiaceae** | | | | |
| *Platycerium stemaria* (P. Beauv.) Desv. | Weed | Herb | R | 10 |
| **Portulacaceae** | | | | |
| *Talinum triangulare* (Jacq.) Willd. | Vegetable/ Weed | Herb | R | 10 |
| **Rhamnaceae** | | | | |
| *Maesopsis eminii* Engl. | Medicinal | Tree | R | 10 |
| **Rubiaceae** | | | | |
| *Tricalysia macrophylla* K. Schum. | Weed | Tree | R | 10 |
| **Rutaceae** | | | | |
| *Citrus reticulata* G. Don | Edible fruit | Tree | R | 10 |
| *Citrus sinensis* Osbek. | Edible fruit | Tree | R | 20 |
| *Zanthoxyllum gilletii* (De Willd.) Waterman | Medicinal | Tree | C | 30 |
| **Sapindaceae** | | | | |
| *Blighia unijugata* Bak. | Medicinal | Tree | R | 10 |
| *Lecaniodiscus cupanioides* Planch. ex Bth. | Medicinal | Tree | R | 10 |
| **Sapotaceae** | | | | |
| *Afrosersalisia afzelii* ( Engl. ) A. Chev. | For charcoal | Tree | R | 10 |
| *Chrysophyllum albidum* | Edible fruit | Tree | R | 10 |
| *Pachystela brevipes* (Bak.) Baill. | For carving | Tree | R | 10 |
| **Selaginellaceae** | | | | |
| *Selaginella willdenovii* (C. Prest.) Spring. | Weed | Herb | R | 20 |
| **Smilacaceae** | | | | |
| *Smilax anceps* Willd. | Weed | Liana | D | 70 |
| **Sterculiaceae** | | | | |
| *Cola acuminata* (P.Beauv.) Schott & Endl. | Edible fruit | Tree | R | 10 |
| *Cola millenii* (Vent.) Schott & Endl. | Edible fruit | Tree | R | 10 |
| *Cola nitida* (Vent.) Schott & Endl. | Edible fruit | Tree | R | 20 |
| *Sterculia tragacantha* Lindl. | Medicinal | Tree | C | 40 |
| **Tiliaceae** | | | | |
| *Desplatsia subericarpa* Bocq. | Edible fruit | Tree | R | 10 |
| *Triumfetta cordifolia* A. Rich | Medicinal | Shrub | C | 30 |
| **Ulmaceae** | | | | |
| *Trema orientalis* (L.) Blume | Medicinal | Tree | R | 10 |
| **Verbenaceae** | | | | |
| *Clerodendron splendens* G. Don. | Medicinal | Liana | R | 10 |
| **Zingiberaceae** | | | | |
| *Aframomum sceptrum* ( Oliv. & Hanb.) K.Schum. | Food crop (Spice) | Herb | D | 60 |
| *Costus afer* Ker. | Medicinal | Herb | C | 40 |

Status* A = Abundant, D = Dominant, C = Common, R = Rare

**DISCUSSION**

Different plants with various economic uses were encountered in this study.Thirty-nine percent (39%) of the 12 species are being used for various medicinal purposes (Gill, 1992; Nwosu, 2002; Idu *et al*., 2003; Oboh *et al.,* 2004; Omoigui *et al*., 2004; Edeoga *et al*, 2005; Ugbogu & Odeowo, 2005; Odugbemi & Akinsulire, 2006, Idu *et al*., 2007a; 2007b; 2007c; 2007d; Idu *et al*., 2008; Akinnibosun *et al.,* 2008).

Edible fruits, food crops, oil crops and spices make up 31% of the plant species. The weed species were 26%. The proposed oil field traverses agricultural plots, primary successional plots, secondary successional plots and mixture of two or more types of plots. Secondary successional plot/ Agricultural plots make up 70% of the sampled sites while primary successional plot was 10%. Fruits, spices, food and oil crops are found in one or some of the habitat identified in this study site. Exclusive Agricultural plot only make up 20% of the sampled site. Primary and Secondary forests are found in the primary and secondary successional plots respectively while agricultural crops are found in the agricultural plots. Farming and timber exploitation have resulted in the disappearance of most of the primary vegetation as the total agricultural plots accounted for 90% of sampled sites. The disappearance of primary vegetation due to farming activities and logging was corroborated by Akinnibosun & Odiete (2007, 2008b). The percentage frequency of occurrence showed the abundance of *Chromolaena odorata* (90%), dominance of *Setaria barbata* (60%), *Smilax anceps* (70%) and common presence of *Paspalum scrobiculatum* (50%), *Panicum maximum* (30%), *Andropogon tectorum* (30%) and *Conyza sumatrensis* (30%) as the most encountered weeds in the studied sites. Poaceae family was the most diverse and has the highest % frequency of occurrence of weed species in the studied field. Weeds have been linked with great pressure on land for agricultural purpose and has resulted in the lost of pristine forest rendering most forest in secondary form (Akinnibosun & Odiete 2007; 2008b). A weed has been defined as a plant growing where man does not want it to be (Onwueme & Sinha, 1991). They are associated with man and his activities and survive unfavourable ecological conditions by producing abundant seeds, storage organs (Ogbe & Osawaru, 1988) and efficient mechanisms for seed dispersal (Onwueme & Sinha, 1991). Weeds have been associated with food production since early men settled down from a fruit gathering enterprise to one in which he grew certain preferred plants to meet his needs for food, fibre and shelter (Akobundu, 1989).

Farming is the main occupation of the local people, cassava (*Manihot esculenta*) (60%) and yam (*Dioscorea rotundata*) (40%) with (*Dioscorea cayenensis*) to a lesser extent were the dominant staple economic crops under cultivation with plantain (*Musa paradisaca*) (80%) and banana (*Musa sapientum*) (60%). *Afromomum sceptrum* (Grains of paradise) (60%) is dominant in this field and is an economically useful spice for the cooking of pepper soup (Akinnibosun & Odiete 2007). The leaves of *Thaumatococcus danielii* another economically important and dominant species (60%) in this field is gathered and sold to generate income especially by women and children. This plant has been reported to be used for wrapping prepared food such as rice, solid pap ('Agidi' or 'Eko') and 'moimoi' (Akinnibosun & Odiete 2007).

Four per cent of the plants in this field are utilized as timber trees. Deforestation, which is the removal of forest and other forms of vegetation cover from a site without replacement does not only involve felling of trees but the removal of shrubs, lianes, grasses and other plants from the forest (Owonubi & Otegbeye, 2004). Other causes of deforestation include fuel wood gathering, livestock grazing, bush burning, de-reservation by government and mining activities (Owonubi & Otegbeye, 2004). The forest is of great value in soil conservation by protecting the soil from erosion and improvement of agricultural land (Owonubi & Otegbeye, 2004).

Industrial development of a nation can not 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 (Oke & Olisa-Emodoh, 1998). (Owonubi & 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 loss of biodiversity due to deforestation should be reduced to the barest minimum when it is inevitable to cut down the vegetation to give way for industrial development.

Plant species encountered in this field have been documented for posterity and for future reference when an Environmental Evaluation Report (EER) of this field is to be made during the decommissioning of the oil company equipment.

**REFERENCES**

Akinnibosun, F. I., Akinnibosun, H. A., Ibeh, I. N. & Osaghae, F. (2008). Antibacterial activity of *Phyllanthus amarus* Schum. and Thonn. on five vegetative organisms. *Plant Archives* 8(2):563-568.

Akinnibosun, H. A. & Odiete, W. (2007). Preliminary studies of floristic diversity and vegetation composition of Utesi West, Edo State, Nigeria. *Tropical Journal of Environmental Science and Health* 10(1):01-10.

Akinnibosun, H. A. & Odiete, W. (2008a). Baseline environmental studies of floristic diversity of a crude oil exploration site in Edo State, Nigeria. *Plant Archives*. 8(2): 551-336.

Akinnibosun, H. A. & Odiete, W. (2008b). Preliminary studies of vegetation composition and floristic diversity of Aageka, Edo State, Nigeria. *Tropical Journal of Environmental Science and Health* 11(1):07-14.

Akobundu, I. O. (1989). Weed Control as a Science in the Tropics. *Nigerian Journal of Weed Science* 2: 57-60.

Akobundu, I. O. & Agyakwa, C. W. (1998). *A Handbook of West African Weeds,* 2nd ed. International Institute of Tropical Agriculture, Ibadan, Nigeria.

Amadi, A., Dickson, A. A. & Matee, G. O. (1993). Remediation of oil polluted soils: 1. Effect of organic and inorganic nutrient supplements on the performance of maize (*Zea mays*). *Water, Air and Soil Pollution* 66:59-76.

Anoliefo, G. O., Vwioko, D. E & Mpamah, P. (2003).Regeneration of *Chromolaena odorata* (L.) K. & R. in crude oil polluted soil: a possible phytoremediating agent. *Benin Science Digest* 1: 9-16.

Bamidele, J. F. & Agbogidi, O. M. (2000). Toxicity of Odidi petroleum oil and its water soluble fraction on three aquatic macrophytes. *Nigerian Journal of Science and Environment* 2**:**113-121.

Azad, M. (2005). Toxicity of water solube fractions of four fuel on *Metamystdopsis insularis*, an indigenous tropical mysid species. *Environmental monitoring and Assessment* 104:37-44.

Edeoga, H. O., Okwu, D.E. & Mbaebi, B. O. (2005). Phytochemical constituents of some Nigerian medicinal plants. *African Journal of Biotechnology* 4: 685-688.

Gill, L. S. (1992). *Ethnomedical Uses of Plants in Nigeria*. Uniben Press, Benin City, Nigeria.

Idu, M., Akinnibosun, H. A.,Omohimin, C. & Ejale, A.(2003). Ethnomedical field study of in the wetland of Udu and Ughievwwen clans of Delta State, Nigeria. Proceedings of the first global sum it on medicinal plants. Sivaram, V. & Anita, M.(eds.). pp. 98 -106. September 25th – 30th, 2003, Mauritius.

Idu, M., Omogbai, E. K. I., Aghimine, G. E. Amaechina, F., Timothy, O. & Omonigho, S. E. (2007a). Preliminary phytochemistry, antimicrobial properties and acute toxicity of *Stachytarpheta jamaicensis* (L.) Vahl leaves, *Trends in Medical Research* 2:193-198.

Idu, M., Omogbai, E. K. I., Aghimien, G. E., Amaechina, F. Timothy, O. & Omonigho, S. E. (2007b). Preliminary phytochemistry and antimicrobial properties of *Stachytarpheta jamaicensis (Linn)*. Vahl stem. *Research Journal of Medicinal Plant* 1: 149-153.

Idu, M., Omonigho, S. E. & Igeleke, C. L. (2007c). Preliminary investigation on the phytochemistry and antimicrobial activity of *Senna alata* L. flower. *Pakistan Journal of Biological Sciences* 10: 806-809.

Idu, M., Onyibe, H. I., Timothy, O. & Erhabor, J. O. (2008). Ethnomedicinal flora of Otuo People of Edo State, Nigeria. *Asian Journal of Plant Sciences* 7: 8 – 12.

Idu,M., Osemwegie, O. O. & Akinnibosun, H. A. (2006).Floristic diversity of Okomu Forest Reserve in Southern Nigeria. *Phytotaxonomy* 6:14-22.

Idu, M., Osemwengie, O. O., Timothy, O. & Onyibe, H. I. (2007d). A survey of plants used in traditional health care by Waja tribe of Bauchi State, Nigeria. *Plant Archives* 7:535-538.

Jain, S. K. (2006). University Herbaria in India. *Phytotaxonomy* 6:128-130.

Keay, R. W. J. (1989). *Trees of Nigeria*. Clarendon Press, Oxford.

Kershaw, K. A. (1977). *Quantitative and Dynamic Plant Ecology,* 2nd ed. Edward Arnold Publisher Limited, U.K.

Lowe, J. & Soladoye, M. O. (1990). Some Changes and Corrections to Names of Nigeria Plants Since Publication of Flora of West Tropical Africa Ed.2 and Nigerian Trees. *Nigeria Journal of Botany* 3: 1- 24.

Mahapatra, H. S. & Baishya, A. K. (2005). Assessment of floristic diversity in proposed sites of hydroelectric power projects in Arunachal Pradesh. *Phytotaxonomy* 5:120-130.

Nwosu, M. O. (2002). Ethnomedical studies on some pteridophytes of Southern Nigeria. *Economic Botany* 56: 255 – 299.

Oboh, P. A., Eguavoen, I. O. & Ekundayo, A. O. (2004). Antimicrobial activities of *Euphorbia hirta* and *Erigeron floribundus*, common herbs of Southern Nigeria. *Nigerian Annals of Natural Sciences* 5: 72 – 76.

Odugbemi, T. & Akinsulire, O. (2006). *Medicinal Plants According to Family Names*. *In*: Odugbemi, T. (Ed.) pp. 117 – 116. *Outlines and Pictures of Medicinal Plants from Nigeria*. University of Lagos Press, Akoka, Yaba, Lagos State, Nigeria.

Ogbe, F. M. D. & Osawaru, M. E. (1998).Structure and distributions of stomata among some Nigerian dicotyledonous weeds. *Feddes Repertorium* 99: 463-466.

Oke, O. C. & Olisa-Emodoh, V. E.(1998). Environmental factors affecting the distribution and Diversity of land mollusks in Ologbo Forest Reserve. *Journal of Environmental Science and Health* 1:34-37.

Omoigui, J. D., Ekaye, S. A. & Onu, N. J. (2004). Ethnobotanical practices of Atani people in Arochukwu Local Government Area of Abia State. *Tropical Journal of Environmental Science and Health* 7:22-25.

Onwueme, I. C. & Sinha, T. D. (1991). *Field Crop Production in Tropical Africa*. CTA, Netherlands.

Owonubi, J. J. & Otegbeye, G. O. (2004).Disappearing forests: A review of the challenges for conservation of genetics resources and environmental management. *Journal of Forestry Management* 1:1-11.

SPDC. (2000). *Environmental Impact Assessment(EIA) Assessment Procedure*. Shell Petroleum Development Company.

Sutherland, W. J. (1997).*Ecological Census Techniques: A Handbook.* University Press, Cambridge U.K.

Ugbogu, O. A. & Odewo, T. K. (2004). Some medicinal plants in the traditional medicare of Nigeria. *Journal of Forestry Management* 1: 29-34.