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*Full Length Research Paper*

# Mangrove biodiversity in the restoration and sustainability of the Nigerian natural environment

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**The objective of this study was to evaluate the floral biodiversity and sustainability of Lagos wetlands. In other to achieve this, mangrove communities of 8 localities in Lagos and its environs viz: Atlas Cove, Five Cowrie Creek, Maroko, Berger De Motz, Palaver Island, Bayeku, Majidun and University of Lagos beach were sampled. A comprehensive quantitative vegetation analysis of the vegetation within the selected lagoonal communities was carried out. Of the 8 sampled sites, only 2 - Palaver Island and Bayeku had their vegetation relatively well preserved. Mangrove at the vicinity of University of Lagos and Majidun preserve relics of their biodiversity. There was evidence of anthropogenic stress at Five Cowrie Creek, which is devoid of vegetation. Maroko swamp has been taken over by grasses, Berger De Motz has sandy substratum, high-energy wave and rip of any typical mangrove species. The study reveals that mangrove swamps in Nigeria are under serious anthropogenic threat. To ensure that these wetlands are not soon forgotten, pragmatic measures which must be put in place to curb degradation, restore, sustain and preserve this vital ecosystem are suggested.**

**Key words:** Degradation, natural environment, restoration, standards, wetlands.

## INTRODUCTION

The mangroves are a characteristic forest biotope in tropical river estuaries and tidal zones (Figure 1). They constitute an incredible adaptation to the environmental conditions of saltwater and incursion of sweet river water. Mangroves are generally classified "unhealthy wastelands" or "useless swamps" by development-eager authorities and businesses and are therefore quickly sand filled to make room for growing cities and agricultural areas. Large-scale destruction and pollution of the mangroves have resulted in the domination of the tidal swamp by floating water-hycianth (*Eichhornia crassipes* ), grasses and weeds. The mangrove forests however constitute one of the most fascinating resources in tropical Africa and centers of biodiversity (Figures 5 - 8), Ajao and Dore (1997). Mangrove in Nigeria is characterized by 3 species of *Rhizophora* which are *Rhizophora harrisonni, R. mangle* and *R. racemosa* (Adegbehin, 1993). 2 other less abundant mangroves, *Avincennia germinans* and *Laguncularia racemosa* as well as the salt-water fern, *Acrosticum aureum* are also present. Associated with mangrove formation, but by the edge mainly near the sea board, where the sea water is undiluted is a strand vegetation of shrubs and herbs, such as *Barteria nigritiana, Hibiscus tiliaceus,* and *Ipomoea pes -caprae* (Keay, 1949). This paper discusses the value of mangroves, the peculiar species found in specific parts of the Lagos coastal area and causes of their depletion so far. Suggestions are offered for a mitigation of the depletion and also for replenishment.

### Economic and environmental importance of mangroves

The mangroves perform many important ecological roles such as filtering nutrients, stabilizing lagoon shores, providing protection for commercially important fish, helping in the continuous formation of soil, in addition to serving as an important migratory point for birds. Mangroves are highly productive biotopes and as such have a vibrant, rich and endemic wildlife. Mangrove forests and the salt marshes connected to them provide food (Moses, 1985) and a home for fish, shellfish, molluscs, wildfowl and an enormous variety of crabs.

Mangrove forests are vital for healthy coastal ecosy-

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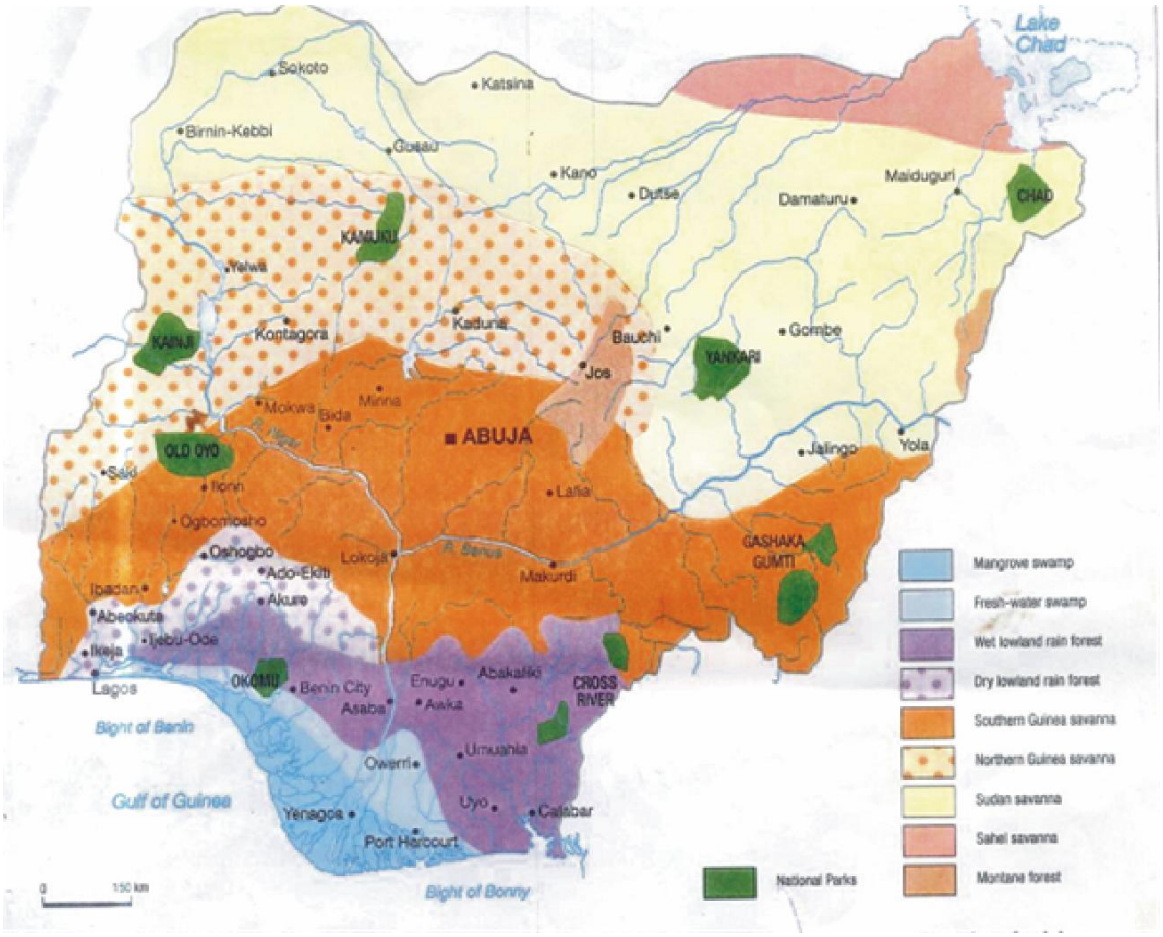


**Figure 1.** Map showing vegetation zones in Nigeria. (F.G.N, 2002).

stems. The forest detritus, consisting mainly of fallen leaves and branches from the mangroves, provides nutrients for the marine environment and supports immense varieties of sea life in intricate food webs (Odum and Herald, 1975). Also the trees in themselves are useful. Mangrove wood is often collected as firewood. The willow plant is used in crafting furniture and other household amenities and many plants of the mangrove have medicinal uses. If properly managed, mangroves can provide timber for construction, charcoal for energy, food for livestock, fish for local consumption and so on. Another important environmental service provided by the mangroves is that they build land and protect the shoreline from being washed away in storms (Savory, 1953). The roots and trunks break the force of the waves and the leaves and branches reduce the effects of the wind and rain. Mangroves can also be very important when the city wastes run off and pollute the nearby coastal waters, the swamp filters the water, making use of the nutrients and also absorbing toxics and leaving the water clean. As long as the waste does not contain too much toxic substance, the mangroves are an excellent waste treatment system.

However, over the past several decades, the area covered with mangroves globally has increasingly been reduced as a result of a variety of anthropogenic activities, such as over-harvesting, freshwater diversion and development. Mangrove forests in Nigeria are logged to supply wood for fuel and construction and they are exploited for oil exploration and drilling. Fishing techniques that use poison and dynamite are destroying the ecosystem here. Furthermore, sewage and other pollutants including solid waste are contaminating and destroying this valuable ecosystem (Figure 9).

## MATERIALS AND METHODS

A motorized boat and a manually operated boat as the need may be were used to access the habitats (Ajao and Fagade, 1990). A list of all the species present in each mangrove community was compiled followed by a comprehensive quantitative vegetation analysis of the vegetation within the selected lagoonal communities was carried out. 8 belt transects of 50 m long and 6 m wide placed at every fifth yard were examined for each sampled site depending on the habitat. Species frequency was numerically determined in 10 quadrats within these transects. The percentage of the total floral was calculated (Muller and Ellemberg, 1974). Visual photographs of selected mangrove communities and representative species encoun-

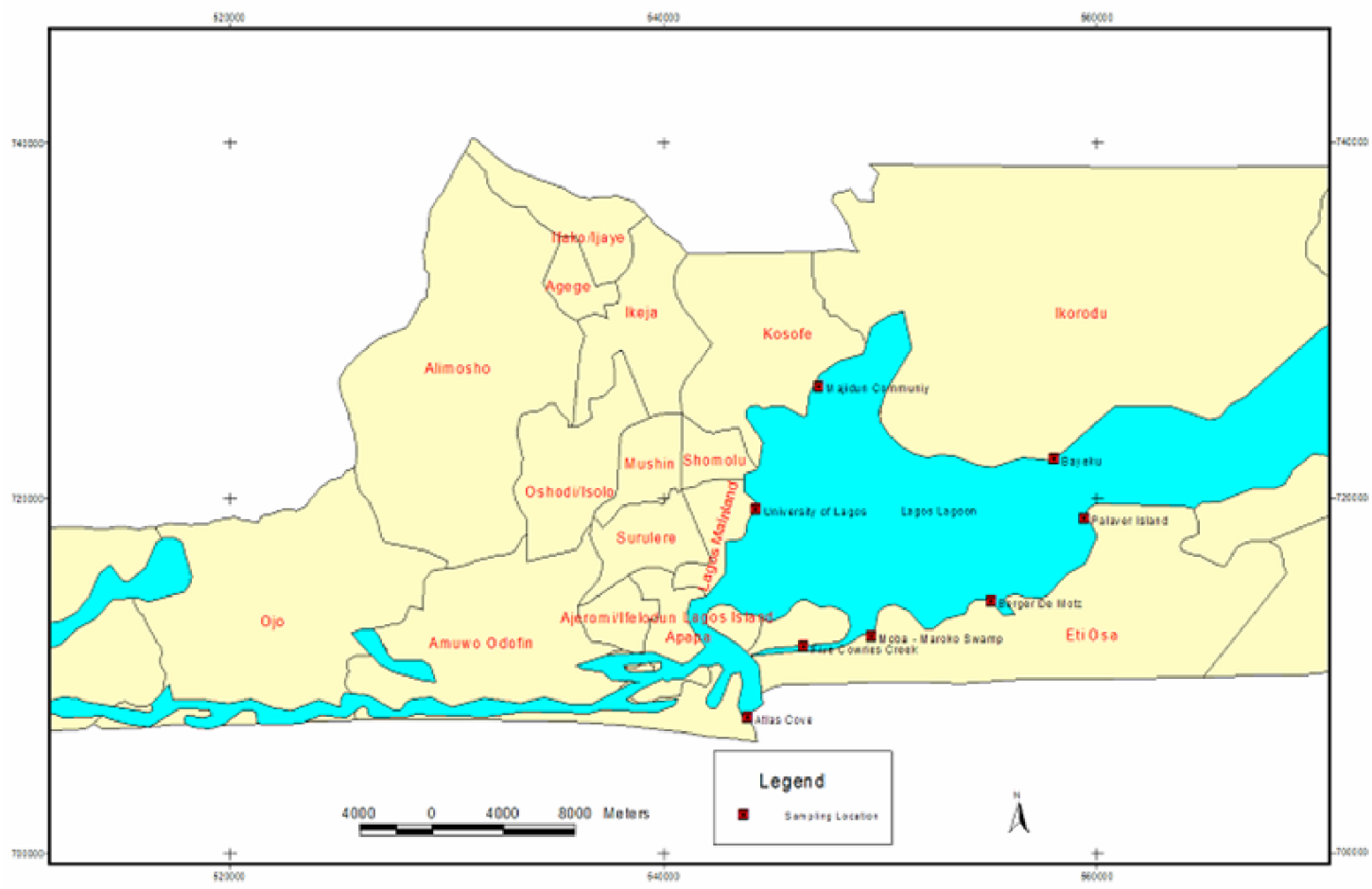


**Figure 2.** Location of study site.

ter were taken using Kodak digital camera.

## RESULTS

Distribution and abundance of swamp forest in Lagos lagoon is presented below according to site. Woody species common to five or more localities are presented in Table 1 while herbaceous species, climbers and grasses common to five or more localities are found in Table 2. Comparative abundance is presented in Figures 3 and 4.

### Atlas cove

Mangrove is dominated by *A. germinans* (6.5%) and *L. racemosa* (6.0%). *R. racemosa* (5.6%) *and Alchornea cordifolia* (5.3%) were very abundant occurring in an almost undisturbed manner. *Casuarina equisetifolia* (2.4%) *and Terminalia catappa* (0.9%) *were other* abundant tree species recorded in this mangrove community. Occurring frequently were shrubs such as *Agave sisalana* (3.6%), *Dalbergia ecastaphyllum* (2.5%), *Drepanocarpus lunatus* (1.9%) and the fern *A. aureum* (2.7%). *Phoenix reclinata* (2.0%), *Cocos nucifera* (1.7%), *Azadiracta indica* (1.3%) and *H. tiliaceus* (1.1%) were found occurring together occasionally. *Paspalum vaginatum* (8.7%), *Portulacaceae* (8.4%) *and Rhynchospora corymbosa* (2.0%) were abundant.

### Five Cowrie Creek

This community is almost completely devoid of vegetation except occasional stands of *C. equisetifolia* (7.5%), *T. catappa* (5.0%), and sparse occurrence of grasses. *Chromolaena odorata* (7.5%) were frequent. The indiscriminate cutting, grazing and sand filing which were obvious at the site has obliterated any sign of the original mangrove.

### Moba, Maroko swamp

This swamp community has been taken over by grasses due to urbanization and reclamation. As a result, grasses such as *Paspalum* (24.0 / 18.0%) *and Andropogon*

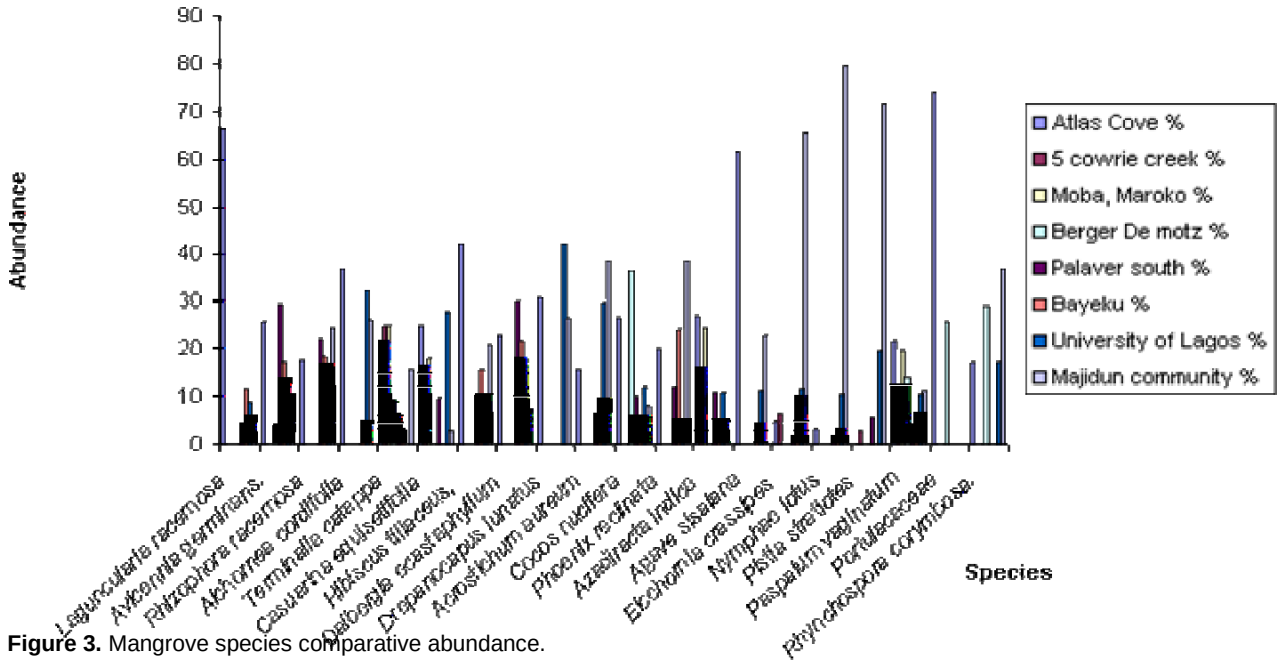


**Figure 3.** Mangrove species comparative abundance.

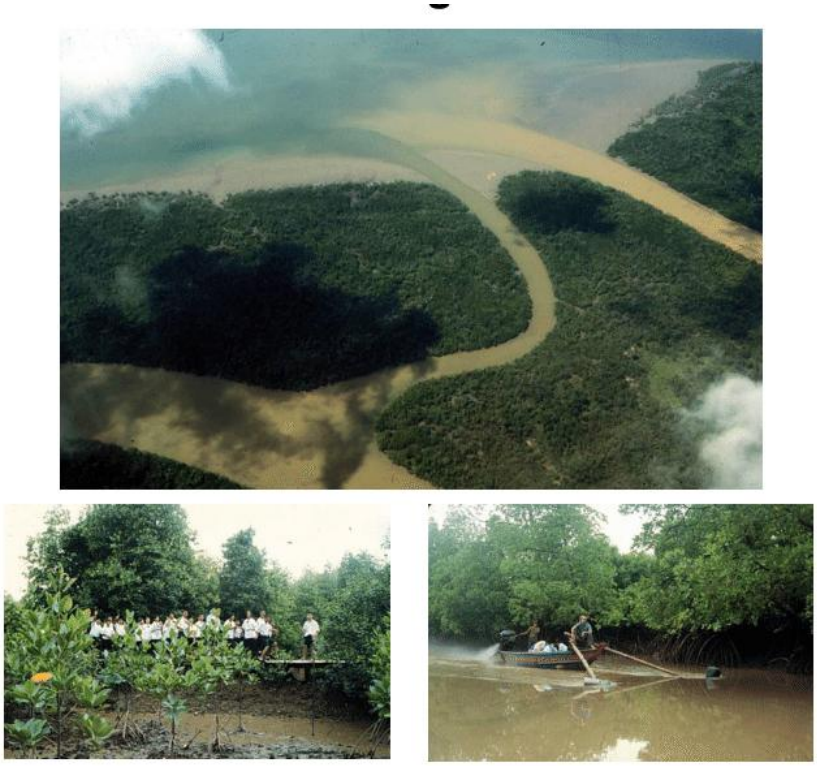

**Figure 4.** Mangrove species comparative abundance contd.

(22.0%) species were found dominating. *Panicum subalbidum* (18.0%) were very abundant reaching about eight feet high. Tree species occurring frequently are *C. equisetifolia* (5.3%), *A. indica* (3.7%) and *T. catappa* (3.3%).

**Berger De Motz**

This community has sandy substratum and high-energy wave. It is rip of typical mangrove species except the ves-


**Figure 5.** Fringing mangroves lining creeks through fresh and salt water showing (i) *D. lunatus* (ii) *P. stratiotes* (iii) *R. corymbosa (*left) with dense forest of *R. racemosa* on the right (iv) at Majidun, Nigeria.


**Figure 6.** Forest of *R. racemosa*, during low tide at Bayeku, Nigeria, typifying a mangrove swamp environment.


**Figure 7.** Mangrove swamp fern *A. aureum* with *R. mangle* and *Paspalum sp*. on the left at University of Lagos lagoon.

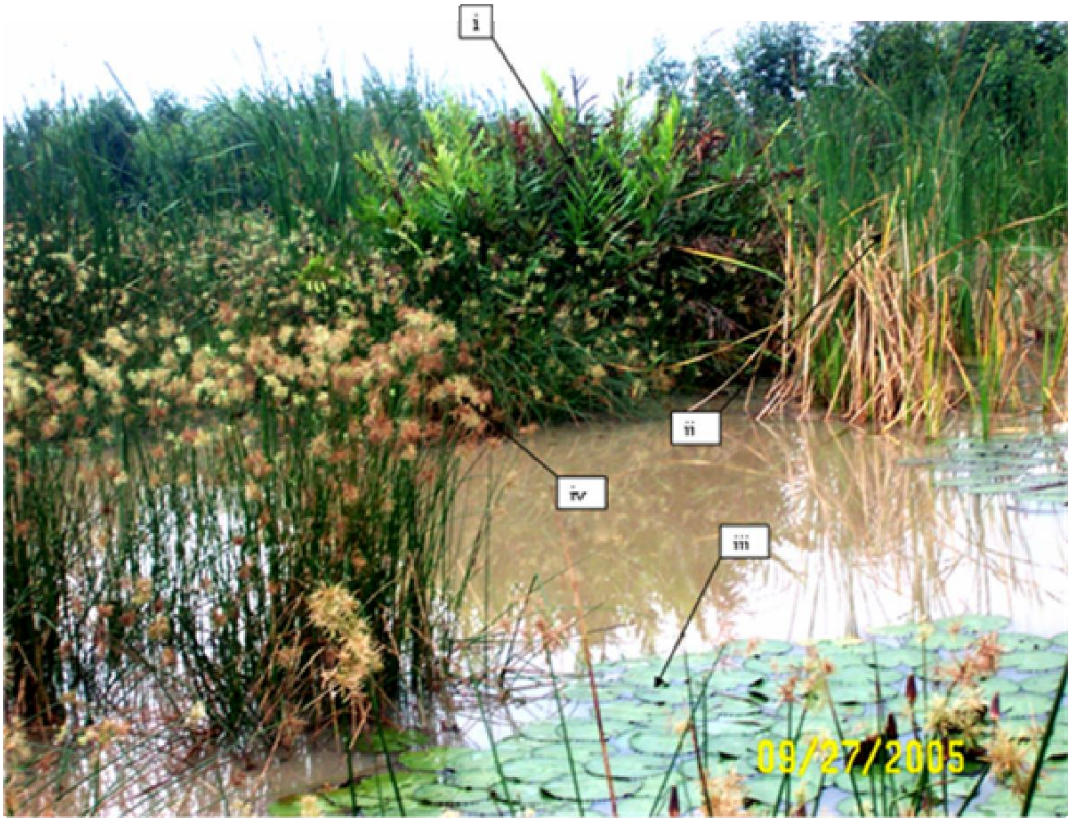


**Figure 8.** A fresh water swamp forest showing the rich biodiversity of swamp vegetation. (i) *A. aureum* (ii) *V. cuspidata* (iii) *N. lotus* (iv) sedge *R. corymbosa* on the left, right at Majidun. Nigeria.


**Figure 9.** *A. germinans* community threatened by influx of solid waste at Palaver land, Lagos.

**Table 1.** Woody species common to 5 or more localities.

| | Species | Family | Habit |
|---|---|---|---|
| 1 | *L. racemosa* | Combretaceae | Tree |
| 2 | *T. catappa* Linn | Combretaceae | Tree |
| 3 | *C. equisetifolia* Linn | Casuarinaceae | Tree |
| 4 | *C. nucifera* | Aracaceae | Tree |
| 5 | *A. indica* A. Juss | Meliaceae | Tree |
| 6 | *A. germinans* | Combretaceae | Tree |
| 7 | *C. erectus* | Combretaceae | Woody |
| 8 | *R. racemosa* G.F.W. Mey | Rhizophoraceae | Woody |

**Table 2.** Herbaceous species, climbers and grasses common to 5 or more localities

| | Species | Family | Habit |
|---|---|---|---|
| 1 | *P. reclinata* | Aracaceae | Herbaceous |
| 2 | *C. odorata* Linn | Compositae | Herbaceous |
| 3 | *M. invisa* Mart | Mimosaceae | Herbaceous |
| 4 | *C. odorata* Linn, King and Robinson Mart | Compositae | Herbaceous |
| 5 | *C. erectus* | Cucurbitaceae | Shrub |
| 6 | *P. vaginatum* Sw | Poaceae | Grass |
| 7 | *P. scrobitulatum* Linn | Poaceae | Grass |
| 8 | *Andropogon* sp. | Poaceae | Grass |
| 9 | *P. subalbidum* Kunth | Poaceae | Grass |
| 10 | *S. depressa* Willd | Cyperaceae | Sedge |
| 11 | *P . vaginatum* | Cyperaceae | Sedge |
| 12 | *S. depressa* Willd | Cyperaceae | Sedge |

tige of *A. germinans* (0.1%) sandwich by grasses (Figure 10) as the natural environment has been adversely modified. Grasses including *Typha australis* (11.0%), *Paspalum* and sedges such as *Kyllinga erecta* (6.4%), *Scleria depressa* (5.4%), *R. corymbosa (4.1%) and Cyperus esculentus* (4.0%) were dominant here. Very abundant were *Centrosema pubesens* (6.4%) and *Asystasia gan-getica* (6.3%). *Ipomoea aquatica* (2.0%) were also abun-dant.

## Palaver Island

This community is relatively undisturbed by developers except the influx of solid waste (figure 9) and indiscriminate cutting for firewood and other uses noted when the site was re-visited in 2008. *R. racemosa* (16.6%) was found dominating; next to this in abundance were the very mature *A. germinans* (17.9%) reaching about 5 feet in girth and about 35 feet in height. *D. ecastaphyllum* (7.99%) were quite abundant. The saltwater fern *A. aureum* (2.56%), *I. aquatica* (2.56%), *C. equisetifolia* (2.24%) and *C. nucifera* (1.6%) were frequent. Although there is less diversity of species, the few flourishing typical mangrove species e.g. *A. germinans* makes the necessity of restoration, sustainability and reservation paramount at this site.


**Figure 10.** Stressed swamp vegetation, showing *Typha australis* (i) and stunted *A. germinans* (ii-iii) at the middle cohabiting with *Paspalum vaginatum* at Berger De Motz, Lagos, Nigeria.

### Bayeku community

The mangrove floral of this community is dominated by *R. racemosa* (12.0%). Very abundant is *A. germinans* (9.6%) and *D. ecastaphyllum* (5.2%). *P. vaginatum* (5.5%), *E. crassipes* (3.8%), *A. aureum* (3.5%) were frequently counted. *L. racemosa* (2.3%) *recorded* only occasional occurrence.

### Majidun community

Dominant in this fringing mangrove lining creeks with fresh water incursion are the sedges *Vossia cuspidata* (6.7%), *Cyperus javanicus* (6.2%) *and R. corymbosa* (2.5%). *R. racemosa* (4.5%) is found occurring together with *A. cordifolia* (2.2%) at some sampled sites. Very abundant here are, *Nymphae lotus* (7.6%), *Eicchornia crassipes* (6.5%), *Pistia stratiotes* (5.9%) and *A. aureum* (3.8%). *Mimosa invisa* (2.7%) , *Raphia finifera* (2.0%) *and Ludwigia* species (2.8%) are abundant. Other frequently occurring species are *P. reclinata* (2.2%), *I. aquatica* (1.5%), *Paspalum scrobiculatum (1.5%), Bambusa vulgaris* (1.3%) and *D. lunatus* (0.9%). *A. sisalana* (0.8%), *T. catappa* (0.4%) and *C. nucifera* (8.16%) are frequent.

### University of Lagos community

Mangrove in the vicinity of University of Lagos is still relatively well preserved with diverse species. A very visibly dominant species in the community is *R. racemosa* (6.4%), Salt water fern *A. aureum* (6.08%) is very abundant. Other important components of this com-munity occurring in abundance are *A. cordifolia* (5.6%), *Avicennia germinans* (4.16%), *C. equisetifolia* (3.2%), *D. lunatus (3.04%), I. aquatica* (2.56%) and *D. ecastaphyllum* (2.4%). *P. vaginatum* (5.12%), *P. stratiotes* (3.36%), *R. corymbosa* (3.36%), as well as species of *A. sisalana* (0.8%) and *P. reclinata* (0.64%) were frequently encountered in the samples. Tree species such as *Alstonia congensis* (1.12%), *Symphonia globulifera* (0.96%) and *T. catappa* (0.0%) were occasionally seen. *E. crassipes* (2.4%) and *N. lotus* (2.08%) recorded rare occurrence.

## DISCUSSION

From this brief overview, it is apparent that Nigeria mangroves have a diverse flora, represented by many species of plants. These varied species are found relatively well preserved at some of the sampled sites.

The largest mangrove stand in Nigeria is found in the Niger Delta and the Lagos lagoon mangrove communities cannot go unnoticed. However, considering the indiscriminate reclamations and degradations of the mangrove, it is obvious that up to the present, Nigeria has used its mangrove swamps with no attempt at conservation. Despite the available environmental laws, legislation and regulations backing Environmental Impact Assessment (EIA) process- such as federal environ-mental protection agency act, 1988 Cap 131 LFN 1990; environmental impact assessment act, 1992 and Nigerian urban and regional planning act, 1992 (Nwafor, 2006) intended to retard and correct the adverse effects of hu-man activities upon the natural environment, mangrove degradation still goes on at an unprecedented rate. Ac-cording to FAO (2005), Nigeria has the highest defores-tation rate, yet with little public notice. Destructions have been greatest in Asia and Latin America and have risen to a considerable degree in Nigeria resulting in loss of biodiversity and flooding among others. The ever-turbulent Lagos bar beach and the seaward ends of the Niger delta at Okirika in Rivers State are great coastal challenges to Nigeria. It is recommended that a very careful examination should be made by the environmental protection agency and plant ecologists before any area of mangroves is allowed to be altered in any way or allocated for any form of development (Carroll and Turpin, 2002; Chapman, 1979). Mangrove swamps adjacent to developing areas should be reserved for their value to fisheries, maintaining equilibrium in the food chain, biodiversity conservation, stability of the natural environments and aesthetic reasons (Jackson, 1967).

The local communities in the vicinity of the mangrove swamps should be sensitized and encouraged to embark on deliberate mangrove reestablishment programme (Kinako, 1977). This group of people benefit directly from the mangrove through fishing activities, harvesting of mangrove wood for firewood and use of the plant parts for medicinal purposes. They therefore should be brought to the awareness that the loss of a very small mangrove area must be compensated for by a planting program in their respective localities. Achieving these goals will require public awareness campaigns, intensive research, community training and coastal education on environmental sustainability (Adegbehin and Nwaigbo, 1992). It is also recommended that extensive mangrove areas, in which the habitat will be protected, should be reserved. Total protection should be given to areas of special interest by establishing mangrove national parks or similar restricted areas.

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