

# **An Appraisal of the Challenges of Resource Exploration and Exploitation for Socio-economic Developments in Nigeria**

**Chijioke EZE, Nigeria**

**Key words:** Resources, Environmental Threats, Degradation, Challenges, Management

## **SUMMARY**

This appraisal focused on threats to the Nigerian Coastal Area (NCA). The coastal environment differs from other ecosystems due to large inputs of matter and energy from both hinterland and sea. This action thus, makes the ecosystem rich in resources. The threat to the NCA has been wanton and continuous with dire health, social and economic consequences for its peoples. The purpose of this paper is to compliment the efforts of various government and agencies towards mitigating coastal area threats resulting from socio-economic activities. In ensuring this threats does not result to human catastrophe, the need for space technology in safety handling of associated challenges of resource extraction in coastal ecosystems is vital. This paper enumerated the threats in NCA with a view to properly manage this very fragile environment. The management of coastal ecosystem may not be adequately conducted without knowing the extent and distribution of impacts of human activities in and around the coast. Space technology tools (GPS, SRS & GIS) are very useful in such study. The paper re-appraises the various methods of checking coastal environmental threats in Nigeria. The aim was to provide modern alternatives to the conventional efforts that are realistic and achievable given the unique circumstances of the Nigerian coast. The paper could therefore be of potential benefit to stakeholders in oil and gas, resource extraction companies, the inhabitants, government and non-governmental outfits. It does thus recommend that the enactment and enforcement of stringent environmental laws, use of space technology tools and continuous mapping is very crucial. This is to fully support the protection of NCA and guarantee the sustainable use of the environment.

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## 1. INTRODUCTION

The multifaceted challenges to coastal environment could be real or imagined some of which include socio-economic, political and environmental threats. The Nigerian coastal area (NCA) has witnessed several threats due to oil and gas exploration and exploitation (OGEE) activities. The socio-economic benefits of oil and gas operations to the nation are enormous. These benefits impact on this fragile ecosystem resulting to some level of threats to the environment. However, the implication of the challenges of socio-economic activities on the coast could have on the economic stability of the nation is very crucial. Nigeria has a total area of 932,768 sqkm and its population is estimated at over 140 million people (2006 census). Also, the Nigerian coast stretches over a distance of approximately 853km, from the tip of Badagry Lagoon to the eastern end off Cross River near Calabar. It lies within latitude 4° 10' to 6° 20' N of the Equator and longitude 2° 45' to 8° 35' E of the Greenwich meridian (figure 1).

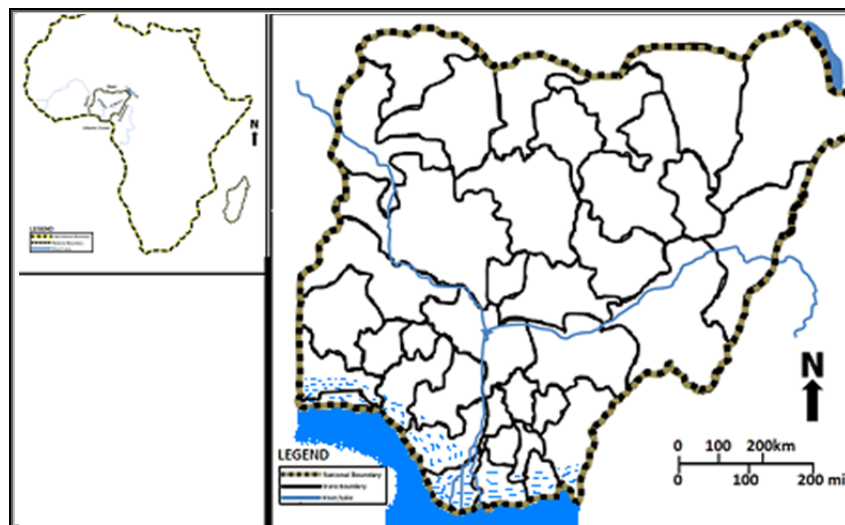


Fig 1: Location Map of Nigeria

This NCA houses the Niger Delta, which extends over about 70,000 km<sup>2</sup> and makes up 7.5% of Nigeria's land mass, and it includes land in Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers States (Njobuenwu and Abowei, 2008). The remaining area covers Lagos and Ogun. About 1/3 of it is made up of wetlands, and the 3<sup>rd</sup> largest world mangrove forests. This ecosystem is rich in biodiversity, but besides the challenges of natural

phenomenon (climate change, sea-level rise, sea storms, coastal erosion, etc) has witnessed considerable threats due to man-made factors that has socio-economic undertones.

The tense relationship among oil companies, the Nigerian state, and oil-bearing communities result to damages on environmental assets (clean air, clean water, land, fisheries and forestry) and social assets (mutual trust, ability to network and security of persons and property) el cetra. The OGEE has raised issues such as biodiversity depletion, coastal and river erosion, flooding, oil spillage, gas flaring, noise pollution, sewage and waste water pollution, land degradation and soil contamination, deforestation for fuel and construction. Other causes of NCA degradation through anthropogenic factor includes: bush burning, grazing, cultivation of marginal land, faulty management and Poverty. The quantification of precise extent of these environmental threats resulting from human induced actions is not easily determined in Nigeria.

The rising spate of coastal activities in the country poses serious threats to food security and sustainability of this natural resource. Although calamities can never be ruled out in any setup, the crux of the matter lies in the attitude towards disaster mitigation. Several institutional arrangements have been put in place in the country for managing matters relating to NCA threats due to socio-economic activities. Despite the various efforts, depletion continues to be a serious threat in NCA. This has therefore called for effective resolution and management of coastal environmental threats in the country.

This paper appraises the challenges, various efforts made in tackling these great problems. The existing environmental law to protect the NCA is very crucial. Also, the concepts of integrating space technology tools in confronting the menace of human actions in NCA. In order to achieve a unique process in information technology (IT) driven mode, space technology tools are very useful. The aim is to provide modern alternatives to the conventional efforts that are realistic and achievable given the unique circumstances of the NCA. This is to fully support and guarantee the sustainable use of the coastal environment. The paper is limited to the NCA with emphasis on resource exploration and exploitation. .

## 2. SOCIOECONOMIC ACTIVITIES

Environmental threats in NCA are increasingly challenging due to social and economic related activities. The socioeconomic activity includes the politics of OGEE, urbanization and industrialization, among others. The consequences of the activities could be in form of arable land pollution, ground water contamination, erosion, wild and aquatic biota extinction, loss of eco-habitat, deforestation, and so on. The NCA has come under intense pressure due to population increase and rapid industrialization. The NCA is home to the oil and gas bearing Niger Delta. Nigeria was recently ranked the 8<sup>th</sup> largest oil economy in the world (CIA, 2009). This drop in ranking was due to the tense politics of oil and gas (resource) control among oil companies, the Nigerian state, and oil-bearing communities in Niger Delta. The NCA is largely dominated with OGEE activities. Its also witnessing urbanization with its associated challenges such as: deforestation, sand mining, rural-urban migration, accommodations and

water. Other social amenities and commercial concerns that are state, national or multi-national enterprises in nature are influencing NCA physical and economic structures. However, before the OGEE, agriculture was the main-stay of the nation's economy.

## 2.1 Oil and Gas Industry

The OGEE in the NCA is with its blessings, in terms of foreign exchange earnings to the nation. Nigeria's external reserve resulting from crude oil sales alone stood at 20 billion US dollars as at March 2009. The nation currently earns a below average cash-flow from the oil related revenue due to global economic meltdown and heightened tension in the restive Niger Delta in the recent past (Tribune, 2009). Militant strikes on oil installations in the area proved quite crippling to the economy. Most of the oil reserves are located in the coastal Niger delta. However, traces of commercially viable oil and gas reserves and other minerals are being unraveled in the deep shore and off-shore areas of Nigerian coastal waters. It is estimated that the NCA has the potential to triple its oil and gas output, if checks that could minimize oil spillages and gas flaring were put in place. Also, the damaging effects of OGEE on the coastal environment are too dangerous to be ignored. The damaging effects includes; loss of coastal aesthetic, destruction of the mangrove ecosystem, displacement of natural habitats and ancestral homes, damage to aquatic biota, contamination of farmable soil and portable water (PW). The issue of PW contamination as it concerns the NCA is very crucial due to the under-mentioned reasons.

### 2.1.1 Ground Water Pollution

The need for PW supply in the NCA is important, because the quality and life expectancy across NCA depends substantially on the availability of PW in quantitative and qualitative terms. This basic need is being given the attention it deserves by various governments (state and federal) and other agencies. Recently, the governments of Rivers State budgeted 14 billion naira for water projects in 2010 and Lagos state set aside over 3 billion US Dollars for PW infrastructure in 2009. The issue of PW pollution is vital due to the rate and magnitude of pollution prone activities from OGEE in the area. The main source of these pollution prone OGEE related activities includes; petroleum, spills, transportation, sabotage, ship wreckages, among others.

- **Petroleum:** Crude oil and gas are normally mined in wells which are dug down to about 10,000m (Oloigili Well). These oil wells are connected to flow stations through a network of surface and underground pipes. In some cases, rupture occurs in these underground pipes, resulting in both noticed and un-noticed seepage of crude oil into the soil where they contaminate both surface and ground water. An estimated 30,000 barrels (about 4.8 million liters) of crude oil was released in Owaza area of Abia land. The release was caused by valve failure at the relief pit behind the flow station and covered over 5 hectares of arable land as at 20 September 2003 (Osuji and Nwonye, 2007).
- **Spills:** In other cases, rupture occurs in surface pipes resulting to wide spread of oil products over the surface. The surface spillage moves horizontally and vertically through gravity and then seeps into the soil directly or flow into a nearby stream, causing ground

water contamination. Spreading of oil spill on water is the horizontal expansion of the oil spill due to gravity, inertia, viscous and surface tension forces (Njobuenwu and Abowei, 2008).

- **Transportation:** Crude oil may be transported to its ports of terminal with tankers through the road or special tanker batches through the creeks. In the process, accidents may occur resulting in the overturning of the tankers from which substantial volume of crude oil spills over the surface. The poisonous crude may further be washed away by rainwater or seeps vertically down the soil until it meets the saturation zone (water table) for further contamination.
- **Sabotage and Bunkering:** It has been alleged that some unpatriotic Nigerians help perpetuate activities that could lead to oil spillage by rupturing some distribution pipes. Either for political, self-mischief or expected undue economic advantage by canalizing the oil companies to pay monetary compensations. Sometimes during crude oil bunkering, alliances among component oil merchants have resulted in the loading of tons of batches (wooden and iron). These batches are towed on a tugboat maximizing the benefits of periodic sea-level (tidal waters) rise to awaiting crude oil merchant vessels at high sea. The capacity of a wooden batch = 200,000 liters (about 6 X 24ft trailer tankers) and an iron batch = 800,000liters (about 24 X 24ft trailer tankers). It is worthy to note that a 24ft tanker = 33000liters.

## 2.2 Urbanization and Population

The increasing demand for housing, employment opportunities, institutions, other urban facilities and services are due to rural-urban migration. This had lead to drastic changes of urban land covers and also a factor contributing to the degradation of quality of the natural environment. Other contributors include temperature increase, geo-hazards occurrence, noise, air and PW pollution in urban areas. Globally, there seem to be higher concentration of people in the coastal area than the hinterland, but Nigeria in its unique character enjoys an even spatial spread of its population. CIA (2009) reported that 48% of the total populations of Nigeria were found in urban areas (2008) and the rate of urbanization stood at 3.8% annual rate of change (2005-2010). There are strong concentrations of people in the cities of Calabar, Uyo, PortHarcourt, warri, Lagos, and so on. These cities merely existed as remote rural (farm) settlement and poorly accessible fishing islands as at 16<sup>th</sup> century. But, urbanization have turned most of these small settlements to mega cities. The lagoon area of the coast houses Lagos with a population estimated to 15million (2010 estimate). The city (Lagos) has been ranked as the world 5<sup>th</sup> largest city that could be compared with Cairo in terms of human resources (CIA, 2009). The resulting impact of the urban development on the coastal ecosystem includes; degradation of coastal aesthetic values, destruction of natural habitats of wild and aquatic life, pollution of springs and streams, deforestation due to city expansion and coastal erosion resulting from indiscriminate sand mining.

### 2.2.1 Sand Mining

The rises in sand mining activities were due to pressure to meet the building material needs of the rapidly growing coastal cities. Also attempts by governments and private partners (local or foreign) to reclaim land from the sea. In a bid to solve accommodation problems in the coastal cities, Lagos state government has proposed a new mega-city known as “Eko Atlantic City”. It is a planned district intended to be built on land reclaimed from the Atlantic Ocean. The proposed development is targeting 250,000 residents and 200,000 commuters flowing daily to the island. The project is planned to return the coast to its position in the 1950s and 1960s, reversing damage done by erosion. This were outside already reclaimed areas like; FESTAC Town, Victoria Garden City, Morroko, Ajah, Lekki, etc. In Bayalsa state, the capital (Yenogua) was almost completely built on sand filled portions of reclaimed land. Delta State is making a total commitment of over N123.43 billion for the construction of roads, airport, bridges, drainage channels, jetties and foreshore walls (Osaji, 2009). These projects are capital intensive in nature and therefore most of them have been planned on rolling basis. The destructions already caused by these actions on the coastal ecosystem are better imagined.

### 2.2.2 Fishing

Aquatic lives were another major component of the coastal values, especially the fishes. Though, NCA are under-exploited in both finfish and shellfish fisheries. This was because peasant fisheries are still dominant in the area. Both the Federal and State governments are gradually finding answers to the maximum exploitation of our coastal waters (Afinowi and Ezenwa, 1982). The fishing gears (nets and its accessories) and some chemicals used along NCA by the fisher-men equally constitute nuisance to the environment.

### 2.2.3 Forest

Mangrove forests are unique tropical eco-systems occurring along the sheltered shore line with muddy to sandy bottoms. They are variously described as coastal woodland, tidal Forests and mangrove forests. Mangroves depend on terrestrial and tidal waters for their nourishment, and on coastal soils and soil deposits from up land as substrate for support. The tides nourish the forests, and mineral rich river-borne sediments enrich the swamp. Thus the mangroves derive the form and nature from both marine and terrestrial influence. Mangrove forests are among the most productive terrestrial eco systems and are natural and are a renewable resource (Rao and Anupama, 2006). This eco-region is losing their habitats as over exploitation of forest for fuel, timber, construction material, etc. Mangroves provide services like protection of coasts against wave and wind erosion , moderating the effects of coastal storms and cyclones, shelter and habitat for diverse wildlife particularly avifauna, entrapment of upland run up sediments thus protecting near shore reefs and reducing water turbidity. Mangroves also provide opportunities for education, scientific research and eco tourism. Though a number of protected areas have been established they are presently too small, and lack adequate protection. Without increased protection efforts, it is unlikely that the viable sections of forest will survive long into the future.

### **3. APPRAISAL OF CHALLENGES IN NCA**

#### **3.1 Oil and Gas Related Conflicts**

Given the number of oil and gas related conflicts which NCA had, it is clear that stakeholders in the country must devise new mechanisms for managing coastal devastations. Nigeria's records in degradation management have been poor as manifested in the frequency that some resource crises reoccur and degenerate. More often than not, it is incapable of predicting spillages. Even when reconnaissance reports provide such warnings, the matter is left unattended to until situations degenerate to a level in which crisis decisions have to be made.

Generally, it was observed that attempts to manage violent situations in Nigeria have largely been based on a fire-brigade approach. This often led to a stop-gap and ad hoc remedial measures such as drafting the military to restore normalcy where it has gone beyond the capability of the regular police. The coercive approach in managing man-made environmental threats based on the confrontational approach has become the first line of action than the last option. The approach never gets to the root of any problem and does not address the fundamental matters required to resolve environmental issues.

The second step was to provide relief to victims of oil and gas related crises. The management and distribution of the relief materials by the government and its agencies are often not effectively carried out. Cases of relief items not reaching the victims are common occurrences in Nigeria. It was also observed that the relief materials are often inadequate and disproportionate to the number of people affected. Government at all levels would have to reappraise their relief management and distribution mechanism for it to meet its set goals.

Thirdly, there was the establishment of commissions of inquiry into the oil and gas related conflicts. It was however sad to note that more often than not, no one reads the reports. Even when there is a white paper, the recommendations are hardly implemented. Non implementation means that the conflicts remain unresolved and could be a source of grievance, which could lead to another conflict. A further problem was that the composition and method of such inquiries do not usually allow for adequate local representation and participation. It is essential that such body is well represented in order to take advantage of wide consultations as a means of resolving conflict.

There has been lack of political will in the resolution of environmental conflicts resulting from oil and gas operations in Nigeria. Political actors, oil exploitation companies and local leaders in most areas of environmental conflict hardly sit together to discuss the causes of OGEE violence and how to prevent future occurrence. Leaders hardly meet to make peace and re-establish mutual confidence. Also, the number of unemployed graduates at all school levels tends to be on the rise. Government should therefore, provide a regular platform for collaborative effort by leaders to meet with other stakeholders, such as non-governmental organizations, the media, and labour.

### 3.2 Management Efforts on NCA

The effort of various stakeholders towards adequate management of the NCA has resulted in enactment of stringent environmental laws to regulate the environmental consequences of human activities in NCA. The actions usually results to the creation of certain (government or non-governmental) agencies to effectively monitor and implement those regulations. These laws exit in form of acts or decrees, and treaties (international or multinational agreements). The international agreements give credence to the assertion that environmental problems observe no national boundary. The existing laws and agencies were detailed in Nwilo and Badejo (2006).

### 3.3 International Agreements and Laws

Nigeria is party by ratification to environment based international agreements like: Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Marine Dumping, Marine Life Conservation, Ozone Layer Protection, Ship Pollution, Wetlands (CIA, 2009). In recognition of the dangers of poor handling of environmental matters, various environmental laws exist in Nigeria. These are under-listed as (<http://www.un.org/esa/agenda21/natlinfo/countr/nigeria/natur.htm>):

- Agricultural (Control of Importation) 12 Cap. LFN 1990.
- Criminal code Act Cap. 77 LFN 1990.
- Environmental Impact Assessment (EIA) Decree No. 86, 1992.
- Exclusive Economic Zone Act Cap. 116 LFN 1990.
- Energy Commission of Nigeria Act Cap. 109 LFN 1990.
- Factories Act Cap.126 LFN 1990.
- Federal Environmental Protection Agency Act Cap.131 LFN 1990.
- Harmful Waste (Special Criminal Provisions)Act Cap.165 LFN 1990.
- Land Use Act Cap. 202 LFN 1990.
- Mineral Oil (Safety) Act Cap. 350 LFN 1990.
- Mineral Resources Act Cap. 226 LFN 1990.
- Natural Resources Conservation Council Act Cap. 286 LFN 1990.
- Oil in Navigable Waters Act Cap. 337 LFN 1990.
- Petroleum Act Cap.350 LFN 1990.
- Quarries Act Cap. 385 LFN 1990.
- River Basins Development Authority Act Cap. 396 LFN 1990.
- Standards Organization of Nigeria Act Cap. 412 LFN 1990.
- Territorial Waters Act Cap. 428 LFN 1990.
- Wild Animals Preservation Act Cap. 132 LFN 1990.
- Endangered Species (Control of International Trade and Traffic) Act. Cap. 108 LFN 1990.
- Kainji Lake National Park Act Cap. 197 LFN 1990.
- Petroleum Act Cap. 350 LFN 1990.
- Petroleum (Drilling and Production) Regulations 1969 Cap 350 Vol.xix P.12777.
- Crude Oil (Transportation and Shipment) Regulations 1984 Cap 350 Vol.xix P.12833.
- Water Resources Decree No. 101of 1993.



- Merchant Shipping Act Cap. 224 LFN 1990.
- The Decree 10 of 1987, the Shipping Policy of Nigeria.
- Sea Fisheries Decree 1971 as amended in 1992.
- Sea Fisheries Decree (Licencing Regulation) of 1971 as amended in 1992.
- Sea Fisheries Decree (Fishing Inspection and Quality Assurance) Regulations 1995.
- Sea Fisheries Decree (Fishing) Regulations of 1992.
- Inland Fisheries Decree No. 108 of 1992.
- Inland Fisheries Decree (Fish Quality Assurance) Regulations 1995.

Other instruments of intervention developed so far that have much bearing on integrated coastal zone management, and which are mandatory include:

- National Guidelines and Standards for Environmental Pollution Control in Nigeria (March 1991);
- National Effluent Limitation Regulations, S.I.8 of 1991;
- Pollution Abatement in Industries and Facilities Generating Wastes Regulations S.I.9 of 1991;
- Waste Management Regulation S.I.15 of 1991; and
- Sectoral Guidelines for Environmental Impact Assessment.

### **3.4 Monitoring and Implementation Agencies**

The institutions or agencies setup to monitor and implement various polices relation to the mitigation of disasters in the Nigerian Coastal areas includes: Integrated Coastal Area Management (ICAM), Federal Ministry of Works and Housing, Federal Ministry of Water Resources and Rural Development, Federal Ministry of Transport, Federal Environmental Protection Agency (FEPA), Nigerian Institute of Oceanography and Marine Research (NIOMR), Niger Delta Environmental Survey, Nigerian Conservation Foundation, Federal Ministry of Commerce and Tourism, Niger Delta Development Commission (NDDC), Federal Ministry of Niger Delta, Department of Petroleum Resources, Federal Ministry of Defense (Nigerian Navy), National Emergency Management Agency (NEMA), National Space Research and Development Agency (NASRDA), Federal University of Petroleum Resources, etc.

## **4. SPACE TECHNOLOGY**

Space technology is the integration of satellite based - satellite remote sensing (SRS) GPS and GIS - tools to achieve a unique process in information technology driven mode, particularly in the monitoring and modeling of spatial distribution of environmental phenomena (Eze, 2007). Inputs of stakeholders in coastal resources management has resulted in the launching of NigSAT-1 with 32m ground resolution into the orbit in 2003. NigSAT-2 with a higher resolution was recently launched into orbit (2011). However, it has been alleged that administrative “bottle necks”, non-justification of huge monetary input on NigSAT-1, and subsequent disappearance of Nig-CommSAT from space in November, 2008 were possible

factors that led to delay in launching of NigSAT-2 initially proposed for 2007. The federal government of Nigeria has tasked stakeholders to justify investments in space satellites. The management of the environmental challenges in NCA entails production of several digital thematic maps.

#### **4.1 Digital Mapping**

The thematic maps of the Nigerian coastal area will be such that best describes visually and spatially the past, present and future state of the area. In order to describe and delineate human and physical elements that impact directly or indirectly on the coast, the immediate environs of the coast must also be in focus. In order to fully support the sustained utilization of the area, the mapping and geospatial databases creation entails the production of:

- Header Maps:
    - Map of Nigeria highlighting the Coastal areas (figure 1)
    - Map of Coastal areas highlighting the component states
    - Map of the Coastal areas showing major cities and towns
  - Socio-Economic Maps:
    - Maps of the coast showing mineral sites
    - Map of the area showing functional mineral exploitation sites
    - Map of the area showing land use
    - Map of the area highlighting forests reserves
  - Physical Maps:
    - Map of the coast showing various landforms
    - Map of the area showing rivers and tributaries with their drainage pattern
    - Relief map of the area (contour and wireframe).
    - Climatic map of the coast (Isotherm development).
    - Soil map of the area.
  - Ecological Map:
    - Map of coastal areas highlighting erosion sites.
    - Map of the area showing major flash points.
    - Map of oil spills in the areas and other encroachments
- Coastal management map based on sub-division of the reserve into management units.
- Others:
    - Special information maps based on human and physical elements in the coastal areas.
    - Special information maps based on strategy and needs

#### **4.2 Methods and Strategies**

The implementation strategies as it concern mapping with space technology tools is broadly divide into two phases (land survey based operation and thematic mapping operation).

##### **4.2.1 Land Survey Based Operation**

The process entails location and recovery of loss beacons if any and the resurvey of the area. This involves sitting of more beacons for proper and adequate delineation as applicable. The

new area of coverage is recalculated using coordinates from the resurvey product. Encroachment identification and delineation may be done in situ or indirectly using satellite remote sensing (SRS) image (data) such as IKONOS (1m resolution) or Quick-bird (0.68m resolution). Detailing of other relevant land marks or features in or around the coastal environment could be implemented in situ or indirectly using spatial electronic data collectors such as GPS. This may be downloaded to an automated (computer) and overlaid on the base.

#### 4.2.2 Thematic Mapping Operation

This entails mapping thematically, the past, present and possible future state of the coastal area as it concerns management and monitoring. Consequently, the following procedures must be followed in the realization of all the above objectives:

- **Recognizance (office and field):** The conventional method of pillar recovery will be avoided whenever it is possible. This is because of the labour intensiveness it demands, rather satellite technology with respect to mapping and positioning application will be used. In this regard, the local coordinate system with which the coastal area plan was made will be converted to UTM or MTM grid coordinate and then uploaded into a GPS or total station for recovery operations.
- **Beaconing/Resurvey:** Following step 1, lost pillars will be replaced (beaconed). A resurvey operation will be done using national origin as a datum and UTM grid coordinates. A precise GPS of not more than 1meter RMSE may be used or a total station be used when satellite visibility is not possible.
- **Thematic Mapping:** In realization of the mapping objective in the study, two set of satellite images will be used. A land observation satellite (landsat) image of not more than 3 years old and another of not less than 10 years. The later will be used for change detection verification across the coastal areas. The image (raster) will be properly geo-referenced so as to properly geo-locate objects from field observations.

#### 4.3 **Instrumentation and Softwares**

The under-listed instrument and implementing softwares will be useful tools in the hands of a map maker concerning coastal area degradation and management:

- GPS – Germin GPS 72 and Germin e-trex.
- Total stations.
- Kanistar compass and tripod.
- Detachable ranging rods of 3meters.
- 100meter measuring tape as back up.
- AutoCAD 2009 or 2010.
- ArcGIS 9.0 or 10.0 versions.
- ERDAS imagin or IDRISI version 2.0 or later
- Sufa 7.0 or 8.0.
- Microsoft office 2007 or Window 7.

## 5. CONCLUSION AND RECOMMENDATIONS

The realization that no amount of on-going plans are too ambitious to ensure protection of the environmental values of the coast, because the challenges we face are too large to ignore. It's not our right to pass on these coastal problems to the next generation; thus, efforts to solve them must not relent. The impact of the human induced actions on this oil rich ecosystem has raised questions of great concern to stakeholders, particularly oil bearing communities who have suffered polluted air, water resources, degraded forests and farm lands, and very high atmospheric temperatures for about forty years now. The federal government should provide the political and economic will for job creation, to reduce unemployment, jobs or activities of doubtful values in the area. Notwithstanding the dominant positions of the private and multinational sectors in our coastal area, the government's role in providing some public goods and services and in framing the basic rules of economic activities in terms of safety standards, protecting the social services and infra-structure, protecting the vulnerable segments of the society and maintaining a non distortionary policy continues to be important.

## REFERENCES

**Agenda 21:** <http://www.un.org/esa/agenda21/natlinfo/countr/nigeria/natur.htm>. visited March 29th, 2009.

**Afinowi, M.A and Ezenwa, B.I.O (1982):** Coastal Aquaculture: Development perspectives in Africa and Case studies from other regions. In Food and Agriculture Organization of the United Nations Organisation des nations unies pour l'alimentation et l'agriculture, Rome 1982. Edited by André G. Coche, CIFA Technical Secretary (Aquaculture). Inland Water Resources and Aquaculture Service. Fishery Resources and Environment Division

**CIA (2009):** CIA - The World Factbook -- Nigeria.mht, March 19<sup>th</sup> 2009 update. Visited March 28, 2009.

**Eze, C.G. (2007):** Application of Remote Sensing and Geographic Information System for Creation and Management of Enumeration Areas in Enugu State, Nigeria. A PhD Dissertation Submitted to Department of Surveying and Geoinformatics, Nnamdi Azikiwe University, Awka-Nigeria.

**Njobuenwu, D. O. and Abowei, M.F.N. (2008):** Spreading of Oil Spill on Placid Aquatic Medium. Leonardo Journal of Sciences ISSN 1583-0233 Issue 12, January-June 2008 p. 11-24 .

**Nwilo, P.C. and Bacejo, O.T. (2006):** Impacts and Management of Oil Spill Pollution along the Nigerian Coastal Areas

**Osaji, P. (2009):** Delta Commits N123.4b to Roads, Bridges, Airport, Others. By Tunke-Aye Bisina Snr Correspondent, Asaba, Daily Independent 19<sup>th</sup> March, 2009 at; <http://www.nigeriamasterweb.com/paperfrmes.html>

**Osuji, L.C. and Nwonye, I. (2007):** An appraisal of the impact of petroleum hydrocarbons on soil fertility: the Owaza experience. African Journal of Agricultural Research Vol. 2 (7), pp. 318-324, July 2007. Available online at <http://www.academicjournals.org/AJAR>. ISSN 1991- 637X © 2007 Academic Journals. Visited 10<sup>th</sup> March, 2009.

**Tribune (2009):** Vice President is Hostage in Aso Rock - Asari Dokubo. Donald Ojogo, Burea Chief, South-South - 21.03.2009. Available at: <http://www.tribune.com.ng/21032009/news/news9.html>

## **BIOGRAPHICAL NOTES**

**Dr. C.G. Eze** serves as a Senior Lecturer of Geoinformatics at the Nigerian Army Institute of Technology and Environmental Studies (NAITES) NASME, Makurdi, Nigeria. He was the founding coordinator of the National Board for Technical Education (NBTE) accredited programme of the ITES (now NAITES). He holds a PhD in Surveying and Geoinformatics from the Nnamdi Azikiwe University, Awka, Nigeria. Dr. Chiji Eze is a rare combination of intellectual and professional officer who holds a regular combatant (RC) commission with the Nigerian Army. He has dutifully blended academics and research, with combat engineering task and the tactics of modern warfare. He is a member of the Nigerian Institute of Surveyors (NIS). Chiji is married with children. He likes playing volley ball and appreciating nature.

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