

## ECOSYSTEM SERVICES OF THE NIGER DELTA FORESTS, NIGERIA

\*JASPER EZENWAKA<sup>1</sup> AND \*\*ANIL GRAVES

\*Department of Crop Production Technology, Faculty of Agriculture, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria, ([Jezenwaka@Yahoo.Co.Uk](mailto:Jezenwaka@Yahoo.Co.Uk); [J.Ezenwaka@Cranfield.Ac.Uk](mailto:J.Ezenwaka@Cranfield.Ac.Uk); +234 (0) 8037845905;

\*\*School Of Environment, Energy And Agri-Food, Cranfield University, Cranfield, Bedfordshire, England, MK43 0AL, UK ([a.graves@cranfield.ac.uk](mailto:a.graves@cranfield.ac.uk))

### ABSTRACT

*This research aimed to appraise the Niger Delta forest ecosystem services. The Millennium Ecosystem Assessment framework was used to categorize the potential benefits from the Niger Delta forests. Data was collected from 90 respondents drawn from selected rural and urban communities. While the urban respondents were aware of all the range of services provided by the forest, the rural respondents had zero knowledge of many of the services. Despite the good knowledge of ecosystem services by the urban respondents, only 42.5% were aware of fresh water provisioning services and only 27.5% were aware of water purification services. Both the urban and rural respondents had preference for the “provisioning services”. Rural populations were particularly dependent on consumptive and extractive benefits for livelihoods and wellbeing. The results highlighted the dependency of local people on provisioning services for basic livelihood requirements and the asymmetric distribution of education and information regarding forest benefits between urban and rural populations. The need for environmental awareness creation and improved access to information of the unseen and un-valued benefits of the Niger Delta forest ecosystem is emphasized.*

**Keywords:** Livelihoods, forest, ecosystem, services, Niger-Delta,

### INTRODUCTION

The Millennium Ecosystem (MA) Assessment (Assessment, 2005) described an ecosystem as “a dynamic complex of plant, animal and micro-organism communities and the non-living environment interacting as a functional unit”. The benefits that people derive from their ecosystems are collectively referred to as *ecosystem services* (Assessment, 2005; DEFRA, 2007; Graves et al., 2009). The importance of the ecosystem services (ES) concept is in how it shows the diversity of flows of benefits from the natural environment and as well provides a means for valuation and recognition of both “value in use and non-use” (Graves et al., 2009). Since the Millennium Ecosystem Assessment (MA) framework highlighted the critical dependency of humankind on the environment, and the degradation that puts that dependency at risk, the

ecosystem services concept has been used as a means of identifying, categorizing, and valuing the benefits that ecosystems provide, and the concept is now firmly established as an analytical tool in policy agenda (Gómez-Baggethun et al., 2010; Fisher et al., 2009).

Ecosystem services are very important to the wellbeing and survival of people. Society depends on the continuous provision of ecosystem services for wellbeing and especially in poor countries where ecosystem services are fundamental in many people's livelihoods. These services according to the MA (Assessment, 2005), include:

- i. *Provisioning services* such as food, fresh water, wood, fuel and fiber;
- ii. *Regulating services* that affect climate, flood, disease, and water purification;
- iii. *Cultural services* that provide recreational, educational, aesthetic, and spiritual benefits; and
- iv. *Supporting services* such as soil formation, photosynthesis (primary production) and nutrient cycling.

The recognition and valuation for each of the above ecosystem services vary greatly depending on whether the impact is direct or indirect. Those services that have a direct impact on livelihoods (such as food, fiber, fuel wood, some cultural services and recreation) are more easily recognized and valued. Other services provided by the ecosystem (such as regulation of the climate, the purification of air and water, flood prevention, soil formation and nutrient cycling) are less recognized and valued, and therefore take the form of "non-market, public goods whose values are difficult to directly ascertain" (DEFRA, 2007; Graves et al., 2009) and this also provides the reason why they are frequently omitted within decision-making and policy appraisals (Isoun, 2006; DEFRA, 2007; Graves et al., 2009).

Forests are often referred to as natural capital and are considered as a stock of capital or assets of given quantities and qualities (Graves et al., 2009). They are also identified as one of the livelihood assets (capitals) in the *Sustainable Livelihood Framework* (Carney, 1998; DfID, 1999). Natural capital supports a number of interrelated ecosystem functions such as "production, regulating, habitat, carrier, and information, to provide capacity to produce a variety of ecosystem goods and services that have value for humans" (De Groot et al., 2002).

Nigeria is endowed with abundant natural resources, both renewable and non-renewable. The oil and gas which accounts for about 95% of Nigeria's export earnings and about 80% of the total annual income (Darah, 2001) has over the years become a cause of many conflicts in the Niger Delta region of Nigeria. Apart from crude oil, the region is also rich in forest resources that are important in the livelihoods of local people. Whilst the forests are of little financial worth (to the government) relative to the export earnings of oil and gas, they are of significant importance to the livelihoods of local stakeholders

and have a range of beneficial market and non-market impacts, providing a source of income, fuel wood, medicine, food, leaves, and raw materials (Obot, 2006; Allison-Oguru, 2006).

The Niger Delta is made up of wetlands, which are considered amongst the most bio-diverse on earth (Obot, 2006) and within these wetlands, distinct vegetation types (the mangroves, freshwater swamp forests and lowland rain forests) are found.

The many islands, rivers, creeks, and other water bodies that are found in the Niger Delta impressed the early Europeans who took several centuries to discover the great natural beauty and economic potential of the area (Allison-Oguru, 2006). As a result of this, Kingsley (1897) stated "*the great swamp region of the Bight of Biafra is the greatest in the world and that in its immensity and gloom it has grandeur equal to that of the Himalayas*". Leonard (1906) also said "*the country (the Niger Delta area) may be described as one in which Nature is at her worst. From the slime and ooze of the soil up to the devitalizing heat and humidity of the atmosphere, it leaves its mark on the people as an enervating and demoralizing influence.*"

Over 80% of the Niger Delta region is seasonally flooded during the wet season. As the dry season progresses, floodwaters recede, leaving permanent swamps and pools. The Niger Delta experiences strong tidal influences with seawater flowing as far inland as to the freshwater floodplains of the River Nun. These tidal flows create varied ecological niches that support complex and diverse life forms (Obot, 2006; LENF, 1998; SPDC, 2015).

The Niger Delta contains ecosystems that are locally and globally of ecologic and economic importance. Singh *et al* (1995) stated that "the full significance of the Niger Delta's biodiversity still remains unknown because new ecological zones and species continue to be discovered and major groups, such as higher plants and birds, remain unstudied in large areas". Powell (1995) considered the Niger Delta a "biological hotspot" with many locally and globally endangered species. Obot (2006) also described the diverseness and eco-importance of the Niger Delta ecosystem.

These highly varied and complex ecosystems offer a variety of important ecological services to local stakeholders. For example, they are a source of wood, meat, raw materials, fruits and medicines (LENF, 1998; Alagoa, 1999; SPDC, 2015; Obot, 2006). The traditional uses of the forests and waterways of the Niger Delta have supplied virtually all the needs of its people (Isoun, 2006).

A wide range of timber and non-timber-forest-products including aquatic resources are collected for food, medicines and utensils. The extent of use and the value of these resources are not valued in economic assessments and in planning for government and other interventions such as conservation actions (Isoun, 2006). The government's conservation plans usually restricts access to these resources and thus have real potential for increasing poverty and conflict (Amoru, 2000; Isoun, 2006).

Water is another vital resource to the Niger Delta people. There are very few activities in the Niger Delta that are not directly or indirectly linked to water. Water in the Niger Delta is far more than a simple element of nature. According to Anderson and Peak (2002), in the Niger Delta “water is synonymous with life itself, with spiritual sustenance, with wealth and prosperity, and especially with communication and identity”.

**Box 1: Some Benefits derived from the Niger Delta Ecosystem**

- Wildlife (duikers, civets, monkeys, cane rats (grass-cutters), porcupines, pangolins *Manis* sp., giant rats *Cricetomys* sp., squirrels, bush pigs, monitor lizards *Varanus niloticus*, otters, water chevrotains); snails, giant snails *Achatina* sp., swamp and lake/pond fish, oysters crabs and periwinkles.
- Medicines: Animal parts and skins for traditional medicine and trophies
- Many fruits, leaves, roots, barks and nuts for medicine, food, and spices (e.g. “ogbono” or bushmangos *Irvingia* sp., “afang” leaves *Gnetum* sp., charcoal from *Rhizophora*, and kola nuts *Cola* sp.)
- Plant parts and extracts for cosmetics, dyes
- Rattan for canes, ropes, fish drying racks
- Honey
- Wine from *Raphia* palms
- Plant and animal parts for traditional cultural uses or arts/crafts.
- Shells and saplings for road and path surfacing
- Leaves for wrapping foods for preservation and steaming
- Saplings/vines for construction, fishing equipment and utensils, etc.

**Source: Isoun (2006)**

Ezenwaka *et al* (2004), Obute (2005) and Ogbe *et al* (2009) researched the medicinal benefits derived from the ecosystem by the Niger Delta people, and concluded that people derive many benefits from medicinal plants. Some were found to earn their livelihood from the sale of medicinal plants and the medicinal plant products. Traditional medicine men earn their living from the sales of these plants and a sizable percentage of the population depended on traditional medicines for their health needs, and for treatment or prevention of diseases (Gesler, 1984; Dauskardt, 1990) following traditions that go back centuries. Akerele *et al* (1991) confirmed the benefits derived from medicinal plants and called on the UN and its agencies to take action for the conservation of medicinal plants.

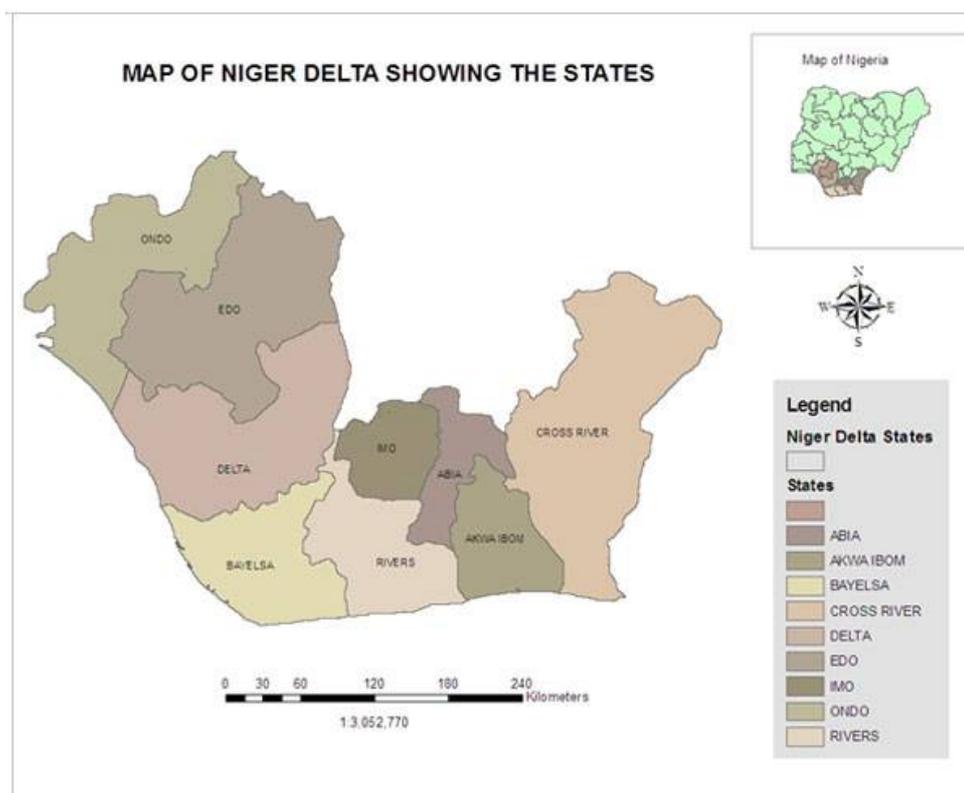
In view of the foregoing, this research aimed to identify how aware the Niger Delta people were of the various ecosystem services provided by the Niger Delta forests and to assess how important these services were to them. This study has become important because of the disproportionate emphasis placed on crude oil production in the region (to the detriment of other resources) and the resultant unrest and conflict that has characterized the region since the 1990's to the present date.

## METHODOLOGY

### Niger Delta region and case study sites

The field study was carried out between October 2013 and May 2014 in Bayelsa State, Niger Delta, Nigeria. Respondents were drawn from two rural communities (Akpide-Biseni and Akipelai-Ogbia), and one urban centre (Yenagoa). The rural communities were chosen bearing in mind (i) the major forest covers in the Niger Delta, (ii) accessibility, (iii) major livelihood activities of the people (i.e. forest dependent), (iv) absence of inter / intra communal conflicts, and (v) population size (less than 3,000 inhabitants). Akpide-Biseni is in a freshwater swamp forest zone while Akipelai-Ogbia is in a mangrove forest zone; both rural communities have pockets of rainforests. Yenagoa, although an urban centre, is also located within freshwater swamp and rainforest ecosystems. Two of the three study communities are hosts to a government forest reserve (Akpide is in the Taylor Creek forest reserve and Akipelai is in the Edumanom forest reserve).

It is worthy to mention that politically, the Niger Delta is comprised of nine states, out of the 36 States and a Federal Capital Territory (FCT) that make up the Federal Republic of Nigeria (NDDC, 2000). The nine States of the Niger Delta (Figure 1) are crude oil producing; they include Ondo, Edo, Delta, Bayelsa, Rivers, Imo, Abia, Akwa-Ibom and Cross River.



**Figure 1: Niger Delta as defined by the NDDC Act (Nwankwo and Ogagarue, 2012)**

The NDDC's definition has included the entire oil mineral producing States rather than the States, which are within the catchment of the Delta of the Niger River. In geographic terms, Anderson & Peek (2002) stated "the delta of the Niger River extends about 450km eastwards from Benin River estuary on the West and terminates at the mouth of the Imo River in the East". By this definition, the geographic (true) Niger Delta (Figure 2) is confined to only three States - Delta, Bayelsa and Rivers States. This area is estimated to be about 70,000km<sup>2</sup> "consisting of barrier islands, estuaries, mangroves, creeks and freshwater swamps" (Obot, 2006).

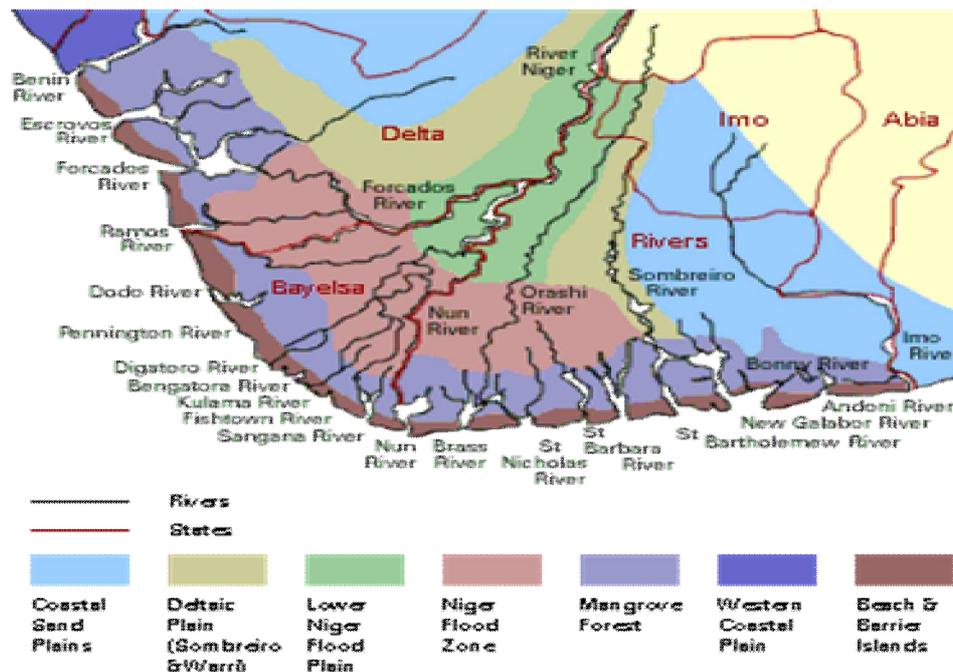


Figure 2: Geographic Niger-Delta (Ezenwaka, 2002)

According to the 1991 Nigerian census, the political Niger Delta is home to 20,386,303 people (NPC, 1991). In other words, almost 20% of the entire Nigerian population lives in the Niger Delta. The inhabitants of the Niger Delta are mostly fishers and farmers (Allison-Oguru, 2006). They engage in fishing in the creeks and rivers, as well as in the open seas. Non-Timber Forest Products (NTFPs), such as lianas, rattans, snails, leaves, roots, fuel wood, wildlife, fiber, fruit, gum, and honey, are a source of income to the people (LENF, 1998). The livelihood of the people is intricately tied to their immediate environment (Ezenwaka and Abere, 2009).

**Development and use of ecosystem services questionnaire**

The MA's ecosystem services framework (Figure 3) was adapted for use for the collection of field data. The questionnaire was used to collect category data

on respondent's awareness of forest ecosystem services from both urban and rural respondents. Whilst in the urban areas, the questionnaire was self-administered, in the rural areas, the questionnaire was used as an interview schedule to guide discussion during the interview, as many could not read or write. The category data were collected directly on the questionnaire form whilst the narrative data were collected using written notes and a voice recorder, where possible.

Seventy-five questionnaires were randomly distributed within the Yenagoa metropolis. From this number, 52 were retrieved but only 40 were properly completed and usable. In each of the two rural communities, 25 persons were interviewed representing various community stakeholder groups e.g. council of chiefs, community development committees, farmers, fishermen, traders, hunters, artisans, women, youth, etc. In total therefore, there were 90 respondents. In the rural communities, a local facilitator was engaged to help interpret the questions into the native language. This was in addition to the researcher having to use the Pidgin English language (generally spoken within the region) to explain each of the services to the respondents. The entire concept was translated into locally relevant ideas that the rural dwellers could identify with. In order to improve accuracy, the same question was asked in different styles. Each interview lasted between 30-50 minutes.

The questionnaires were retrieved from the urban respondents and the results collated. In the rural areas, the response of the interviewees was noted against each question as the semi-structured interviews proceeded. The results were also then collated.

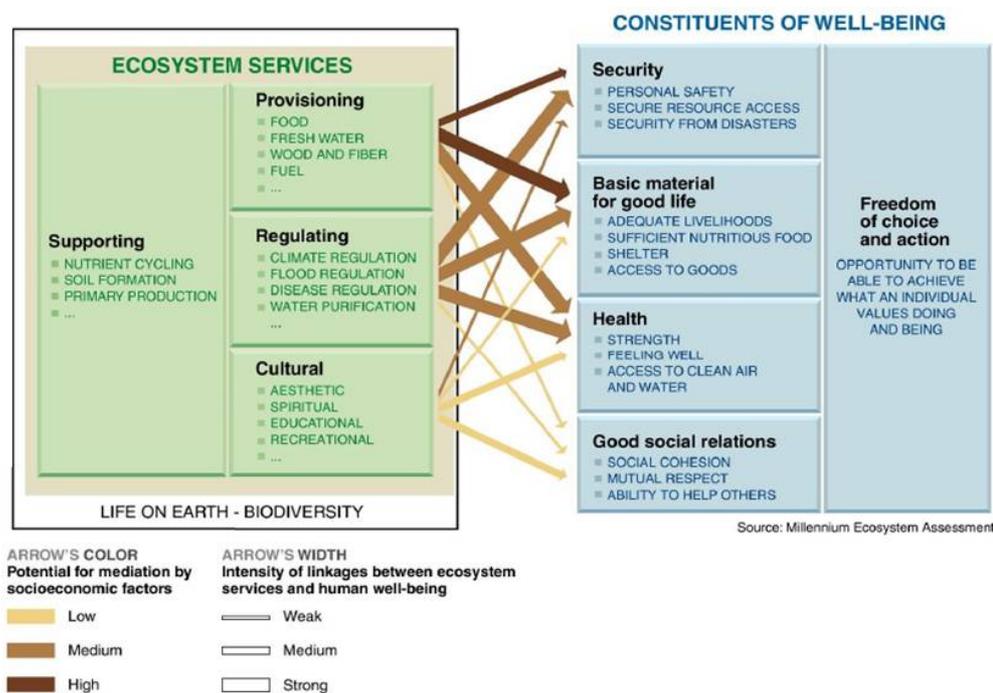


Figure 3: Ecosystem Services Framework (Assessment, 2005)

### Data analysis and presentation

The data from the survey were collated in an Excel spreadsheet and were analysed to obtain basic statistical information that are presented in histograms. This was done because the main aim was to identify how many and to what extent, respondents were aware of forest ecosystem services in the Niger Delta Nigeria.

The narrative data were written down in a summary transcript and then coded using thematic content analysis (Corbin and Strauss, 2008; Taylor-Powell and Renner, 2003) to develop understanding of how urban and rural dwellers felt they benefitted from the forest.

## RESULTS AND DISCUSSION

### Awareness of ecosystem services

The general result shows that the urban dwellers are more aware of the various ecosystem services than the rural dwellers (Figure 4). While the urban dwellers have fairly good knowledge of all the services (though very few of them, 42.5%, had knowledge of fresh water provisioning and another 27.5% have knowledge of water purification services), the rural dwellers have no knowledge of fresh water and fibre provisioning, aesthetics and educational value, no knowledge of any regulating services and are not aware of primary production function (Figure 5).

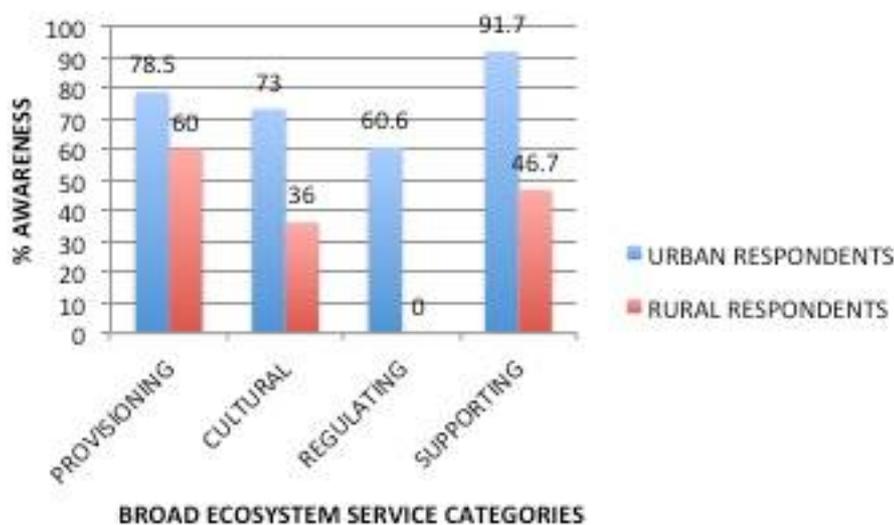
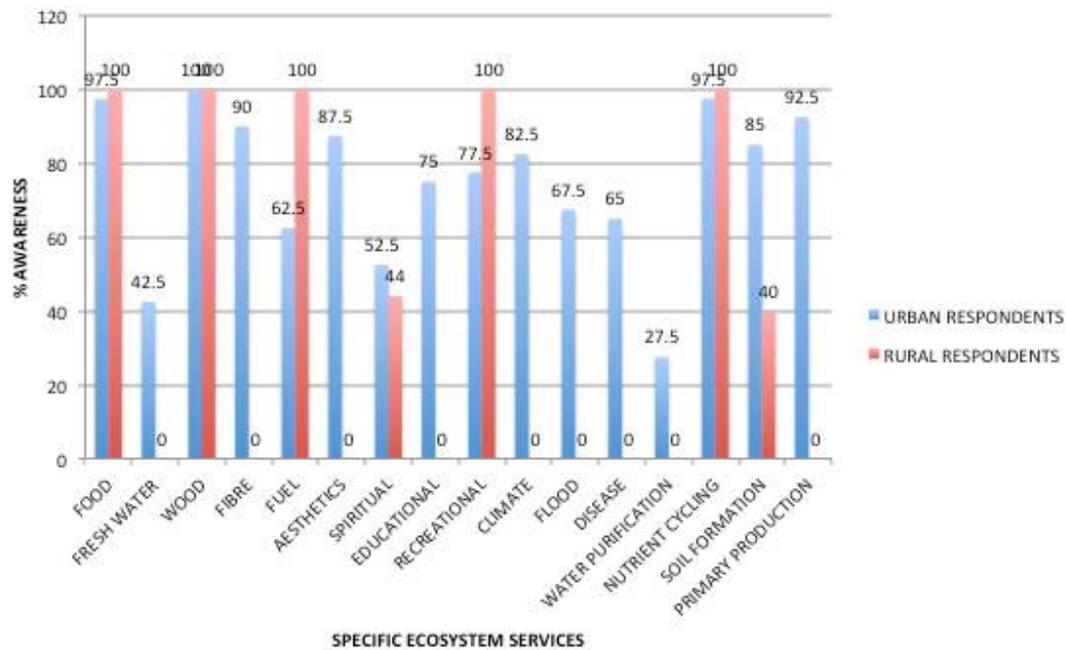


Figure 4: General Knowledge of ES by Urban and Rural Respondents



**Figure 5:** Knowledge of specific forest ES by urban and rural respondents

While it is encouraging that more than 50% of the urban respondents are aware of most of the ecosystem services, less than half of them are aware of services such as water provisioning and purification. Also, the rural respondents are only mostly aware of those benefits that relate to their daily livelihoods (as they lack knowledge of fresh water provisioning, fibre, aesthetics value, educational, climate regulation, flood, disease, water purification and primary production). These unknown services are vital to the wellbeing of these rural dwellers as much as the well-known services.

### **Awareness by the Urban respondents**

From Figure 4 and Figure 5, it is encouraging to see that the urban respondents are aware of all the ecosystem services as listed in the MA’s framework (Assessment, 2005) although the percentage of those that are aware of specific ecosystem services differ. While all of the urban respondents (100%) are aware that the forest provides “wood”, it was 97.5% of them that knows of “food” and “nutrient cycling” services. 92.5% of the urban dwellers are aware of the “primary production” function of the ecosystem while 90% are aware of “fiber” provisioning. 87.5% of them agrees to the “Aesthetics” value of the ecosystem while only 85% appreciates the “soil formation” function. While 82.5% of them knows of the “climate” regulation function of the forest ecosystem, the percentage awareness drops to 77.5% for “Recreational” service, 75% awareness for “Educational” function, 67.5% for “Flood” regulation, 65% for “Disease” regulation, 62.5% for “Fuel” provisioning and

52.5% awareness for "Spiritual" services. The percentage awareness for "Freshwater" provisioning and "Water purification" services were the lowest where the awareness were just 42.5% and 27.5% respectively for the urban respondents.

This tells that the urban residents think of "wood" essentially when the word "forest" is mentioned. The exceptionally low awareness for "freshwater" provisioning and "water purification" service is worrisome.

When the average of the awareness scores is calculated under each broad ecosystem category, we see the highest average score of 91.7% for "Supporting" services, followed by 78.5% for "Provisioning", 73% for "Cultural" and 60.6% for "Regulating" services. The exceptionally low score for "Freshwater" under the "provisioning services" has contributed to why the "Supporting services" had the highest average score; for instance, if the highest three scores are considered for the "Provisioning services", the average score for this category would have been 95.8%.

### **Awareness by the Rural respondents**

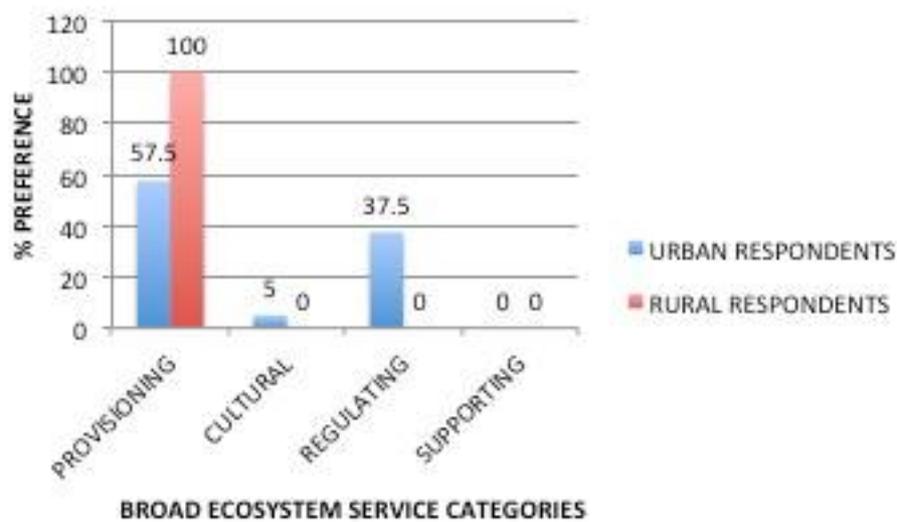
It is a sharp contrast when compared with that from the urban dwellers. Figure 4 and Figure 5 shows that the rural dwellers are only aware of such ecosystem services as relate directly with their livelihood provisions. A 100% of them are aware of "food, wood and fuel" provisioning as well as "recreational and nutrient cycling" services. Only 44% of them are aware of "spiritual" services and just 40% are aware of "soil formation" services. Beyond the above listed ecosystem services, no other ecosystem service is known to the rural dwellers. Although these other unknown (freshwater, fiber, aesthetics, educational, climate, flood, disease, water purification and primary production) services affect their lives as well on a daily basis, they seem not to be conscious of it. They simply are not aware of it.

The average scores for the broad ecosystem categories sees the "provisioning services" having the highest average awareness score of 60%. This score is this low because of the zero scores for "freshwater and fiber" provisioning services. The second highest average score is for the "supporting services" with an average awareness score of 46.7%. These people are farmers and are aware of the nutrient cycling function of the forests as they practice shifting cultivation as a system of farming. The third is "cultural services" with an average awareness score of 36%. The worst is "regulating services" where there was no score at all.

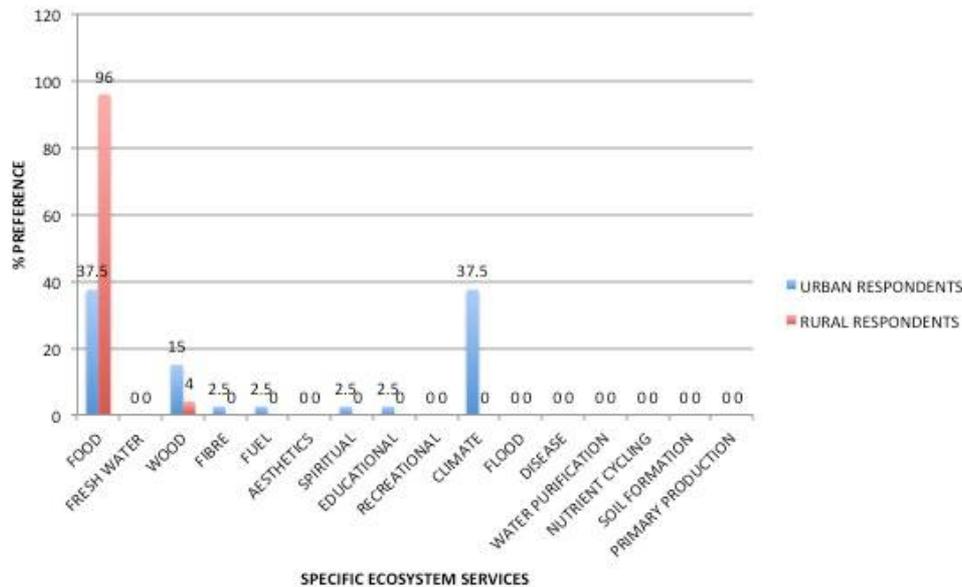
The low awareness by the rural dwellers of many ecosystem services is a thing of concern because these are the closest people to the forests and their daily activities impacts on the ecosystem service flows.

### Preference for ecosystem services

With regards to general preference for the forest ecosystem services (**Error! Reference source not found.**), 57.5% of the urban respondents preferred the provisioning services of the forest ecosystem while another 37.5% preferred the regulating services. The remaining 5% preferred the cultural services. No urban respondent wanted the supporting services. The rural respondents showed a big contrast with 100% of them preferring the provisioning services. On specific preferences for these services (**Error! Reference source not found.**), 37.5% of the urban respondents preferred the food provisioning and climate regulating functions of the forest ecosystem while 96% of the rural respondents showed preference for food provisioning services.



**Figure 6:** General preference for ES by urban and rural respondents



**Figure 7:** Preference for specific ES by urban and rural respondents

The “provisioning” ecosystem service was the most important ecosystem service to rural people. An equal number of urban respondents (37.5%) showed preference for food provisioning and climate regulating functions of the ecosystem.

### Most important forest ecosystem service

The urban respondents felt that “food provision” (37.5%) and “climate regulation” (37.5%) were of greatest importance as forest ecosystem services and both were given equal importance (Figure 6 and **Error! Reference source not found.**). The reasons for this were because the urban people knows that most food products are from the forest areas and are also equally aware of various environmental campaigns aimed at curtailing global warming and climate change. However, when the percentage scores of the specific services are added together under each broad ecosystem service categories, we have 57.5% of the urban respondents preferring the “provisioning” services. The score of 37.5% for the “regulating” services from the urban respondents shows their level of awareness to the importance of the forest in this regard. The score of a total of 5% for “cultural” services tells that a few urban residents still appreciate this service compared to a score of 0% for “supporting” services.

The above is a huge contrast to that of the rural respondents. The rural dwellers placed more value on “food” as 96% of them preferred “food” while the remaining 4% preferred “wood”. It is worth mentioning that the 4% that preferred “wood” are actually loggers; logging is their source of livelihood and therefore the most important service from the ecosystem to them, is “wood”. When the scores are added together, 100% of the rural dwellers chose

“provisioning” services of the forest ecosystem above all other services. This is in line with the MA’s (Assessment, 2005) statement that the ecosystem services are very important to the livelihoods of especially, the poor. They have no other alternatives; to them, the ecosystem services, is life. The result of the interviews also shows a 100% of them depending on environmental resources for sustenance. They do not have any other source to earn a living.

### **The usability of the MA’s ecosystem framework**

The MA’s ecosystem framework (Assessment, 2005) was useful during this field work. It covered most of the services people could identify with. There were other services provided by the Niger Delta environment that this framework did not classify. Transportation was found to be an important service for the riverine Niger Delta communities. Many of the communities in the Niger Delta cannot be accessed by road. They rely on the water networks for transportation of both humans and goods. It is these same river networks that take them to their farmlands and it is a sign of wellbeing to own a canoe in these communities. Other versions of the ecosystem framework (De Groot, 2006) listed transportation under “carrier” functions of the ecosystem. Fishing and table salt production are among other uses to which the water resource of the Niger Delta is put (LENF, 1998; Isoun, 2006).

Other very important provisions from the Niger Delta forests, which were not listed in the MA’s framework, are medicines and raw materials; the rural respondents mentioned these as part of benefits from their forests. LENF (1998), Alagoa (1999), SPDC (2015), and Obot (2006) confirms the importance of the Niger Delta forests in providing medicines and raw materials for the people. DEFRA (2007) listed medicine under the “provisioning” services while De Groot (2006) listed medicine and raw materials under the “production” functions. De Groot (2006) listed mining, waste disposal and cultivation under the “carrier” functions. It was observed that these are true for the rural dwellers of the Niger Delta; sand mining and domestic waste disposals were observed at their streams.



**Figure 8:** Fiber boat, powered by an outboard engine is a means of commercial transportation in the Niger Delta. They are faster than the locally dug out wooden canoes.



**Figure 9:** Wooden canoe; a valuable transport asset to local people. It is more affordable than the fibre boat. It is a sign of wellbeing to own one in these

communities. Figures 8 and 9 shows the waters as a means of transportation and movement of goods in the Niger Delta.



**Figure 10:** Fishing gears (Non-return valve trap) made from Rattan



**Figure 11:** Production of furniture items from Rattan

Figures 10 and 11 shows the forest as a source of raw materials. Rattan is a useful raw material harvested freely from the Akpide forest. It is used in making items including fishing gears and furniture. The man in Figure 10 earns his living from the harvesting and use of rattan.



**Figure 12:** Fuel wood for domestic cooking; Rural people do not have easy access to other means of domestic fuel for cooking; they rely on firewood, which are freely available in their forests.



**Figure 13:** Sand mining from perennial streams; a means of livelihood for some rural dwellers. It is their source of sand for building and other works. *(Photos by Jasper Ezenwaka, 2014)*

The forest is considered by the rural dwellers as a source of income and employment. The MA (Assessment, 2005) stated that the ecosystem services are vital to the livelihoods of especially, the poor. In Nigeria, the extent of use and the value of these resources are not valued in economic assessments and in planning for government and other interventions such as conservation actions (Isoun, 2006). The government's conservation plans usually restrict access to these resources and thus have real potential for increasing poverty and conflicts (Amoru, 2000; Isoun, 2006).

### **CONCLUSION AND RECOMMENDATIONS**

It is concluded that the forest is valuable to both the urban and rural dwellers of the Niger Delta Region of Nigeria. It has also become evident that apart from crude oil, for which the region is known, the dwellers appreciate other services provided by their environment.

However, the low awareness level of some of the vital ecosystem services calls for immediate / urgent actions to be taken to make positive changes. The Niger Delta is a region where because of the difficult terrain; most of the forests (especially the mangroves) have not been lost to logging. Government and her development partners should invest in awareness creation as regards the benefits of conserving these forest resources.

### **REFERENCES**

- Akerele, O., Heywood, V. H. and Synge, H. (1991), *The Conservation of medicinal plants: proceedings of an international consultation, 21-27 March 1988 held at Chiang Mai, Thailand*, Cambridge University Press.
- Alagoa, E. J. (1999), *The land and people of Bayelsa state: Central Niger Delta*, Onyoma Research Pub.
- Allison-Oguru, E. A. (2006), "Socio-economic characteristics of the Niger Delta", in Ezealor, A. and Akinsola, O. (eds.) *The Renewable Natural Resources of the Niger Delta; Options for its Sustainable Management*, Nigerian Conservation Foundation, Lagos, pp. 15-31.
- Amoru. (Director of Forestry, Ministry of Environment, Bayelsa State), (2000), *The impact of forest exploitation and crude oil prospecting activities on natural forests and forest plantations in Bayelsa State, Nigeria* (unpublished Presentation), Yenagoa, Bayelsa State, Nigeria.
- Anderson, M. G. and Peek, P. M. (2002), "Ways of the rivers: Arts and environment of the Niger Delta", *African arts*, , pp. 12-93.

- Assessment, M. E. (2005), *Millennium Ecosystem Assessment Findings*, Millennium Ecosystem Assessment.
- Carney, D. (1998), "Sustainable rural livelihoods: what contribution can we make? Papers presented at the Department for International Development's Natural Resources Advisers' Conference, July 1998.", *Sustainable rural livelihoods: what contribution can we make? Papers presented at the Department for International Development's Natural Resources Advisers' Conference, July 1998*. Department for International Development (DFID), .
- Corbin, J. and Strauss, A. (2008), *Basics of Qualitative Research*, 3rd ed, Sage publications, London.
- Darah. (Niger Delta Environment Managers Development workshop, Airport Hotel, Port Harcourt), (2001), *The Politics of oil in the Niger Delta* (unpublished Presentation), Port-Harcourt, Nigeria.
- Dauskardt, R. P. (1990), "The changing geography of traditional medicine: urban herbalism on the Witwatersrand, South Africa", *GeoJournal*, vol. 22, no. 3, pp. 275-283.
- De Groot, R. (2006), "Function-analysis and valuation as a tool to assess land use conflicts in planning for sustainable, multi-functional landscapes", *Landscape and Urban Planning*, vol. 75, no. 3, pp. 175-186.
- De Groot, R. S., Wilson, M. A. and Boumans, R. M. (2002), "A typology for the classification, description and valuation of ecosystem functions, goods and services", *Ecological Economics*, vol. 41, no. 3, pp. 393-408.
- DEFRA, U. (2007), *An introductory guide to valuing ecosystem services*, Department for Environment, Food and Rural Affairs (Defra), UK, UK.
- DfID, U. (1999), "Sustainable livelihoods guidance sheets", *UK DFID Department for International Development: London.*) Available at: [Www.Livelihoods.Org/info/info\\_guidancesheets.Html](http://www.Livelihoods.Org/info/info_guidancesheets.Html) (accessed 05 April 2007), .
- Ezenwaka, J. and Abere, S. A. (2009), "  
I. Role of Social Capital in Sustainable Livelihoods and Community Development in the Niger Delta", *International Journal of Geography and Regional Planning*, vol. 1, no. 1, pp. 44-53.

- Ezenwaka, J., Ekeke, B. A., Oyebade, B. A. and Anyadiegwu, O. A. (2004), "Identification and Evaluation of some Threatened Indigenous Medicinal Plants of the Tropical Rainforests of Eastern Nigeria", *Roan, The Journal of Conservation, Nigerian Conservation Foundation*, vol. 3, no. 1&2, pp. 131-142.
- Ezenwaka, J. (2002), *Role of Social Capital in Sustainable Livelihoods and Community Development in the Niger Delta* (unpublished MSc thesis), Cranfield University, UK, Cranfield, UK.
- Fisher, B., Turner, R. K. and Morling, P. (2009), "Defining and classifying ecosystem services for decision making", *Ecological Economics*, vol. 68, no. 3, pp. 643-653.
- Gesler, W. M. (1984), *Health care in developing countries*, Assn of Amer Geographers.
- Gómez-Baggethun, E., De Groot, R., Lomas, P. L. and Montes, C. (2010), "The history of ecosystem services in economic theory and practice: from early notions to markets and payment schemes", *Ecological Economics*, vol. 69, no. 6, pp. 1209-1218.
- Graves, A., Morris, J., Chatterton, J., Angus, A., Harris, J., Potschin, M. and Haines-Young, R. (2009), "Valuation of Natural Resources: A NERC Scoping Study Final Report", .
- Isoun, M. (2006), "Forests of the Niger Delta and Challenges to Their Management", in Augustine, E. and Akinsola, O. (eds.) *The Renewable Natural Resources of the Niger Delta; Options for its Sustainable Management*, Nigerian Conservation Foundation, Lagos, Nigeria, pp. 43-69.
- Kingsley, M. H. (1897), *Travels in west Africa: Congo Français, Corisco and Camerons*, .
- LENF. (Living Earth Nigeria Foundation), (1998), *Living Earth Environment Action Programme; Participatory Learning and Action report* (unpublished Report), Port-Harcourt, Nigeria.
- Leonard, A. G. (1906), *The lower Niger and its tribes*, Macmillan.
- NDDC, P., ( 2000), *The Niger Delta Development Commission Act 2000*, The Niger Delta Development Commission, Port-Harcourt, Nigeria.

- NPC, A. (1991), *1. Final Results of 1991 Population Census of Nigeria.* , , National Population Commission, Abuja.
- Nwankwo, C. and Ogagarue, D. (2012), "An investigation of temperature variation at soil depths in parts of Southern Nigeria", *American Journal of Environmental Engineering*, vol. 2, no. 5, pp. 142-147.
- Obot, E. A. (2006), "1. Biophysical characteristics", in Augustine, E. and Akinsola, O. (eds.) *The Renewable Natural Resources of the Niger Delta; Options for its Sustainable Management*, Nigerian Conservation Foundation, Lagos, Nigeria, pp. 9-14.
- Obute, G. C. (2005), "Ethnomedicinal Plant Resources of Southeastern Nigeria", *Ethnobotanical Leaflets*, vol. 1, no. 1, pp. 5.
- Ogbe, F. M. D., Eruogun, O. L. and Uwagboe, M. (2009), "Plants used for female reproductive health care in Oredo local government area, Nigeria.", *Scientific Research and Essays*, vol. 4, no. 3, pp. 120-130.
- Powell, C. B. (1995), *1. Wildlife Study 1. Report submitted to the Environmental Affairs Department, Shell Petroleum Development Company of Nigeria, Ltd.* , , Shell Petroleum Development Company of Nigeria, Ltd., Port-Harcourt, Nigeria.
- Singh, J., Moffat, D. and Linden, O. (1995), *Defining an environmental development strategy for the Niger Delta*, World Bank.
- SPDC, P. (2015), *People of the Niger Delta*, available at: [www.shellnigeria.com/frame.asp?page=peopledelta](http://www.shellnigeria.com/frame.asp?page=peopledelta) (accessed January, 15).
- Taylor-Powell, E. and Renner, M. (2003), *Analyzing Qualitative Data* , , University of Wisconsin--Extension, Cooperative Extension, Online Report.