

COMPARATIVE STUDY OF THE BENEFITS OF WETLAND ECOSYSTEM SERVICES AND WETLAND DEVELOPMENT IN PORT HARCOURT

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ABSTRACT

This study compared the socio-economic, health and environmental benefits of wetland ecosystem services to wetland development by analyzing the benefits, services and their effects respectively on the environment and its inhabitants, using the result as a yardstick to recommend for policy review on wetland development in order to conserve nature's rich resources. This was achieved by making explicit the benefits/services of wetland ecosystem services and wetland development to the well-being of humans, plants and animals, and the associated impacts on wetlands/environment. This study will help decision makers in reviewing projects/development plans around wetland/coastal areas and also serve as a guide to the acceptance or rejection of such projects. This study provides an overview of wetland, ecosystem services and wetland development with its effects on the environment, especially as it affects the inhabitants of an area. The researcher also identified and revealed the conditions of the reclamation sites within the study area with detailed description of reclamation works on ground. The researcher identified study gaps in the area of the study, which are: (1) The measurement of (the quantity or quality) ecosystem services on the environment. (2) The description of interconnectivity or chain of interaction between the living members and non-living members of the ecosystem community. Overcoming the above-mentioned gaps is important, as it will help to enlighten wetland ecosystem services, thereby removing double counting of services in ecosystem service valuation. The study concluded that it is reasonable to preserve the wetlands, as their service provides life support system to the earth's inhabitants, while development on wetland destroys the natural environments.

KEYWORDS: *Benefits of Ecosystem Services; Ecosystem; Ecosystem Services; Wetlands; Wetlands Reclamation Sites*

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INTRODUCTION

Wetlands depict the presence of water, either at the surface or the root zone, seasonally or permanently. According to Jiang Bo, Christina P. W., Cui Lijuan and Ouyang Zhiyun (2016), wetland provides a diversity of ecosystem services which makes them valuable to the society. They have unique soil conditions that differ from adjacent uplands and they support vegetation's adaptability to the wet condition (hydrophytes) and conversely, they are characterized by an absence of flooding intolerant vegetation. According to Ramsar convention (2007), wetlands have been estimated to cover 5 to 10% of the earth surface (about 1280 million hectares), playing a number of roles, such as water purification and storage, processing of carbon and other nutrients, stabilization of shorelines supporting plants and animals, providing habitation for

aquatic plants (hydrophytes) and animals (USDA), and are considered the most biologically diverse of all ecosystems, serving as a home to a wide range of plants and animal species. Wetlands occur naturally on every continent and vary widely depending on the locational or regional differences, including human disturbances. They have two major categories, which are:

- Coastal/tidal wetlands: These are found along the coastal areas and are closely linked to our nation's estuaries where the sea/salt water mixes up with the fresh water to form an environment of varying degree of salinity. Mangrove swamp with salt-loving shrubs or trees are common in these areas.
- Inland or non-tidal wetlands: These occur naturally or artificially in lands and are not subject to tidal actions of the seas. This category consists of the following: Prairie, potholes, peat lands, bogs, fens, playas, mountain meadows and Riverine wetland on flood plains. Sometimes, these non-tidal wetlands are called upland/fresh water wetlands to distinguish them as occurring in areas not influenced directly by coastal waters.

Ecosystem according to Chapin F. S., Pamela A. Matson and Harold A. Mooney (2002) is defined as a community of living organisms in conjunction with the non-living components of the environments (air, water and mineral soil) interacting as a system. Ecosystems are defined by their network of interactions amongst the organisms, their environment and they can be of any size, but usually encompasses specific limited spaces. Energy, water, nitrogen and soil minerals are other essential abiotic components of an ecosystem, and the energy that flows through the ecosystem is obtained primarily from the sun. Ecosystems are controlled both by external and internal factors. External factors include climate, time, potential biota and parent materials that form the soil and the topography that control the overall structure of the ecosystem, while the internal factors involve the processes or functions that occur within them to produce useful services. The tangible goods are food, medicinal plants, crops, raw materials, etc., and less tangible items of the ecosystems are tourism and recreation, etc.

Ecosystem Services are common services that are beneficial to plants, animals and human; thereby contributing to their welfare. Bo *et al.*, (2016) citing MA (2005) and Daily (1997) described ecosystem services as a means of understanding the influence of ecosystems on human well-being. Ecosystems, such as wetlands, forests and estuaries can be characterized by the processes and functions that occur within them. They are maintenance of hydrological cycles, cleaning air and water, the maintenance of oxygen in the atmosphere, crop pollination, aesthetics, inspiration, etc. The Millennium Ecosystem Assessment (MA, 2005) defined ecosystem services as benefits inhabitants obtained from the ecosystem and distinguished four categories of ecosystem services where the supporting services are regarded as the basis for the services of the other three categories. These include;

- Support services; according to MA (2005), these are services that are necessary for the production of all other ecosystem services. These include nutrient recycling, primary production, soil formation, flood regulation, water purification, etc.
- Provisioning services; according to the MA (2005) includes food (seafood, game, crop, wild foods, etc.), raw materials (lumber, skins, fuel wood, organic matters and fertilizers), genetic resources, water, giogenic minerals, energy (hydropower, biomass fuels), ornamental resources (fashion, handicraft, jewelry, worship decorations, etc.).
- Regulating services according to MA (2005) are carbon sequestration (seizure) and climate regulation, waste decomposition and detoxification, purification of water and air, pest and diseases control.

- Cultural services; according to (MA 2005) are non-material benefits, such as spiritual and historical, cognitive development, reflection, recreation and aesthetic experiences. Cultural services (folklore, natural/traditional symbols, architecture, historic and worship sites, etc.), spiritual and historical (religious/natural heritage), recreational experiences (eco-tourism and outdoor sports), science and education (research and scientific discovery.), therapeutic (eco-therapy, social forestry and animal-assisted therapy).

Wetland Development is the use of wetlands for development of infrastructures, housing units, investment projects, farming, etc. It involves clearing of wetlands for the provision of infrastructure in order to meet up the rising demand for it. This significantly changes the natural state of the wetlands, thereby impacting heavily on the flora and fauna of the wetland.

Problem Statement

The increasing demand for land and landed properties in the study area for development of infrastructure to meet the rising demand for food, housing, medical, transportation, security, power, economic development, etc., within Rivers State has led to massive reclamation of wetlands in Port Harcourt. Despite the importance of wetlands to the well-being of the inhabitants of the State, wetlands have become the most threatened ecosystem in Port Harcourt and in Extension Rivers State due to the massive reclamation works, industrial waste disposal and exploitation of wetland resources. These activities are destroying earth's life support system which threatens the health/life of the inhabitants of the area and has currently resulted in persistent flooding, loss of wetland resources (raw materials) and services, loss of means of livelihood, ecosystem imbalance, insects/reptiles invasion into the community, destruction of cultural/worship/spiritual/recreational sites, pollution of wetland and surrounding environment, etc.

Aim of the Study

The aim of this study was to compare the benefits of wetland ecosystem services against the benefits of wetland development using it as the basis for advocating for policy review on wetland development in the State. To achieve the aim, one objective pursued is the identification of wetland reclamation sites within the study area (Port Harcourt) and its effects on the inhabitants, especially on the environment, socio-economic conditions and health of the people. The research question which the study considered is what are the locations of major wetland reclamation sites in Port Harcourt and its impacts, especially on the environment, socio-economic conditions and health of the inhabitants?

LITERATURE REVIEW

Ecosystem services and the natural resources that are responsible for the production of these services are important to earth's life support system. Bo *et al.*, (2016), citing MA (2005), describes wetland ecosystem as socially and economically important for fish and reed production, air/climate regulation, flood regulation, erosion control, tourism and spiritual reasons. They are common benefits that inhabitants of a particular area obtain from wetlands, which contributes to the welfare of human lives. Citing Kinzig A., Perrings C. and Scholes B., (2007), Bo *et al.* (2016) detailed that ecosystem provides a mechanism for optimizing investments in biodiversity conservation and directing them to where they are most useful. Citing Daily (1997), Bo *et al.*, (2016) continued that the quality and quantity of ecosystem services provided in an area depends greatly on the resource use decisions of the people. Fu *et al.* (2010) defined ecosystem services as services provided by the ecosystem conditions and process that are directly beneficial to human beings. Addressing the issue of double counting of services for the purpose of valuation, Wallace (2007), divided the ecosystem service into direct (final) and indirect (immediate) services, and recommended that delineating direct and indirect ecosystem services reduces the

risk of double counting in valuation of ecosystem services. Bo *et al.* (2016) citing MA, (2005) and Daily (1997) noted that ecosystem services clarify the multiple ways nature contribute to our lives insisting that to understand ecosystem services requires knowledge about ecosystem processes (ecology), human welfare benefits (health and social sciences), human values (economics and the humanities) and the negotiation of multiple interests (political science). Citing Boyd *et al.* (2007), Nahlik *et al.* (2012) and Bo *et al.* (2016) maintained that ecosystem services are the final biophysical outputs directly relating to human benefits, which economists can value in a valuation process.

Classification of Ecosystem Services

Examining the MA, (2005) classification of ecosystem services, Bo-Jie *et al.* (2010), stated that there is overlapping between individual ecosystem services in the widely used MA classifications system which inevitably leads to double counting. For example, surface water flow is a regulation service, water quality improvement by infiltration through soil is a supporting service and portable water supply is a provision service. Aggregating these services, according to them, will simply lead to double counting, insisting that water flow regulations and water treatment by soil helps to provide the same final product which is potable drinking water. Constanza *et al.* (1997) differentiated ecosystem functions from ecosystem services noting that their function refers to various biological processes of the ecosystem. According to them, ecosystem goods (food) and services (waste/carbon assimilation) represents the benefits humans derive, directly or indirectly from ecosystem functions. For simplicity, they referred ecosystem goods and services together as ecosystem services. The millennium ecosystem assessment (MA 2005), a UN-sponsored global ecosystem service valuation program, classified ecosystem services into four major groups, such as provisioning services, regulating services, cultural services and supporting services.

Development on Wetlands

The benefits of wetland to the society have attracted increasing global importance; but unfortunately wetlands are under increasing pressure from reclamation and development. According to Okonkwo *et al.* (2015), majority of the threats to Nigerian wetlands include anthropogenic activities and the Niger Delta region has been faced with different environmental, social, health and economic threats from these anthropogenic activities. Okonkwo *et al.*, (2015); therefore, emphasized the need to preserve wetlands and a development plan to implement proper management and containment of affected sites at local, regional, national and international levels. According to Okonkwo *et al.* (2015), in Nigeria, an estimated 28,000 km² (about 3%) of the 923,768 km² of land surface area of the country is covered with wetlands (Uluocha and Okeke, 2004). Citing Mitsch *et al.* (2007) and Okonkwo *et al.*, (2015) asserts that wetlands have been estimated to cover between 5 - 10% of the earth's surface, about 1,280 million hectares. According to Moser *et al.* (1996), internationally, wetlands have been condensed by 50% in the last 100 years. The millennium ecosystem assessment (2005) also stressed that global wetland loss is now more rapid than those of other ecosystem with United States and Europe, having lost over 50% of their wetlands to development (Finlayson *et al.*, 1999) and Bo *et al.*, (2016) citing Lei *et al.* (2005) stressed that despite the importance of wetlands, they are the most threatened ecosystems in China because of wetland reclamation.

RESEARCH METHODOLOGY

An Interpretivist's philosophy was adopted in this study because it focuses on the personal thoughts and views of participants or respondents and seeks to know the phenomena through the meaning people give to them, thereby making the investigator to know how people reacted to issues, and also helping the researcher to evaluate their experiences and perceptions towards the object of the study.

Research Instruments Used

Primary data was obtained from interviews, direct observation and photography. The researcher collected data with the above listed instruments from the following reclamation sites: Ogbunabali/Nkpogu, Okuru-Ama (Golf Estate), Woji (Gbalajam) and Eagle Island. While the secondary data for this study was obtained from various journals, conference papers, textbooks, Google earth and other online documented sources.

The Study Area

Port Harcourt City Local Government area is one of the 23 Local Government Areas in Rivers State, southern part of Nigeria. It comprises of towns, urban communities and neighborhoods and is situated 52 km (32 miles) southeast of Ahoada and about 40 km (25 miles) northwest of Bori. It is bounded to the south by Okrika, to the east by Eleme, to both by Obio/Akpo and to the west by Degema Local Government Areas. It has an area of 109 sq km (42 sq mile) with 26 urban communities and is part of Rivers East Senatorial District consisting of 20 electoral words.

Data Presentation and Analysis

Wetland Reclamation Sites in the Study Area

There are several wetland reclamation sites and ongoing developments on wetlands in the study area, Port Harcourt City Local Government area of Rivers State, which are being carried out by different groups for different purposes and at different levels, some of the developers are using high capacity dredging equipments, while others are using manual means to reclaim wetlands. Some of these sites include Ogbunabali/Nkpogu, Okuru-Ama (Golf Estate), Gbalajam (woji), Azuebe, Orije (old GRA), Eagle Island, Rumuolumeni, Elioju, Igwuruta and Eneka Rainforests.

Ogbunabali/Nkpogu; Nwaja River is currently being reclaimed by Pelfaco Nigeria Limited for Rivers State Government. The site which is situated between Nkpogu and Ogbunabali communities in Port Harcourt is about 17 hectares of wetland (approximately 366 plots of land, measuring approximately 465 m² per plot). The project which is in three phases including building of offshore protection (embankment wall) to ensure that sand-filled area is not washed out by the River, commenced September 2016 and is still ongoing now at almost 90% stage of completion with a sand fill height of 2.65 m depth from the bed (depth of wetland) and well above the road level.

Orijie (old GRA): This site is situated along the eastern-by-pass directly opposite to NLNG Head Office in Port Harcourt and can be viewed from old GRA, Orije, Port Harcourt, has been totally reclaimed and fenced round ready for use by a multinational service and logistics company.

Okuru-Ama (Golf estates): A joint venture project arrangement between the state government and real estate development companies with the following estates: Rivtaf Golf Estate, Reef Courts Estate, the Reserve Estate and the Sterling Estate. Rivtaf Golf Estate is a residential housing estate designed to accommodate 1001 housing units of varying accommodation types built on 40 hectares of reclaimed land which has been completed and fully sold out and occupied. Reef Courts Estate is currently building and selling her estates now which are still under construction. The reserve and sterling estate developers are yet to begin development but have been acquired and sand filling is ongoing at different stages by different individuals/companies or groups to cover another 354 plots of wetland (over 16 hectares) sold out by the community at a price range of ₦15 million to ₦30 million per plot (465 m²) depending on the position of the site.

Wetland at Azuebe/woji;the site being reclaimed by Belema oil is situated between Azuebe and Woji town along the Okuru-Woji Bridge. The site which measures about 450 m along the bridge and above 500 m at the rear have been reclaimed and drainage, road network and other internal works are being built now.



Figure 1: Wetland Reclamation Site at Ogbunnabali/Nkpogu.



Figure 2: Showing Reclamation Works at Okuru-Ama Area, Directly Opposite NLNG Head Office.

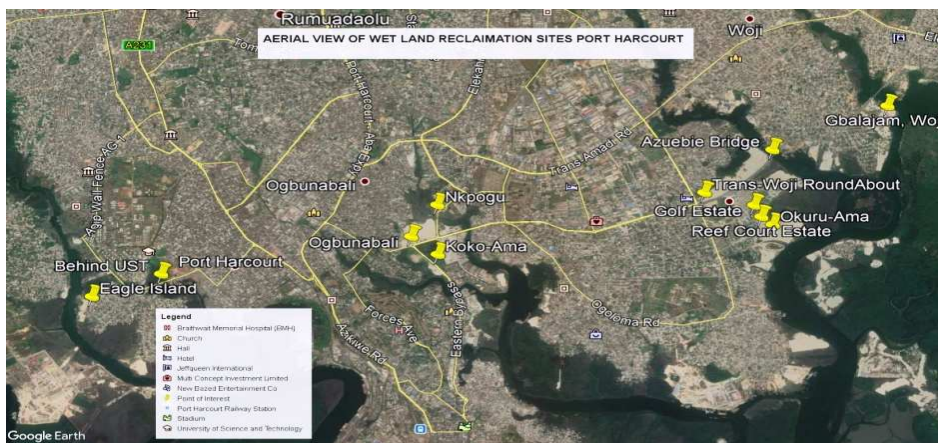


Figure 3: Aerial View of Wetland Reclamation Sites within Port Harcourt.

The Impacts of Developments on Wetland

Wetland reclamation has associated problems (impacts) on the immediate environment and this also affects the well-being of the inhabitants and other community of living things/organisms of the wetland which provides support in the chain of ecosystem processes. Some of the effects are environmental effects; loss of mangrove/rain forests, loss of fish/shell fish, crabs, etc., loss of herbs/shrubs and other medicinal vegetables for traditional medication. Loss of water (water treatment, regulation and purification processes) causes imbalance in the ecosystem (breaking the interconnected chain of communications between living and non-living things), flooding, loss of air/climate regulatory services (trees/forest), loss of fishing rights/places, destruction of cultural/historic/spiritual and recreational sites, loss of raw materials (fiber, fuel wood, etc.), loss of aquatic life/processes/crop pollination, loss of natural treatment of generated wastes in the area, loss of natural cooling effect of the wetland/river, loss of all ecosystem services that are beneficial to human, plants and animal from the wetland, loss of transport Routes, loss of sources of livelihood, exposing the environment to wind storms and other natural disasters, invasion of insects, reptiles and mosquitoes into the inhabitants community and littering of waste products/direct discharge of sewage on the surrounding environment by residents who depend on discharging same into the creeks/wetlands. Other impacts include environmental changes that have increased mosquitoes, malaria and related diseases, increased heat wave, etc.

Health Effects: These include increased malaria and other water-borne diseases, increased medical bills, respiratory problems and increased pollution.

Socio-Economic Effects: High cost of sea foods, loss of fishing rights/places and means of livelihood, loss of wetland resources (food, fiber and firewood), increased costs of managing the effects of flooding, loss of worship center/shrine, historic and recreational sites.

Summary of Findings

From direct observations, site inspections, etc., wetlands in the study area, Rivers State and other parts of Niger Delta Region are massively being reclaimed for one use or the other. This is the main cause of environmental challenges the region has experienced over the years and the study area has currently been troubled by flooding at any slight rainfall.

Comparative Analysis of Wetland Ecosystem Services and Wetland Developments

Natural Benefits of Wetland Ecosystem: Wetlands are considered the most biologically diverse of all ecosystems and if maintained, plays a number of roles/services which are for the common benefits of humans, plants and animals. Some of these roles include:

- **Environmental benefits:** Water purification, carbon sequestration, nutrients recycling, water storage, stabilization of shoreline, provision of habitation for plants and animals, climate/air quality regulation, flood control and storm protection, regulates heat waves, disease control, waste treatment, aesthetics, educational, spiritual, inspirational, recreational services, soil formation, photosynthesis, primary production, nutrient cycling, etc. They also act as bioremediation agents for polluted sites because they have the natural ability to gradually remove pollutants from the environment/water. They provide excellent habitation for the aquatic life, they provide cover (trees) and natural cooling system for the environment by absorbing carbon dioxide from the atmosphere, food and water for several wild life species as well as protection, nesting, breeding, feeding for several avian wildlife species such as organism, waterfowl, birds and cranes. According to Moseley (2015), wetlands have higher plant diversity due to the increased plant and animal life around them.

- Health: The well-being of plants, animals and human beings depend greatly on the condition of their surrounding environments. Ecosystem enables plants (shrubs and herbs) and other species to grow, which are useful for both herbal medicine and production of drugs for medication. It helps in disease control, provision of natural cover (trees) which in turn filters the excess carbon in the air, enabling humans to have clean air, thereby reducing respiratory problems and other diseases associated with air pollution.
- Socio-economic benefits: These include availability of food, sea foods and others at good price, maintenance of sources of livelihood, provision of other environmental resources that are beneficial to humans, plants and animals, worship/recreational centers, natural and historic parks, aesthetics, etc.

Wetland Developments

Wetland reclamation is usually carried out to create an environment for the development of infrastructure to meet up the rising need for housing, road network, health care, education, etc. This is associated with both benefits and problems. The benefits include;

- Economic development: This attracts businesses in the area and a corresponding demand to meet that change, thereby attracting more buying and selling and other services to the area.
- Employment opportunities: Labor and specialized skills are required to carry out the reclamation and development mandate.
- Availability of land: Reclamation makes land available for all kinds of development.
- Investment opportunities: Here, different kinds of business interests and opportunities will be attracted to the reclaimed site.
- Revenue generation: Tax, royalties, land/building rates, etc.
- Wealth creation and capital realization: Business creates wealth for the investors and those who participate (worker) in the processes and monies realized from the sales of the wetland/reclaimed land and built up areas.

CONCLUSIONS

The study concludes that wetland reclamation in the study area has;

- Destroyed the ecosystem processes that support food production for plants, animals, fisheries and humans. This is important because food and water are necessary for survival.
- Destroyed the system that regulates/controls the production of these services; water purification, air filtration, nutrients recycling for plants survival, etc., thereby producing food and good health for earth's inhabitants.
- Resulted in loss of jobs for the inhabitants of the area who depend on these natural resources for survival, especially farmers, fishermen and marine transport workers, etc.

The study concludes that wetlands development on the other hand has provided;

- An environment for infrastructures to be built, businesses and investments to thrive on.
- An environment that will enable wealth creation (businesses).
- An environment that will enable job opportunities to be created.
- An environment that enables production of goods and services which perpetually displaces the sources of raw materials and other natural resources used in the production processes.
- Opportunities for human capital development and provision of essential services, etc.

Wetland development damages or removes the natural environment, natural life support system and sources of raw materials by providing opportunities for environmental pollutants to be introduced into the environment as a means of increasing production, thereby destroying the environment if not properly managed. These bring hardship to the inhabitants who depend on wetland resources for survival. There is always an alternative site for any development and land uses can be changed to meet up a specific demand anywhere within the study area. From the above comparative analysis, it is clear that wetlands' ecosystems are better preserved than destroyed due to their essential service and their support to life and natural existence.

RECOMMENDATIONS

This study presents the under listed as ways of proffering solution to these problems and recommend strict compliance on the same.

- The use of wet/coastal lands for development purposes should be discouraged. This can be achieved by reviewing of policies that support wetland reclamation and implementing the existing environmental protection laws as well as development of appropriate sanctions for defaulters.
- Development control Government should, through her regulatory and environmental protection policies/agencies, define what is sustainable and acceptable development on or around wetlands, forests, rivers, etc., to control developments on our natural resources.
- Our natural environment can be a source of revenue to the government and citizens, if sustained, for recreational activities and will certainly attract tourist from other parts of the world if properly harnessed.

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