

# AN APPRAISAL OF THE BENEFITS OF MANGROVE AND WETLAND ECOSYSTEM IN NIGERIA

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## **Abstract**

The mangroves of Sub-Saharan Africa covers a large expanse along the coastline stretch of West and Central Africa. This ecosystem is important to the economy and livelihoods of the people of Sub-Saharan Africa. The key elements of the mangroves that interact for the functioning of the mangrove ecosystem include; climate, salinity, freshwater, siltation, erosion, substrate and nutrients which have first-order reaction on plants and animals. This paper reviewed the economic, social and ecological benefits of mangrove and wetland ecosystem in Nigeria and elsewhere. There is clearly a need to utilize wetland and mangrove resources on a sustainable basis, to reduce the levels of conversion to other land uses and declare certain mangrove areas, especially those with pristine resources, as conservation and preservation zones. The paper recommended the development of ecotourism as a mechanism for revenue generation and provision of job opportunities, eco-policing of natural sites which will facilitate the establishment of undisturbed areas as future mangrove ecosystem tourism site. A bilateral monitoring strategy should be developed and implemented to ensure that freshwater is supplied thereby protecting the economic, cultural and environmental resources of mangrove ecosystem.

**Keywords:** Appraisal, Ecosystem, Benefits, Mangrove, Wetland, Socio-economic.  
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## **Introduction**

The Ramsar Convention Secretariat (2007) defined wetlands as “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six metres”. Wetlands are amongst the most important ecosystems in the world and occupy about 6 percent of the land surface of the world (Wilcox, 2008; Okonkwo *et al.*, 2015). Wetlands provide many opportunities for recreational activities, such as bird-watching, hunting, fishing, trapping, and hiking, and they provide educational opportunities for nature studies and scientific research. Mangrove ecosystems are among the most productive and bio-geochemically active ecosystems and represent potentially important sinks of carbon in the biosphere (Bradley *et al.*, 2008).

Mangroves are trees or shrubs that have the common trait of growing in shallow and muddy salt water or brackish waters, especially along quiet shorelines and in estuaries.

Some animals that live on wetlands include microorganisms which often have adaptations that allow them to live in water without oxygen and certain species of crab. In addition to microorganisms and invertebrates, reptiles, such as turtles, snakes, and alligators, are common in wetlands. Many amphibians – frogs, salamanders and toads – live in wetlands during at least part of their life cycle.

In Nigeria, the mangrove extends from Badagry in the West to Calabar in the East covering a total area of 10,000km<sup>2</sup> along the coast (Abere and Ekeke, 2007). Nigeria presently has eleven sites designated as Wetlands of International Importance with a surface area of 10767km<sup>2</sup> and three of these wetlands, Apoi Creek, Oguta Lake and Upper Orashi Forests are situated in the Niger Delta (Okonkwo *et al.*, 2015). Throughout the extensive coastline of the Niger Delta Region of Nigeria, mangroves represent a rich and valuable ecosystem (Okpiliya *et al.*, 2014). It provides a unique and valuable range of resources and services to rural people. However, mangrove ecosystems are among the most threatened global ecosystem with global rates of loss in the past two decades varying from 20% (Wilkie and Fortuna, 2003) to 35% (Valiela *et al.*, 2001). A total of 21,342 hectares of mangrove vegetation was reported to have been lost between 1986 and 2003 due to urbanization, dredging activities, and pollution from oil and gas companies (Adedeji *et al.*, 2011).

People depend on mangrove wetland ecosystem for fishing, clam collection, crab collection, natural shrimp farming, retting of coir fibre, medicinal plants, fodder and other variety of uses. A growing body of evidence show that mangrove wetlands form a highly valuable ecosystem. There is clearly a need to utilize wetland and mangrove resources on a sustainable basis, to reduce the levels of conversion to other land uses and declare certain mangrove areas, especially those with pristine resources, as conservation and preservation zones (Khaleel and Jaleel, 2009). It is of prime importance that resource conservation and mangrove land allocation should be properly spelt out in mangrove development plans to sustain the benefits of the resource over a long period of time and for a greater number of people. A United Nations Environment Program report in 2009 highlighted that half of the world's mangroves have been lost to development since early nineteenth century (Khaleel and Jaleel, 2009). The following elements of the mangrove ecosystem interact for the functioning of the mangrove ecosystem namely, climate, salinity, freshwater, siltation, erosion, substrate and nutrients, which have first-order reaction on plants and animals. These factors make up the functional cycles of transported materials in the mangrove, including daily tides, run-off, rainfall, decomposition, mineral intake and activities of the fauna in general.

In Nigeria, the increased demand for mangrove trees/plants for building, traps, firewood, charcoal, etc. has resulted in widespread mangrove deforestation, which in turn leads to degraded life support system (Irikana, 2011). The beneficiaries of mangrove wetland

goods and services span the entire scale of local, national/regional and global as well as individuals, commercial entities and public bodies. Determining the benefits accruing to these stakeholders is crucial in understanding the synergies and benefits between the different utility values attributed to each stakeholder. The aim of the paper is to highlight the socio-economic and ecological benefits of mangrove and wetland ecosystem in Nigeria.

### **Economic benefits**

Abere and Ekeke (2007) in their report on Nigerian Mangrove and Wildlife development stated that traditional uses of mangrove species are not currently commercially utilized in Nigeria as local communities collect large variety of mangrove products such as food (crabs, shrimps), honey, medicine, dyes, thatching and numerous other household products from the mangroves. In addition, they noted that mangrove salt and periwinkles (*Tymopanonus fuscatus*) are both important sources of income for local people who are dependent on the mangroves for all intents and purposes.

Okpiliya *et al.*, (2014) in their work on mangrove forest ecosystem utilization for sustainable livelihood in Calabar reported that plant community of wetland origin formed an ecological niche for trees, reptiles, monkeys, birds, fishes, shrimps, mollusks and other wildlife often harvested for wood, fuelwood, tannin, leaves, fibers and dyes. Further, they stated that mangrove ecosystem in particular is important for inland fisheries as well as logging and lumbering of fuelwood for charcoal production. These inform the migration of fishermen from Delta, Akwa Ibom and Akpabuyo to settle and take advantage of the rich supply at that point.

Bradley *et al.* (2008) outlined that the most widespread uses of mangrove resources are for fuel, construction and fishing. In addition, they stated that mangrove forest trees are also widely valued for their bark (used in tanning and dyes) and wood fibre (used to make rayon and paper); as sources of animal fodder, vegetable foods, and diverse traditional medicines and toxicants. Fisheries production constitutes the major value of marketed natural resources from mangrove ecosystems. In terms of habitat use, the mangrove support to commercial, recreational and subsistence fisheries is well documented (Bradley *et al.*, 2008).

Dauda (2014) estimated the contribution of wetlands to national and local economies by producing resources (fish, fibre, water), enabling recreational activities and providing other benefits such as climate regulation, water purification, pollution control and flood protection.

Pearce and Pearce (2001) suggested a clustering of net non timber forest products (NTFPs) values in the range from US\$5-\$100 per hectare per year. NTFPs include

construction materials such as bamboo, rattan and palm leaves; wild food such as fruits, nuts and bush meat; animal fodder; and medicinal plants. The type and importance of the product in supporting local communities and hence their economic value vary significantly with location.

### **Ecological benefits**

Adekola and Mitchell (2011) in their work on Niger Delta wetlands reported that mangrove wetland ecosystem supports a variety of ecosystem services, often called ecological benefits, which are classified into supporting, provisioning, regulating and cultural services.

Adekola and Fanen (2015) wrote that supporting services are those that are necessary for the production of all other ecosystem services including soil formation, photosynthesis, primary production, nutrient cycling and water cycling. Supporting services such as photosynthesis and water cycling can support the production of medicines and safe potable water.

Adekola and Mitchell (2011) explained provisioning services as natural products generated by mangroves including food, freshwater, fibre and fuel, biochemical, genetic materials and other products. In addition, other products include raffia, snail, spices, mangrove salts, reeds and sedge while genetic materials include medicinal species vital to biotic life.

Okonkwo *et al.* (2015) in their work on Niger Delta wetland ecosystem wrote that regulating ecosystem services are the benefits obtained from the regulation of ecosystem processes such as climate regulation, water regulation, water purification and waste treatment, erosion regulation and natural hazard regulation. Further, they stated that water regulation provides buffer against natural disaster including coastal erosion and flood regulation while climate regulation provides a good sink for greenhouse gases such as carbon-dioxide and methane.

Bradley *et al.*, (2008) reported that cultural services emanate from dynamic and complex social attributes. They stated that the varieties within coastal ecosystems provide humans with almost unlimited opportunities for aesthetic and recreational experiences, cultural and artistic inspiration, as well as spiritual and religious enrichment.

### **Social benefits**

Albert *et al.* (2012) in their work on socio-economic importance of red mangrove stated the social benefits of *Rhizophora racemosa* to rural dwellers: 100% said they derived satisfaction from the use of the plant, 69.1% said it helps to relief pains and worries, 63.6% said it is a means of relaxation/recreation, 81.8% said they got information about

community, state and country, 100% said they are happy because they are involved in the plant business while 61.4% said they are not sure of the social benefits.

Turner *et al.* (2003) in their work on valuing nature listed the social benefits of mangroves to include NTFPs, flood prevention and sediment control. In addition, sustainable forest, conversion to oil palm and conversion to small scale agriculture contributed 206%, 10% and 34% respectively to total social benefits of mangroves.

Adekola *et al.* (2012) in their work on the value and social distribution of Niger Delta wetland services stated that apart from biodiversity loss, corporate actors are responsible for burning farmland, polluting water and destroying crops. The implications of these changes are economic (less food; less money for food, medicine and children's education); emotional (inability to assist relatives and neighbours) and social (poor health, religious desecration).

By focusing on multiple benefits of mangroves, Reduced Emissions from Deforestation and Forest Degradation (REDD+) activities can lead to direct social benefits such as jobs, livelihoods, land tenure clarification, enhanced participation in decision-making and improved governance; in addition to the carbon incentives (UNEP, 2014).

Okonkwo *et al.* (2015) in their work outlined the cultural heritage of mangroves to include the physical structures and artefacts of the past, traditional water and land-use management practices, the religious as well as spiritual significance of wetlands and their wildlife.

### **Conclusion and Recommendation**

There is no doubt that wetlands are important ecosystem to man and that the several essential ecosystem services that wetland perform will be lost when wetland disappear. The prevalence of floods, coastal erosion and in recent times, changes in occupation of people are clear manifestation of overexploitation of the mangrove ecosystem. Therefore, a bilateral monitoring strategy should be developed and implemented to ensure that freshwater is supplied thereby protecting the economic, cultural and environmental resources of mangrove ecosystems.

The following suggestions should be adopted for management of the mangrove wetlands in Nigeria:

- (i) Coastal structure in the proximity of mangrove areas should be designed in such a manner as to avoid excess sedimentation or erosion.
- (ii) An inventory should be taken of the resources that can be made available locally and an assessment should be made of their maximum potential output. A regular monitoring of the ecosystems reaction to the extraction of forest and fishery

products should be maintained since the rate of natural regeneration of the ecosystem varies with season, site and biotic influences.

- (iii) Discourage retrogressive aquaculture practices such as above sea level ponds for agri-aquaculture thereby keeping mangroves intact. Siting aquaculture ponds behind mangroves rather than inside them. Silvi-aquacultural practices are sound measures for exploitation and management of mangrove resources.
- (iv) Develop ecotourism as a mechanism for revenue generation, provision of job opportunities and eco-policing of natural sites which will facilitate the establishment of undisturbed areas as future mangrove and wetland ecosystem tourism site.

## References

- Abere, S.A., and Ekeke, B.A. 2007. The Nigerian Mangrove and Wildlife Development. *Proceedings of the 1st International Technology, Education and Environment Conference*, Omoku, Nigeria, 2011.
- Adediji, O.H., Ibeh, L., and Oyeboji, F.F. 2011. Sustainable Management of Mangrove Coastal Environments in the Niger Delta Region of Nigeria: Role of Remote Sensing and GIS. *Proceedings of the Environmental Management Conference, Federal University of Agriculture, Abeokuta, Nigeria*.
- Adekola, O., and Fanen, T. 2015. Integrating Ecosystem Services Approach in Achieving Development Goals: The Role of the Geographer. *Journal of Environment and Earth Science*, 5(4), pp. 92-102.
- Adekola, O., and Mitchell, G. 2011. The Niger Delta Wetlands: Threats to Ecosystem Services, Their Importance to Dependent Communities and Possible Management Measures. *International Journal of Biodiversity Science, Ecosystem Services and Management*, 13(6), pp. 43-52.
- Adekola, O., Mitchell, G., and Grainger, A. 2015. Inequality and Ecosystem Services: The Value and Social Distribution of Niger Delta Wetland Services. *Ecosystem Services*, 12, pp. 23-32.
- Albert, C.O., Nwisiator, D., and Gangan, B.C. 2012. Socio Economic Importance of Red Mangrove (*Rhizophora Racemosa*) to Rural Dwellers in Southern Nigeria. *Journal of Natural Sciences Research*, 2(8), 182-187.
- Bradley, B., Ronnback, P., Kovacs, M., Crona, B., Ainul Hussain, S., Badola, R., Primavera, H., Barbier, E., Dahdouh-Guebas, F. 2008. Ethnobiology, Socio-economics and Management of Mangrove Forests: A review. *Journal of Aquatic Botany*, 2(6), 220-236.
- Dauda, A.B. 2014. Salvaging Wetland Ecosystem in Nigeria: Towards Ensuring Sustainable Fish Production. *Nature and Science*, 12(9), pp. 34-41.
- Irikana, G. J. 2011. Mangrove Resources Utilization in Nigeria: An Analysis of the Andoni Mangrove Resources Crisis. *Sacha Journal of Environmental Studies*, 1(1), 49-63.

- Khaleel, K.M., and Jaleel, C.A. 2009. Environmental Challenges to the Mangrove Wetlands of North Malabar (Kerala), India: Their Sustainable Development and Influence on Local People. *Knowledge and Management of Aquatic Ecosystems*, 3(1), 333-341.
- Okonkwo, P.C., Kumar, L., and Taylor, S. 2015. The Niger Delta Wetland Ecosystem: What Threatens it and Why Should We Protect it? *African Journal of Environmental Science and Technology*, 9(5), 451-463.
- Okpiliya, F.I., Effiong, E.B., Imoke, E., and Eja, I. 2013. Mangrove Forest Ecosystem Utilization and Depletion: Implication for Occupational Changes in Calabar South, Nigeria. *European Journal of Sustainable Development*, 2(1), 149-162.
- Okpiliya, F.I., Oka, P., and Effiong, E.B. 2014. Mangrove Forest Ecosystem Utilization for Sustainable Livelihood in Calabar South, Nigeria. *International Journal of Ecology and Ecosolution*, 1(2), 42-51.
- Pearce, D.W., and Pearce, C.G. 2001. "The Value of Forest Ecosystems", A Report to the Secretariat, Convention on Biological Diversity, University College, London.
- Ramsar Convention Secretariat (RCS) 2007. Wise Use of Wetlands: A Conceptual Framework for the Wise Use of Wetlands, Ramsar Handbooks for the Wise Use of Wetlands. 3rd edition. Ramsar Convention Secretariat Gland, Switzerland.
- Turner, K.R., Paavola, J., Farber, S., Jessamy, V. and Georgiou, S. 2003. Valuing nature: Lessons Learned and Future Research Directions. *Ecological Economics*, 46, 493-510.
- UNEP 2014. Carbon Pools and Multiple Benefits of Mangroves in Central Africa: Assessment for REDD+. United Nations Environment Programme (UNEP), pp. 262-290.
- Valiela, I., Bowen, J.L., and York, J.K. 2001. Mangrove Forests: One of the World's Threatened Major Tropical Environments. *BioSci.* 5(1), pp. 807-815.
- Wilcox, D.A. 2008. "Wetland." Microsoft® Encarta® 2009 [DVD]. Redmond, WA: Microsoft Corporation.
- Wilkie, M.L., and Fortuna, S. 2003. Status and Trends in Mangrove Area Extent Worldwide. *Working Paper FRA 63*, Forest Resources Division, Forestry Department, UN-Food and Agriculture Organization, pp. 292-323.