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Natural Resources of Mangrove and Wetlands: Problems and Panacea

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ABSTRACT

The undervaluation of natural products and ecological services generated by mangrove ecosystems is a major driving force behind the conversion of this system into alternative uses. This trend of undervaluation is partly due to the difficulty involved in placing a monetary value on all relevant factors, but lack of ecological knowledge and a holistic approach among those performing the evaluation may be even more important determinants. This article identifies the ecological and biophysical links of mangroves that sustain capture fisheries and aquaculture production. Fish, crustacean and mollusc species associated with mangroves are presented and the ecology of their direct use of this system is reviewed. Through a coastal seascape perspective, biophysical interactions among mangroves, seagrass beds and coral reefs are illustrated. The life-support functions of mangrove ecosystems also set the framework for sustainable aquaculture in these environments. The value of mangroves in seafood production would further increase by additional research on subsistence fisheries, biophysical support to other ecosystems, and the mechanisms which sustain aquaculture production.

Keywords: Mangroves,Coastal seascape,Ecological services,Capture fisheries,Aquaculture, Economic evaluation

I. INTRODUCTION

Mangroves are coastal forests that lie on the crossroad where oceans, freshwater, and land realms meet. They are among the most productive and complex ecosystems on the planet, thriving in salty and brackish conditions that would just kill ordinary plants very quickly. Their capacity to protect against storms and even sea level rise make them indispensablefor coastal communities in their fight against climate change.

Located primarily in tropical and sub-tropical coastal regions, mangroves constitute less than 1% of all forest areas worldwide, but they play an extremely important role in providing environmental services. Mangroves serve as an essential nursery for coastal and offshore fisheries, provide an array of timber and non-timber forest products to local communities, and sequester and store a large amount of carbon, which helps to mitigate the impacts of global climate change. Mangroves also enhance sediment deposition and protect the coast from the destructive power of waves and storm surges—a point brought home during the Indian Ocean earthquake and tsunami of 2004, when communities with intact mangroves were generally less affected than areas where mangroves had been lost.

Despite being among the most productive ecosystems, mangrove forests have historically been undervalued. Around the globe, mangroves have been cleared for agricultural expansion and aquaculture and coastal development.

Unsustainable forms of harvesting for timber, fuelwood, charcoal, woodchip and pulp production have also led to the degradation of the remaining mangrove forests. The world has seen a 50% decline in the total area of mangroves since the mid-twentieth century, making them one of the most threatened tropical ecosystems.

Fortunately, though, this dire situation is starting to change as international, national and local governing bodies place greater importance on the conservation and restoration of these valuable forests.

Mangrove forests also provide protection and shelter against extreme weather events, such as storm winds and floods, as well as tsunamis. Mangroves absorb and disperse tidal surges associated with these events. As indicated by Hirashi and Harada (2003), a mangrove stand of 30 trees per 0.01 hectare with a depth of 100 m can

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reduce the destructive force of a tsunami by up to 90%. Recent research by TNC and Wetlands International proves that mangroves reduce wave height by as much as 66% over 100 metres of forest.

Mangrove ecosystems represent natural capital capable of producing a wide range of goods and services for coastal environments and communities and society as a whole. Some of these outputs, such as timber, are freely exchanged in formal markets. Value is determined in these markets through exchange and quantified in terms of price.

Climate change and the Mangrove

Storage of carbon in mangroves takes place through accumulation in living biomass and through burial in sediment deposits. With living biomass typically ranging between 100-400 tonnes/ha, and significant quantities of organic matter being stored in the sediments, mangroves rival the sequestration potential of rainforests.

Endangered Mangrove Coastlines and Human Development

Globally, half of all mangrove forests have been lost since the mid-twentieth century, with one-fifth since 1980 (Spalding et al. 2010). Conversion into shrimp farms causes 25% of the total destruction, according to UNEP (Botkin and Keller, 2003), happening mostly in Southeast Asia and Latin America, but this threat is expanding to east Africa, although this region has suffered deforestation by 8% in the pas 25 years (FAO, 2005).

As a result of their intricately entangled above-ground root systems, mangrove communities protect shorelines during storm events by absorbing wave energy and reducing the velocity of water passing through the root barrier.[14] In addition, mangroves protect intertidal sediment along coastlines from eroding away in harsh weather year round. As new cities are developed, mangrove forests around the world have felt a great impact not only on their ecosystems health, but also their wave-attenuating capacity.[15] Wave energy may be reduced by 75 per cent in the wave's passage through 200 meters of mangrove forests, a very substantial amount once the mangrove has been removed.[16] Mangrove covered shorelines are less likely to erode, or will erode significantly more slowly, than unvegetated shorelines during periods of high wave energy.[17] Other factors mangroves have an influence on, include coastal profile, water depth and bottom configuration. The mangrove population has felt both direct and indirect effects due to coastal engineering and human development, resulting in a devastating decline in population. This decline has led to a negative chain of effects in other ecosystems that are dependent on mangrove forest for survival.[18] In just the last decade, at least 35 percent of the world's mangroves have been destroyed, exceeding the rate of the disappearance of tropical rainforests.[19] Mangroves provide a number of essentials for many different ecosystems, including food and shelter for a diverse animal community, living both below and above sea level.[20] Maintaining a healthy mangrove forest sustains natural protection and is less expensive than seawalls and similar erosion control structures, which can increase erosion in front of the structure and at adjacent properties due to coastal currents. Unless ecosystems have the space to adjust their location or elevation in the intertidal zone to the sea-level rise, they will be stressed by changed inundation periods.[21] The Global Mean Sea Level (GMSL) has risen 4 to 8 inches over the past century, almost twice the average rate of 80 years prior.[22] It appears that as the sea-level is slowly rising, mangroves are a better alternative to protecting coastlines from eroding than other man made structures, such as seawalls.

The tsunami has provided an opportunity to illustrate that healthy mangroves serve as a natural barrier against massive waves – protecting infrastructure developments and saving lives. The World Conservation Union (IUCN) compared the death toll from two villages in Sri Lanka that were hit by the devastating tsunami giant waves. Two people died in the settlement with dense mangrove and scrub forest, while up to 6,000 people died in the village without similar vegetation [23] This study proves that mangroves provide a natural wall, which is necessary in high impact natural disasters areas such as this one.

In west and central Africa some 20-30% of the mangroves have been lost in the past 25 years. Threats vary per country, but the largest are man-made: urbanisation and urban infrastructure development, salt and sand extraction, industrial pollution, but also mangrove cutting for firewood (Ajonina et Usongo, 2001; Ajonina et al 2005). This wood is used for fish smoking and salt water cooking as part of salt production. Read more on the sustainable production techniques we introduce in West Africa. Natural causes include salt intrusion and drought.

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Mangroves in Nigeria

Wildlife Habitat

Mangrove systems support a range of wildlife species including crocodiles, birds, tigers, deer, monkeys and honey bees.[8] Many animals find shelter either in the roots or branches of mangroves. Mangroves serve as rookeries, or nesting areas, for coastal birds such as brown pelicans and roseatespoonbills. Many migratory species depend on mangroves for part of their seasonal migrations. For instance, an estimated two million migratory shorebirds of the East Asian-Australasian Flyway, which annually migrate from the Arctic Circle through South-East Asia to Australia and New Zealand and back, stop to forage at numerous wetlands along this Flyway, include the wetlands of Oceania.[9]

Improving Coastal Water Quality

Mangroves maintain coastal water quality by abiotic and biotic retention, removal, and cycling of nutrients, pollutants, and particulate matter from land-based sources, filtering these materials from water before they reach seaward coral reef and seagrasshabitats.[10] Mangrove root systems slow water flow, facilitating the deposition of sediment. Toxins and nutrients can be bound to sediment particles or within the molecular lattice of clay particles and are removed during sediment deposition. Compared with the expense of constructing a wastewater treatment plant, mangroves are commonly selected as receiving areas of effluent. Increasingly the notion of specifically constructed mangrove wetlands is being adopted and used for treatment of aquaculture and sewage effluents.[11]

Mangroves are functionally linked to neighbouring coastal ecosystems.[12] For instance, terrigenous sediments and nutrients carried by freshwater runoff are first filtered by coastal forests, then by mangrove wetlands, and finally by seagrass beds before reaching coral reefs. The existence and health of coral reefs are dependent on the buffering capacity of these shoreward ecosystems, which support the oligotrophic conditions needed by coral reefs to limit overgrowth by algae.[13] Mangroves supply nutrients to adjacent coral reef and seagrass communities, sustaining these habitats' primary production and general health.

II. CONCLUSION AND RECOMMENDATION

The survey revealed that the majority of mangroves in the area sustained only partial damage, or no damage at all, and that they are in the process of natural recovery. It was concluded that these mangroves only need some enrichment planting and protection, not massive reforestation as premised by the DENR's Mangrove and Beach Forest Development Project.

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