Biosciences, Biotechnology Research Asia Vol. **7**(1), 469-472 (2010)

Management of coastal mangrove forest development: (A review)

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(Received: March 20, 2010; Accepted: April 24, 2010)

ABSTRACT

Mangroves are the characteristics littoral plants, grouped under unique ecosystems, inhabiting mostly the sheltered coastlines, within the intertidal zone of tropical and subtropical regions. In this paper, the authors has described the values of mangroves, conservation and degradation of mangroves, factors of mangrove degradations, world mangroves and their distributions and mangrove management strategy.

Key words: Mangrove, management, ecosystem and forest.

INTRODUCTION

Mangroves are specialized ecosystems developed along estuarine sea coasts and river mouths in tropical and subtropical regions of the world, mainly in the intertidal zone. Hence, the ecosystem and its biological components are under the influence of both marine and freshwater conditions and have developed a set of physiological adaptations to overcome problems of anoxia, salinity and frequent tidal inundations. This has led to the assemblage of a wide variety of plant and animal species of special adaptations suited to the ecosystem. The ecosystem is also considered as most productive and biodiverse providing significant functions in the coastal zones as buffer against erosion, storm and tsunamis. The carbon fixed in mangroves is highly important in the coastal food webs and the litter from mangroves and the subsequent formation of detritus and its tidal export have also profound effect on promoting biodiversity richness.

Mangroves are the characteristic littoral plants, grouped under unique ecosystem, inhabiting mostly the sheltered coastlines, within the intertidal zone of tropical and subtropical regions. Globally mangrove ecosystems contain about 60 species of trees and shrubs and about 20 additional species associated with the mangrove flora, but not necessarily restricted to it (Hamilton and Snedaker, 1984). Mangroves, freshwater swamps, peat swamps, coral reefs, sea-grass beds, coastal lagoons, open beaches and islands are the eight main types of wetland habitats that constitute the "coastal zone" wherein mangroves play the most vital role.

Values of mangroves

The mangrove lands that, used to be considered as "waste land" in the past, have recently been treated as valuable ecosystem, especially for their unique features. Mangrove forests have been traditionally utilized by the local people for a variety of purposes. Values of mangroves are recognized as "tangible" and "intangible" benefits.

The forest of mangrove ecosystem is capable to yield the following tangible or direct benefits:

1. Lumber or similar construction wood.
2. Poles, fuelwood, fishing gear, etc.
3. Raw materials for the wood-based industry of various nature and including board mills, rayon mills, match factories and charcoal products, etc.
4. Non-timber products including tannin (mostly from bark) to supply raw materials for leather tanning industries, fishing net processing units, thatching material for roofing and raw materials for indigenous medicine.
5. Edible products including honey and wax, game animals, meat and fish, fruits, drinks and sugar.

The mangrove ecosystem can yield the following intangible or indirect benefits:

1. Natural spawning ground for fish and crustaceans, especially for shrimps and prawns, protection and conservation of wild life habits of a rare nature, control and regulation of the food chain in stores.
2. Contribution to mud flat formation and control of erosion.
3. Capability to check inland salinity intrusion.
4. Enhanced capability to combat the impact of cyclone and tidal surge.
5. Enhanced capability to function as a shelter belt during storms and cyclones.

Conservation and degradation of mangroves

Like the tropical rain forests, mangroves are being degraded and destroyed globally. Mangroves and mangrove ecosystems used to be regarded as "wastelands" of little or no value till they were put under a variety of uses such as fish ponds, salt beds, rice fields, urbanization, housing estates, human settlements (transmigration), roads, mining and similar uses for the so-called "development", which at times resulted into a complete destruction of the whole ecosystem.

The mangrove forest in Thailand depleted from 360 000 ha in 1960 to 174 000 ha in 1991 and that in Malaysia decreased 505 300 ha to 269 000 ha between 1980 and 1990 (Cough, 1993). In Indonesia 75% of the major cities having over 100 000 inhabitants are located in coastal areas, most of which were mangrove forests. By 1990 about 269 000 ha of mangroves in Indonesia were converted to fish ponds (Choudhury, 1996). Even in small nations such as Fiji, major urbanization has taken place by converting the mangroves of its coastal zones. In the Philippines, 169 852 ha of mangroves disappeared between 1967 and 1976 (Srivastava).

Factors of mangrove degradation

The Major factors that cause mangrove degradation around the world, in general, may be illustrated as follows:

1. Population expansion.
2. Higher short-term benefits.
3. Lack of government attention and overall awareness.
4. Obscure regulations.
5. Inefficient reforestation techniques.
6. Inadequate manpower and logistics.

Besides these, the use of herbicides in Vietnam by US Army caused the depletion of 104 123 ha of mangroves which are yet to cover (FAO, 1982). Along with the complete depletion of mangroves, the so called "coastal development" has posed various other stresses on the existing mangrove ecosystems through solid and liquid waste disposal, oil and other hazardous chemical pollution.

Waste water effluent produced by factories, direct dumping of municipal wastes into the rivers, pesticide run-off from neighboring agricultural areas, including accumulation of heavy metals into the mangrove ecosystem, are causing definite stress on them.

Oil pollution is unavoidably increasing in mangrove areas from shipyards, ship breakers, offshore oil wells, oil tanker, accidents and washing of tanks in coastal waters. A new parameter of thermal pollution is being added to these. Though research findings on these issues are still limited, the potential for major disturbances to mangroves and related ecosystems from thermal and other associated impacts from power stations is high.

World mangroves and their distribution

Mangroves are generally found along the

coast lines of tropical and subtropical regions, usually between 25^{0}N and 25^{0}S latitude, through out the world. As an exception to these, mangroves are found as far South as New Zealand and as far north as Japan. Local environmental factors such as warm sea current, frost, salinity stress, wave action, etc., determine the occurrence of mangroves beyond the above-mentioned latitudinal limits. Most tropical countries had mangroves in the past.

Walsh (1874) considered the world mangroves to be broadly divided into two main areas.

1. The Indo-Pacific region and (2) Western Africa and American regions.

He also suggested five basic requirements for extensive mangrove development which are;

1. Tropical temperature.
2. Fine grained alluvium.
3. Low wave and tidal action.
4. Salt water
5. Large tidal range.

Some other authors divided the world mangroves into two groups; (1) the old world mangrove swamps and (2) the new world and waste African mangrove swamps.

Two of the primary genera of mangrove, Rhizophora and Avicennia, contain separate species in the old and new worlds, suggesting independents speciation in each region, though there are views that suggest the Indian-Malaysian region as the original centre of distribution for mangroves. The estimated areas of the world's existing mangroves are shown in Table 1 (Aksornkoae, 1937).

Mangrove management strategy

Mangroves constitute a rich, diverse and complex ecosystem which is generally a productive resource base, but poor management practices in general have caused severe widespread degradation of this resource around the world. In some countries, however, mangrove forest management was initiated long back, mostly with the aim to produce forest products such as wood, fuel wood and thatching materials. The use of silvicultural systems as the tool for the management of natural or planted mangroves is accepted world-wide. The newly added dimension to this is the "sustainable" management of "the ecosystem" as a

Table 1: Estimated areas of existing mangroves

Country	Area in Thousand Ha	Country	Area in Thousand Ha
Australia	1150	Malaysia	674
Bangladesh	450	Mexico	660
Brazil	2500	Mozambique	455
Burma	812	Nigeria	970
Cameroon	272	Pakistan	345
Colombia	440	Panama	486
Cuba	400	Papua New Guinea	553
Ecuador	235	Peru	28
Equatorial Guinea	20	Philippines	240
Fiji	39	Sri Lanka	4
Gambia	60	Tanzania	96
Guinea	260	Thailand	287
Guyana Frances	55	Trinidad & Tobago	4
Haiti	18	Venezuela	260
India	96	Vietnam	320
Indonesia	2500	Zaire	50
Jamaica	7	Kenya	45

whole or an "integrated management" of the resource. Demonstrated successful adaptation of such management techniques is yet to be recorded though many countries are seriously thinking or starting such practices.

Recommended management strategy

The old strategy of managing mangroves for forest products alone needs to be reviewed and integrated ecosystem management approach on a sustained yield basis, under the umbrella of a bigger national coastal zone management plan, should be the ultimate present-day aim of mangrove management. Mangrove users, along with the mangrove dwellers, need to receive due consideration and to be incorporated into such management activities to ensure people's participation at large. It is suggested that the following may be consider in this connection.

1. Mangrove management should be a component of the total coastal zone management of the country.
2. Mangrove management planning should be consultative effort between government, nongovernmental agencies, resource users, mangrove dwellers and the scientific community.
3. Public awareness should be raised regarding the value of mangroves with special emphasis on their linkage effects.
4. An information database needs to be improved with systematic investigations under national and international sponsorships.
5. Political commitments towards the sustainable management of mangrove ecosystems will be required at the national levels.
6. Cooperation among international mangrove institutions should be enhanced to change ideas and experience in the field of the mangrove ecosystem and its management.

CONCLUSION

Mangroves owe their existence to the mangrove ecosystem. Mangrove habits are among the most intriguing places on earth and are special places on the threshold of time, where the life of the sea and the life of the land merge in a biological blur. The continuous world-wide depletion of mangroves through conversion of mangrove lands to other uses is alarming. Present mangrove management techniques have often failed to retain the original level of the resource. The dynamic nature of the ecosystem need to be duly considered and an integrated management approach on a sustained yield basis under the umbrella of a total coastal zone management plan for the country concerned, needs to be initiated with the creation of true mangrove reserves to conserve biodiversity at large.

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