ECOLOGY AND MANAGEMENT OF MANGROVE RESTORATION AND REGENERATION IN EAST AND SOUTHEAST ASIA

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Chief Editor

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Sanit Aksornkoae, Vipak Jintana, Urajchata Chaochalakorn, Richard William Jones

ECOLOGY AND BIODIVERSITY OF MANGROVES

Sanit Aksornkoae

Faculty of Forestry
Kasetsart University
Bangkok 10900, THAILAND

ABSTRACT

Mangroves occur in the intertidal zones along the sea coast in most tropical and sub-tropical countries and are among the most productive of ecosystems. The total mangrove area of the world has been assessed to be approximately 18.15 million hectares. Mangroves represent a rich and diverse living resource and are valuable to both the economy and protection of coastal environments. Mangrove ecosystems, both structure and functions, depend heavily on various important environmental factors such as climate, tides, waves and currents, salinity, dissolved oxygen, soils and nutrients. Mangroves are rich in biological diversity including many varieties of flora and fauna and these living organisms consist of specialized plant and animal species, well adapted to the unique conditions of mangrove ecosystems. During the last decade, considerable number of research papers regarding to the survey of flora and fauna of mangrove forests in the world have been published. More than 80 species of plants including trees, shrubs, palms, ferns, epiphytes and algae can be found in mangroves. Various kinds of fauna including shrimps, fishes, crabs, molluscs, mammals, reptiles, birds, insects and microorganisms are also found in this ecosystem. Understanding ecology and biodiversity of mangroves is highly significant in managing and conserving these coastal resources to be sustainable.

INTRODUCTION

Mangrove forests are one of the primary features of coastal ecosystems throughout the tropical and subtropical regions of the world. The mangrove has been variously described as "Coastal Woodland" and "Intertidal forest".

Mangrove forest generally embodies two different concepts which firstly refers to an ecological group of evergreen plant species belonging to several families but possessing marked similarity in their physiological characteristics and structural adaptation to similar habitat preferences. Secondly, it implies a complex of plant community fringing the sheltered tropical shores. And such communities usually have a border to trees which are mainly species of *Fam, Rhizophoraceae* associated with other trees and shrubs growing in the zone of tidal influence both on the shelter coast itself and inland along the banks of estuaries and rivers.

It has been estimated that between approximately 60% to 75% of the tropical

coastline is lined with mangrove forests (McGill, 1958). Walsh (1974) pointed out that there seems to be five basic requirement for extensive mangrove development and these are 1) tropical temperature, 2) fine-grained alluvium, 3) shores free of strong waves and tidal action, 4) salt water and 5) a large tidal range. These five important environmental factors can influence the occurrence and size of mangroves, the species composition, species zonation, other structural characteristics, and ecosystem functioning itself.

AREA DISTRIBUTION OF THE WORLD'S MANGROVES

Global geographical distribution of mangroves is mainly restricted to the tropics but are also found in some parts of the subtropics, particularly in Japan and New Zealand, reported by Oyama (1950) and Steenis (1962a) respectively. Walsh (1974) stated in his paper that the geographical distribution of mangrove vegetation can be divided into two main groups: that of the Indo-Pacific region and that of western Africa and the Americas. The Indo-Pacific region is composed of East Africa, the Red Sea, India, Southeast Asia, Southern Japan, the Philippines, Australia, New Zealand, and the Southern Pacific archipelago as far east as Samoa. The West Africa-American regions included the Atlantic coasts of Africa and the Americas, the Pacific coast of tropical America, and the Galapagos islands. The general geographic distribution of mangroves in differenttro regions in illustrated in Figure 1.

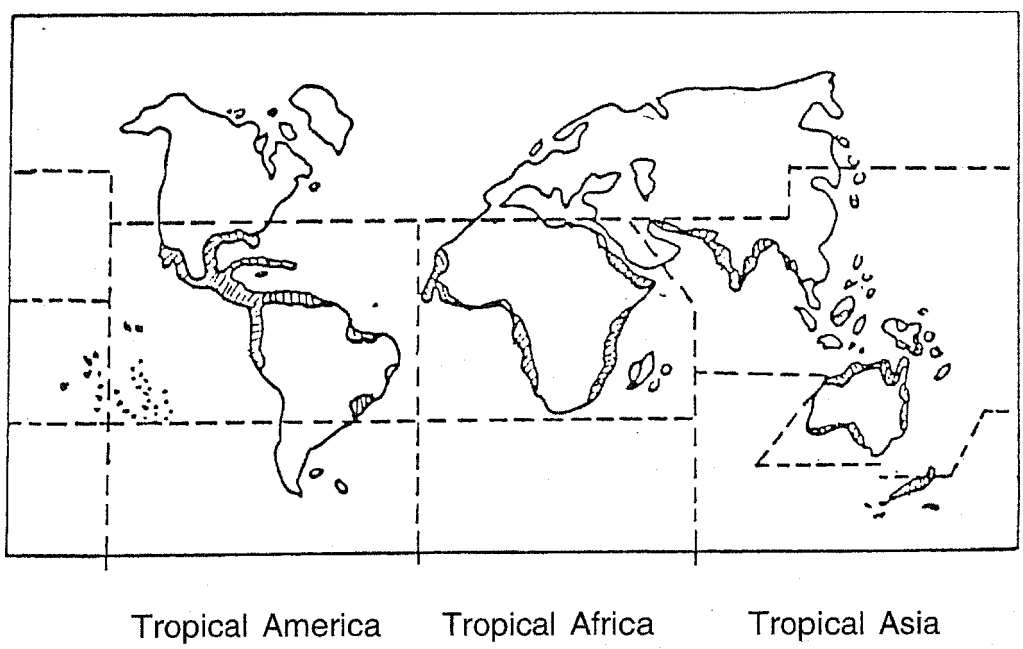

Figure 1 General geographical distribution of mangroves in the world

The areas of mangrove forests in different parts of the world as shown in Table 1 were collected from several publications. The exact existing mangrove area at present in several countries has still not been investigated. However, as based on the data in Table1, it can be estimated that the total mangrove area of the world in approximately 18,148,000 ha in tropical Africa. This data is slightly variable due to the techniques used and the date of determination.

STRUCTURAL CHARACTERISTICS

Species composition

Mangrove species are variable from place to place or country depending on geographical conditions and environmental factors e.g. soil and water conditions. Saenger et al (1981) reported that there are about 33 genus and 79 species of mangroves over the world including 22 genus and 62 species of trees, 6 genera and 10 species of shrubs, 3 genera and 3 species of palms, 1 genus and 3 species of ferns and 4 species of shrubs and trees. Details of the distribution of the individual mangrove species in different regions are given in Table 2.

Species zonation

In most mangroves, different species dominate certain bands of zones which are clearly delimited from the others. This characteristic zonation pattern results from differences in the rooting and growth of seedlings of the competitive advantages which each species has along the gradient from below the low water of above the high water lines (Kuenzler, 1968), the frequence of inundation (Watson, 1982), soil and water salinity (de Hann, 1901; Macnae, 1968), drainage and soil moisture (Thom, 1967), and geographic conditions (Aksornkoae and Kongsangchai, 1980). Due to the differences among those factors, species zonation varies from place to place or country to country. Aksornkoae (1976) described the mangroves in southeast Thailand, noting that the community structure varied from the edge of the estuary or rive to inland sites. *Rhizophora apiculata, Rh. mucronata* are dominant species occuping an area along the edge of the forest. *Nipa fruiticans* is also found in this area. *Avicennia* and *Bruguiera* associated with *Rhizophora* but they formed a more distinct zone behind the zone of *Rhizophora.* On areas adjacent to the *Avicennia* and *Bruguiera* which have drier soils and the less subject to tidal inundation. *Xylocarpus* and *Excoecaria* become the dominant species. Some areas behind the *Avicennia* and *Bruguiera* zone particularly the areas with a low topographic relief and soils high in clay content, *Ceriops* and *Lumnitzera* are usually found. *Melaleuca* reaches its highest dominance further inland.

In Florida, *Rhizophora* was the dominant species forming the forest margin. *Avicennia, Laguncularia* and *Conocarpus* dominated areas more inland. The species zonation of mangroves in this area is similar to the mangrove zonation of West Africa.

However, it can be concluded that the main factors affected species zonation were degree of tidal flooding, elevation of the land, and salinity of the soil water.

Species diversity

The complexity of mangrove forests may be expressed by the species diversity index. The species diversity of mangrove forests in different parts of the world are quite different depended on species composition and number of individual species of vegetation community. The species

diversity index in southern Florida is about 0.4979 (Lugo and Snedaker, 1973). The species diversity index of mangrove in Thailand was determined in different parts of the countries. Mangroves in Chantaburi and Trad, southeast Thailand, the species diversity index were about 0.8790 (Aksornkoae, 1976) and 0.7806 (Patanaponpaiboon, 1979) respectively. The values of species diversity of mangroves in Phang-nga (Aksornkoae and Jitt, 1980) and Ranong, southern Thailand (Aksornkoae et al. 1982) were 0.4103 to 0.7576 and 0.4330 respectively. No data on the species diversity index of mangroves in other parts of the world are available at the present time.

Associated biota

In mangrove communities, there quite number of associated species, both plants and animals. Some of these organism live in the mangroves for only part of their life cycles, or alternately the mangroves provide a suitable permanent habitat. However, these associated biota are considered to be the important resources of the mangrove ecosystem. The important associated species are bacteria, fungi, algae, bryophyes/ferns lichens, monocotyledons, dicotyledons, sponges/bryozoa, coelenterata/ctenophora, nonpolychaete worms, polychaetes, crustaceans, insects/arachnids, molluses, echinoderms, ascidians, fish, reptiles, amphibians, birds and mammals.

The common species of fishes, shrimps, crabs and molluscs in mangroves are shown in Table 3 to 6 respectively. Table 7 indicates the richness of flora and fauna found in the mangroves of Thailand.

Table 1 Area distribution of the worlds mangroves

Country	Area (Thousand ha)	Country	Area (Thousand ha)
Bangladesh	450	Malaysia	674
India	96	Peninsular Malaysia	(149)
Pakistan	345	Sabah	(350)
Sri Lanka	4	Sarawak	(175)
Burma	812	Philippines	240
Thailand	287	Kampuchea	10
Brunei	7	Viet Nam	320
Indonesia	2,500	Papua New Guinea	553
Australia	m	Fiji	m
		New Zealand	m
Total area of mangrove in Tropical Asia 8,409,000 ha			
Mexico	660	Bolivia	m
Costa Rica	39	Brazil	2,500
El Salvador	45	Colombia	440
Guatemala	50	Equador	235
Honduras	145	Uruguay	m
Nicaragua	60	Peru	m
Panama	486	Venezuela	260
Central America & Mexico	1,485	Tropical Latin America	3,435
Belize	75	Cuba	400
Guyana	150	Guyana Français	55
Jamaica	7	Haiti	18
Trinidad & Tobago	4	Republic Dominicana	9
		Surinum	115
Caricom	236	Other of the Caribean	597
Total area of mangrove in Tropical America 6,337,000 ha			
Senegal	169	Equatorial Guinea	20
Gambia	60	Gabon	140
Guinea-Bissau	230	Zaire	50
Guinea	260	Mozambique	455
Sierra Leone	170	Madagascar	300
Liberia	20	Tanzania	96
Ivory Coast	m	Kenya	45
Ghana	m	Somalia	20
Togo	m	Ethiopia	m
Benin	m	Sudan	m
Cameroon	272	Nigeria	970
Angola	125		
Total area of mangrove in Tropical Africa 3,402,000 ha			
Grand total area of mangroves 18,148,000 ha			

Table 2 Distribution of the individual mangrove species in different tropical regions

A-Exclusive Species	Life-form	Tropical Asia	Tropical America	Tropical Africa
Acanthus ebracteatus	S	✓	x	x
Acanthus ilioifolius	S	✓	x	x
Acanthus volubilis	S	✓	x	x
Aegialitis annulata	S	✓	x	x
Aegialitis rolundifolia	S	✓	x	x
Aegiceras corniculatum	S	✓	x	x
Avicennia alba	T	✓	x	x
Avicennia bicolor	T	x	✓	x
Avicennia eucalyptifolie	T	✓	x	✓
Avicennia germinans	T	x	✓	x
Avicennia intermedia	T	✓	x	x
Avicennia lanata	T	✓	x	✓
Avicennia marina	T	✓	x	x
Avicennia officinalis	T	✓	x	x
Avicennia rumphiana	T	✓	x	x
Avicennia tomentosa	T	x	✓	x
Avicennia tonduzil	T	x	✓	x
Bruguiera cylindrica	T	✓	x	x
Bruguiera exaristata	T	✓	x	✓
Bruguiera gymnorrhiza	T	✓	x	x
Bruguiera hainesii	T	✓	x	x
Bruguiera paraviflora	T	✓	x	x
Bruguiera sexangula	T	✓	x	x
Camptostemon philippinensis	T	✓	x	x
Camptostemon schultzii	T	✓	x	x
Berions decandra	T	✓	x	✓
Ceriops tagal	T	✓	x	✓
Conecarpus erectus	T	x	✓	x
Cynemetra iripa	T	x	x	x
Cynemetra ramiflora	T	✓	x	x
Excoecaria agallocha	T	✓	x	✓
Heritiera litteralis	T	✓	x	✓
Heritiera fomes	T	✓	x	x
Kandelia candel	T	✓	x	x
Leguncularia racemosa	T	x	✓	✓
Lumnitzera littorea	S/T	✓	x	x
Lumnitzera racemosa	S/T	✓	x	✓
Nypa fruticans	P	✓	x	✓

A-Exclusive Species	Life-form	Tropical Asia	Tropical America	Tropical Africa
Osbornia octodonta	S	✓	x	x
Pellicira rhizophorae	T	x	✓	x
Rhizophora apiculata	T	✓	x	x
Rhizophora harrisonii	T	x	✓	✓
Rhizophora mangle	T	x	✓	✓
Rhizophora mucronata	T	✓	x	✓
Rhizophora racemosa	T	x	✓	✓
Rhizophora x selala	T	✓	x	x
Rhizophora stylosa	T	✓	x	x
Rhizophora x lamarokii	T	✓	x	x
Scyphiphora hydrophyllacea	S	✓	x	x
Sonneratia alba	T	✓	x	✓
Sonneratia apetala	T	✓	x	x
Sonneratia caeoeolaris	T	✓	x	x
Sonneratia griffithii	T	✓	x	x
Sonneratia ovata	T	✓	x	x
Xylocarpus australasicus	T	✓	x	x
Xylocarpus gangeticus	T	✓	x	x
Xylocarpus granatum	T	✓	x	✓
Xylocarpus moluccensis	T	✓	x	✓
Xylocarpus parvifolius	T	✓	x	x

Table 2 (cont.)

B-Some important,non-cxclusive species	Life-form	Tropical Asia	Tropical America	Tropical Africa
Acrostichum aureum	F	✓	✓	✓
Acrostichum danaefolium	F	x	✓	x
Acrostichum speciosum	F	✓	x	✓
Barringtonia racemosa	T	✓	x	✓
Brownlowia argentata	T	✓	x	x
Brownlowia tersa	S/T	✓	x	x
Cerbera floribunda	T	✓	x	x
Cerbera manghas	T	✓	x	x
Clerodendrum inerme	S	✓	x	x
Cynometra mannii	T	x	x	✓
Dolichandrone spathacea	T	✓	x	x
Hibiscus bamabo	T	✓	x	x
Hibiscus tiliaceus	T	✓	✓	✓
Maytenus emarginata	S	✓	x	x
Myristica hollrungii	T	✓	x	x
Oncosperma filamentosa	P	✓	x	x
Perphis acidula	S/T	✓	x	✓
Phoenix paludosa	P	✓	x	x
Pterocar officinalis	T	x	✓	x
Thespesia acutiloba	T	x	x	✓
Thespesia populneoides	T	✓	x	x
Thespesia populneoides	T	✓	x	x
Total	67	14	24	

Key: S = Shrub, i.e,less than 3m
T = Tree,i.e,greater than 3m
P = Palm
F = Fern
✓ = present
x = absent

Table 3 Fishes in mangrove forests (Monkolprasit, 1983)

Family	*Species*	
Megalapidae	*Megalops cyprinoides*	
Clupeidae	*Clupea dispilonotus*	*Clupeoides life*
	Clupea Perforata	
Engraulidae	*Engraulis grayi*	*Stolephorus indicus*
Chanidae	*Chanos chanos*	
Ariidae (Tachysurlidae)	*Arius sagor*	
Plotosidae	*Plotosus canius*	
Bagridae	*Macrones Gulio*	
Hemiramphidae	*Hemiramphus gaimardi*	*H. melanurus*
Mugilidae	*Mugil borneensis*	*M. subviridis*
	M. dussumieri	*M. vaigiensis*
	M. kelaarti	*M. seheli*
Atherinidae	*Altherina valenciennesi*	
Centropomidae	*Ambassis buruensis*	*A. interrupta*
	A. commersoni	*A. interrupta*
	A. dayi	*A. kopsi*
Serranidae	*Epinephelus areolatus*	*E. tauvina*
	E. bleekeri	
Theraponidae	*Therapon jarbua*	
Apogonidae	*Apogon sangiensis*	
Sillaginidae	*Sillago sihama*	
Carangidae	*Chorinemus lysan*	*Chorinemus sp.*
Lutjanidae	*Lutjanus argentimaculatus*	
	L. johni	*L. russelli*
		L. vaigiensis
Leiognathidae	*Gazza minuta*	*L. equulus*
	Gerres abbreviatus	*L. lineolatus*
	G. punctatus	*L. splendens*
	Leiognatus brevirostris	*Leiognathus sp.*
Pomadasyidae	*Pomadasys argyreus*	*Pomadasys*
	Pomadasys hasta	*maculatus*
Sciaenidae	*Otolithus ruber*	
Mullidae	*Mulloidichthys sp.*	
	Upeneus sulphureus	
Psettidae (Monodactylidae)	*Monodactylus argenteus*	
Scatophagidae	*Scatophagus argus*	
Callionymidae	*Callionymus sagitta*	
Siganidae	*Siganus punctatissimus*	

Family	Species	
Eleotridae	*Butis butis*	
	Ophiocara porocephala	
Gobiidae	*Acentrogobius viridipunctatus*	*Glossogobius giurus*
	Bathygobius fuscus	*Stigmatogobius javanicus*
	Brachygobius sua	*Taeniodides anguillaris*
Periophthalmidae (Apocrypteidae)	*Boleophthalmus boddari*	
	Periophthalmus barbarus	
Platycephalidae	*Platycephalus scaber*	
Triacanthidae	*Triacanthus biaculeatus*	
Tetraodontidae	*Sphoeroides lunaris*	*Tetradon fluviatlis*

Table 4 Shrimps in mangrove and adjacent areas (Chaitiamvong, 1983)

Habitat	Species	
Marine to coastal area near mangroves	*Metapenaeopsis mogiensis*	
	M. palmensis	*M. stridulan*
	Metapenaeus conjuntus	
	M. dobsoni	*M. intermedius*
	M. moyebi	
	Parapenaeopsis coromandilica	
	P. hardwickii	*P. marillipedo*
	P. uncto	
	Penaeus japonicus	
	P. latisulcatus	
	Trachypenaeus granulosus	*T. sedili*
Marine to brackish water (mangroves)	*Metapenaeus affinis*	
	M. brevicornis	*M. ensis*
	M. lysianassa	*M. tenuipes*
	Parapenaeopsis hungerfordi	
	Penaeus indicus	*P. merguiensis*
	P. monodon	*P. semisulcatus*
	Acetes erythraeus	*A. indicus*
	A. japonicus	*A. vulgaris*
	Alpheus euphrosyn	
	Eropalaemon styliferus	

Habitat	Species
Brakish water (mangroves)	*Macrobrachium equidens* *M. mirable* *Palaeander* sp. *Palaemonetes* sp.
Fresh water to brackish water	*Mocrobrachium rosenbergii* *Leptocarpus potamiscus*

Table 5 Molluscs in the mangroves (Isarankura, 1976)

Habitat	Gastropods (Univalves)	Pelecypods (Bivalves)
Living on trees (Arboreal or tree fauna)	*Cassidula aurisfelis* *Cerithidea obtusa* *Ellobium aurisjudae* *Littorina carinifera* *L. melanostoma* *L. scabra* *L. undulata* *Nerita birmanica* *N. violacea* *Onchidium* sp.	*Crassostrea* sp. *Isognomon ephippium* *Teredo* sp.
Living on mangrove soil (Forest Floor or soil fauna)	*Cassidula aurisfelis* *Cerithidea cingulata* *Ellobium aurismidae* *Onchidium* sp. *Syncea brevicula* *Telescopium tetescopium* *Terebralia sulcata*	*Geloina ceylonica* *Isognomon ephippium*

Table 6 Crabs in mangroves and adjacent areas (Naiyanetr, 1983)

Family	Species	
Grapsidae	*Sesurma mederi*	*S. versicolor*
	S. singaporensis	*S. moeschii*
	S. sediliensis	*S. bocourti*
	S. polita	
	Parasesarma plicata	
	P. lanchesteri	*P. leptosoma*
	Chiromentes eumolpe	
	C. indiarum	*C. fusciata*
	C. darwinensis	*C. dussumieri*
	S. semperi	
	Sarmatium indicum	*S. crassum*
	S. germani	
	Holometropus limbense	
	Metaplar elegans	*M. dentipes*
	M. crenulata	*M. distinctus*
	Monosesarma batavicum	
	Clistocoeloma merguiensis	
	Mettopograpsus latifrons	
	Varuna litterata	
Ocypodidae	*Macrophthalmsu brevis*	
	M. tomentosus	*M. erato*
	M. japonicus	*M. definitus*
	Paraclestostoma microcheirum	
	Tylodiplar tetraylophora	
	Ityopla lingulatus	
	I. obiquus	*I. punotatus*
	Uca forcipata	*U. annulipes*
	U. perplexa	*U. urvillei*
	U. dussumieri	*U. vocans*
	U. spinata	*U. bengali*
Portunidae	*Scylla serrata*	
Gegarcinidae	*Cardisoma carnifea*	
Paguridae	*Clibanarius longitarus*	
	C. lineatus	*C. padavensis*
	Diogenes avarus	
Coenobitidae	*Coenobita cavipes*	
Xiphosunidae	*Carcinoscorpius rotundicauda*	

Table 7 Distribution of flra and fauna in forests of Thailand

Community	No. of Species	Reference
Flora		
1. Mangroves (Trees, shrubs, fern and palms)	74	Santisuk, 1983
2. Epiphytes	18	Sahavacharin & Boonkerd, 1976
3. Algae	44	Lewmanomont, 1983
Fauna		
1. Fishes	72	Monkolprasit, 1983
2. Shrimps	37	Chaitiamvong, 1983
3. Crabs	54	Naiyanetr, 1983
4. Molluscs	20	Isarankura, 1976
5. Birds	88	Nabhitabhata, 1982
6. Mammals	35	McNeely & Lekagui, 1976
7. Insects	38	Vaivanijkul, 1976
8. Reptiles	25	Way, 1977
1) Snakes	12	
2) Amphibians	6	
3) Turtles	1	
4) Lizards	5	
5) Crocodiles	1	

USES OF MANGROVES

Mangrove forests have been widely and variously used by the people who live in or close to them and who traditionally have made a living from the mangrove ecosystem for thousands of years. People have depended on mangrove trees for many purposes. Firewood and charcoal are the main products obtained from mangrove trees in Southeast Asian countries, particularly Thailand (Aksornkoae, 1979). The utilization of mangrove trees for timber in large quantities was found in Indonesia and Bangladesh (Burbridge and Koesoebiono, 1980: Ahmad, 1980). Many countries also use mangrove woods for construction purposes. Paper and wood-chip from mangrove woods are used in Malaysia. Tannin from mangrove barks are widely used in Latin American countries like Panama and Costa Rica but very little quantity is used in Southeast Asian countries only for dyeing fishing nets.

The use of mangroves in fish production has been recognized. Many commercially important fishes, crabs, prawns and various kinds of molluscs use mangroves as nursery grounds and also shelters during their juvenile stages. By this relationship, it can be seen that many mangrove dwellers catch marine animals around mangrove forests. Aquaculture is also widely practised in mangrove areas particularly in Southeast Asian countries.

Some countries, like India and Indonesia, use mangrove trees for grazing. Honey raising is also observed in mangrove forests especially in Bangladesh. Many kinds of mangrove species are used for medicinal plants but they still need scientific proof. Moreover, in some countries, mangroves are used as a wildlife sanctuary, protecting coastlines and riverbanks against tidal bores and cyclones. Mangrove are also reserved for park and study areas in many countries.

CAUSES OF MANGROVE DESTRUCTION

The global status of mangrove forests is such that it has been found that vast areas are being destroyed either intentionally or as a secondary result of other activities. The causes of mangrove destruction in various countries are very similar. The degree of destruction in each country depends on specific purposes. The main problem is that the population of each country increases and this leads to increased demands for food, fuel, building materials, urbanization and land for cultivation. However, it can be concluded that the causes of mangrove destruction around the world are made in many ways and these can be classified as overexploitation by traditional users, conversion to aquaculture, conversion to agriculture, conversion to salt pans, conversion to urban development, construction of harbours and channels, mining, liquid waste disposal, solid waste of garbage disposal, oil spillage and spillage of other hazardous chemicals. Natural stresses such as cyclones and freshwater discharges are also destroying mangrove forests but the areas are minimal.

MANAGEMENT AND ADMINISTRATION

Since mangrove forests are very important to the daily life of mangrove dwellers and those who live close to the mangroves; to the economy of the countries and also to maintain ecological equilibrium as previousely mentioned, all countries containing mangroves have set a plan for using the mangrove resources as sustained yield basis. The concept of sustainable use

involves either sustainable harvest of sustainable economic returns while at the same time the system can be maintained in as natural or close to its original state as possible.

Sustained yield management of mangroves for forestry production is carried out by various countries, particularly in Southeast Asia. The utilization of mangroves for forest production is not widely observed in Latin American countries: most of them are reserved for sustained yield management for coastal fisheries. In some countries, the mangroves are permanently kept for shoreline protection and tourist areas, especially in Japan. The sustained yield management of mangroves for forestry products is based on management plans and the silvicultural system. The cutting rotation period varies from country to country between 10 to 40 years. The principle practice is that the mature trees are clearfelled in strips, as in Thailand or Venezuela, or in blocks, as in Malaysia, of a few hectares in area. The timber is removed for specific purposes. These areas will be planted if natural regeneration is insufficient.

Regarding sustained yield management of mangroves for coastal fisheries, the mangroves are kept for providing nutrients for increased productivity of fisheries, sheltering nursery grounds as permanent habitats and breeding grounds. The multiple-use management system or socalled "Silvofishery system" is being operated. The practice is that fish or shrimp ponds are constructed around mangrove plantations and this method is successfull in Indonesia.

At present, many countries are attempting to maximize the use of their mangroves, especially for the sustainable production of forestry and fisheries. In Asian countries, the National Mangrove Committee (NATMANCOM) were established to advise governments in planning and implementation of technical projects and to determine the existing problems on utilization and conservation of mangrove resources. Various laws and regulations regarding mangrove resources' management were revised in many countries according to the situation.

INTERNATIONAL COLLABORATION

Mangroves play a very important role in the life of the people who live in or close to mangrove areas and also to the economy of the country. Countries containing mangrove forests try to conserve them for many purposes and to utilize them on a sustained basis but the results come out with success in some countries and failure in others. There are many reasons to take into account but today it can indicate that individual countries can not work successfully alone. The action and collaboration of various countries and foreign agencies need to be carried out: UNESCO, UNDP, IUCN, FAO etc. play a significant role in bringing scientists and decision-makers from various developing countries and less developed countries to seek understanding of the natural characteristics and the mangroves to the survival of humans along the coastlines. The situation in desert countries such as in Africa have shown to the world poverty, famine and motality. No one can be sure that it would not happen to humans along the coastlines if the food habitats, knowns "mangroves", have been destroyed.

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