

## REHABILITATION OF MANGROVE ECOSYSTEM IN THAILAND

Vipak Jintana<sup>1</sup>

### บทคัดย่อ

การบุกรุกเข้าไปใช้ประโยชน์และทำลายพื้นที่ป่าชายเลนอย่างต่อเนื่อง ส่งผลให้พื้นที่ป่าชายเลนในประเทศไทยลดลงเป็นจำนวนมาก จากการสำรวจโดยอาศัยภาพถ่ายจากดาวเทียมในช่วง 32 ปี (2504-2536) พบว่ามากกว่าครึ่งหนึ่งของพื้นที่ป่าชายเลนได้ถูกเปลี่ยนไปใช้ประโยชน์ที่ดินในรูปแบบอื่น มีความพยายามหลายประการที่ดำเนินการเพื่อแก้ปัญหาข้อขัดแย้งการใช้ประโยชน์ที่ดินป่าชายเลน ได้แก่ การจำแนกเขตการใช้ประโยชน์ที่ดินในพื้นที่ป่าชายเลนทั่วประเทศออกเป็น 3 เขต ประกอบด้วย เขตอนุรักษ์เพื่อการป้องกันรักษาสภาพสิ่งแวดล้อม เขตเศรษฐกิจ ก เพื่อผลิตทางด้านป่าไม้อย่างต่อเนื่อง และเขตเศรษฐกิจ ข เพื่อการพัฒนาในรูปแบบต่างๆ ที่ไม่ส่งผลกระทบต่อสภาพแวดล้อม เนื่องจากการทำลายพืชพรรณไม้ป่าชายเลนทำให้ระบบนิเวศขาดความสมดุล และส่งผลกระทบต่อผลผลิตของทรัพยากรธรรมชาติบริเวณชายฝั่ง รัฐจึงได้แสดงความมุ่งมั่นที่จะหาวิธีที่เหมาะสมเพื่อดำเนินการฟื้นฟูระบบนิเวศป่าชายเลนที่เสื่อมสภาพ ซึ่งการปลูกสร้างสวนป่าชายเลนถือเป็นกิจกรรมหลักประการหนึ่ง ในปี 2535 รัฐได้จัดทำโครงการปลูกฟื้นฟูป่าชายเลน จำนวน 250,000 ไร่ อยู่ในเขตอนุรักษ์ 57,400 ไร่ และในเขตเศรษฐกิจ ก 192,600 ไร่ โดยคาดว่าจะดำเนินการให้เสร็จภายในปี 2539 ศูนย์ผลิตเมล็ดพันธุ์ไม้ป่าชายเลนได้ถูกตั้งขึ้นเพื่อสนับสนุนโครงการปลูกป่าชายเลนในแต่ละภาค มีการพัฒนาการใช้เทคโนโลยีสมัยใหม่ในการเก็บรักษาเมล็ดพันธุ์และกล้าไม้ การปลูกบำรุงและการจัดสร้างสวนป่าชายเลน อย่างไรก็ตาม ความรู้ความเข้าใจเกี่ยวกับระบบนิเวศป่าชายเลน การอนุรักษ์ การใช้ประโยชน์ และการฟื้นฟูป่าชายเลนยังคงเป็นปัญหาที่จำเป็นต้องหาทางแก้ไขต่อไป

### ABSTRACT

Human activities have caused severe destruction of mangrove forests especially in Thailand where more than a half of mangrove areas was destroyed during the past 32 years (1961-1993). The mangrove forests have been exploited for various purpose. Many efforts have been done to solve problem on the conflicts of mangrove land use. Mangrove areas were classified into three zones, i.e. preservation zone for conservation of nature and environment, economic zone A for conservation of forestry product, and economic zone B for other development programmes. Thailand is taking proper measure to rehabilitate the degraded mangrove ecosystem. Because the destruction of woody part causes the deterioration of the ecosystems concerned, thus, artificial plantation of mangrove forests are widely introduced to rehabilitate the degraded ecosystems. In 1992, reforestation programme of mangrove forest was approved by the government. Total area of 40,000 ha including 9,184 ha in preservation zone, and 30,816 ha in economic zone A were expected to be reforested by the end of 1996. Mangrove Forest Seed Production Centers were established to supply the seedlings for each region. New technology in handling propagules,

<sup>1</sup> Technical Forest Office, Royal Forest Department, Bangkok 10900, Thailand



planting and establishing plantation have been developed. However, the knowledge concerning mangrove ecosystem, i.e. conservation utilization, and rehabilitation, is still an urgent need for Thailand.

## INTRODUCTION

A mangrove forest is an ecosystem where mangroves play a great role in system maintenance and development. It develops on coastal zones of tropical and subtropical regions. The properties of soils and water are closely related with the plants' life in the system. The factors directly affecting the distribution of mangrove forests are climate, water salinity, tidal range and soil properties (Odum *et al.* 1982). Mangrove forests in Southeast Asia were reported to be the greatest luxuriance in the word (Macnae 1968).

Mangrove forest resources play a very important role not only in terms of production of forest itself but also in fishery production. In Thailand, for instance, people have utilized mangrove woods for firewood and charcoal for many decades. In fishery point of view, mangrove forests are used as nursery ground, shelters and food source for various kinds of marine animals. Moreover, mangrove forests also play an important role in stabilizing the coastal areas particularly soil erosion from wind stress and current action. It is necessary to indicate that the mangrove forest is also a highly symbolic

resource, straddling the interface between the terrestrial and marine ecosystems.

This paper concerns the status of mangrove ecosystems of Thailand. Impact of economic development on deterioration of mangrove forests, and government effort to conserve and rehabilitate the degraded ecosystems are discussed.

## DISTRIBUTION AND HABITAT

Of the 2,600 km of coastline in Thailand, 36% are covered with mangrove forest. From the first survey in 1961, total mangrove forest area was about 367,900 ha. It extends along the eastern and northern coasts of the Gulf of Thailand, and the eastern and western coasts of the Peninsular Thailand. The greatest extent and diversity was found along the western coast of peninsula at Ranong, Pang-Nga, Trang, and Satul provinces.

Table 1 shows biodiversity of mangroves in Thailand which compiled from reports of several authors. It is found that at least there are 138 species of plants including 74 species of trees and shrubs, 46 species of algae, and 18 species of epiphytes. At least 422 species of animals including 36 species of mammals, 204 species of birds, 32

Table 1. Biodiversity of mangroves in Thailand

Organisms	Families	Genera	Species	Authors
Plants				
Trees and	35	53	74	Santisuk (1983)
Shrubs	16	28	46	Liewmanomon (1976)
Algae	3	13	18	Sahavacharin & Boonkerd (1976)
Epiphytes				
Animals				
Mammals	13	24	36	Kongsangchai & Prayoonsitti (1990)
Birds	38	122	204	Kongsangchai & Prayoonsitti (1990)
Reptiles	13	27	32	Kongsangchai & Prayoonsitti (1990)
Amphibians	4	4	6	Kongsangchai & Prayoonsitti (1990)
Fishes	30	43	72	Monkolprasit (1983); Monkolprasit <i>et al.</i> (1987)
Crabs	4	9	30	Naiyanetr (1985); Naiyanetr & Baphavijit (1979)
Shrimps	4	8	15	Chaitiamvong (1976); Chaitiamvong (1983)
Univalves	7	12	22	Isarakuru (1976)
Bivalves	4	5	5	Isarakuru (1976)
Microorganisms				
Bacterium		7		UNDP/UNESCO (1991)
Fungus			50	UNPD/UNESCO (1991)

species of reptiles, 6 species of amphibians, 72 species of fishes, 30 species of crabs, 15 species of shrimps, 22 species of univalves, and 5 species of bivalves are recorded. At least 7 genera of bacterium and 50 species of fungus are identified.

#### DETERIORATION OF MANGROVES

Like other countries in Southeast Asia, Thailand faces a serious problem of deterioration of mangrove areas at a high rate. The forest areas were converted to aquaculture, industrial site, urbanization, tin mining, salt pan, harbour, and agriculture. Approximately, 192,513 ha or 52.33 % of the mangrove forests have already been destroyed by conversion to other land uses

during 1961-1992. Among these, about 60 % of the total degraded mangrove areas were turned into aquaculture purpose especially for the tiger prawn, *Penaeus monodon*. Change in areas of mangrove forest in Thailand is shown in Table 2.

Mangrove ecosystems function as an interactive system of four major components of soils, water, plants, and animals. They are interregulated through the physical, chemical, and biological process (Ogino *et al.* 1988). The destruction of woody part of the forest resulted in the deterioration of the ecosystem concerned and in turn became affected the sustainable yield of natural resources. Jintana (1993) stated that stresses



Table 2. Change of the existing mangrove forest in Thailand during 1961-1993

Year	Existing area (ha)	Rate of change		Rate of decreasing (ha/yr)
		ha	%	
before 1961	372,448			
1961	367,900	4,548	1.23	
1975	312,700	55,200	14.81	3,943
1979	287,308	25,392	6.82	6,348
1986	196,435	90,872	24.38	12,982
1989	180,559	15,876	4.27	5,292
1991	173,821	6,738	1.82	3,369
1993	168,683	5,138	1.39	2,569
<b>Total/Average</b>		<b>203,765</b>	<b>54.72</b>	<b>6,226</b>

Sources: Charupatt (1993); Rattanasermpong *et al.* (1993)

of mangrove substratum, i. e. extremely low oxygen concentration, and strong acid, obstructed growth and development of the *Rhizophora apiculata* seedlings. Even though the seedlings showed the capability to adapt the anaerobic stress, but no positive evidence of possible adaptability to the acid stress was observed. These stresses are induced and stimulated by human activities. The most serious one is the formation of acid sulphate soils caused by the oxidation of accumulated pyrite in the soils. The acidity resulting from this process is detrimental to plant growth.

#### CLASSIFICATION OF MANGROVES

In 1986, 72,265 ha of mangrove forests of the country disappeared. They were converted to other types of land use. Royal Forest Department (RFD) and other

organizations concerned have set a plan to solve the conflicts of mangrove land use. The national mangrove zonation together with management strategies has been established by the THAI NATMANCOM and RFD in 1987. The zonation was approved and declared for implementation on December 15, 1987. Attached to the measures are maps defining mangrove throughout the country into 3 zones for 3 types of development activities, i.e. preservation zone for conservation of nature and environment, economic zone A for conservation of forestry, and economic zone B for other development programmes. This attempt is to use the mangrove area for multiple sustainable use rather than conversion for only a single exclusive use. Table 3 shows the zonation of mangrove areas in Thailand.

Table 3. Land use classification of mangrove areas in Thailand

Regions	Preservation zone (ha)	Economic zone A (ha)	Economic zone B (ha)	Total (ha)
Central part	3,907	972	62,103	66,982
Eastern part	3,174	30,203	21,468	54,845
East of peninsula	6,186	19,212	31,051	56,449
West of peninsula	29,411	149,302	15,459	194,172
Total (ha)	42,678	199,689	130,081	372,448
(%)	11.46	53.61	34.93	100

Source: RFD (1987)

### REHABILITATION OF MANGROVES

During 1968-1989, the area of 28,849 ha was reforested after clear cutting under concession regulation. The area was classified as the economic zone A for sustainable wood production purpose. A rotation of 30 years with 15 years felling cycle was adopted since 1968. However, a large scale of mangrove forests has been destroyed as mentioned earlier. The most urgent need of Thai government is to take a proper measure to rehabilitate the degraded mangrove ecosystem. Recently, artificial plantation of mangrove forests has been widely introduced to rehabilitate the degraded mangrove ecosystems. A total area of 40,000 ha including 9,184 ha in preservation zone, and 30,816 ha in economic zone A was proposed to be reforested during 1992-1996. Reforestation programme in preservation zone for ecological benefits has been carried out since

1991. Total area of 7,816 ha was already reforested (Table 4). *Rhizophora*, *Bruguiera*, *Ceriops*, *Xylocarpus* and *Avicennia* were selected for the planting. A spacing at 1.5 by 1.5 m was used in the clear-cut or mud flat areas whereas associated planting was done in poor natural stands.

In 1991, Mangrove Forest Seed Production Centers (MFSPC) were established in 4 provinces, i.e. Trat in the eastern part, Nakorn Srithammarat in the east of peninsula, Phang-Nga and Satul in the west of peninsula, to supply the seedlings for each region. Nursery techniques in handling propagules, planting and establishing mangrove plantation were developed to improve the seedlings quality as well as forest productivity (Head of MFSPC, personal communication). Genetic improvement and related silvicultural techniques of the mangrove tree species are under investigation by staffs of the RFD and several universities. However, the present

Table 4. Reforestation of mangrove preservation areas in Thailand during 1991-1994

Regions	1991 (ha)	1992 (ha)	1993 (ha)	1994 (ha)	Total (ha)
Central part		160	240	256	656
Eastern part		400	480	640	1,520
East of peninsula	160	584	352	944	2,152
West of peninsula	112	1,096	1,032	1,360	3,488
Total (ha)	272	2,240	2,104	3,200	7,816

Source: RFD (1994, unpublished data)

state of knowledge concerning mangrove ecosystem in connection with socio-economic development is still far from satisfaction.

#### RECOMMENDATIONS

In order to manage the mangrove ecosystems sustainability, several concepts should be mentioned herewith. Firstly, it has been proved in Thailand that the most efficient way to cope with the ecosystem degradation is have local people involved in protecting their own resources. Therefore, the programme for creating people's awareness of the importance of the mangrove ecosystems and the proper use of resources is the necessity for each particular area. Secondly, the balance between economic gain and environmental and social loss should be weighed in favour of the longer term objectives. And the last, but not least, more attention should be paid on the impact of development on mangrove ecosystems, i.e.

the biodiversity including ecodiversity, species diversity, genetic diversity, and the productivity of bioresources.

#### REFERENCES

- Chaitiamvong, S. 1976. Shrimps in mangroves and adjacent areas in Thailand. The first national seminar on mangrove ecosystem in Thailand. Phuket. January 10-15. 16 pp.
- Chaitiamvong, S. 1983. Shrimps in mangroves and adjacent areas. The UNDP/UNESCO Regional training course on introduction to mangrove ecosystems. NRCT. Bangkok. March 2-30.
- Charupatt, T. 1993. Mangrove forest situation in Thailand in 30 years (1961-1991). The eighth national seminar on mangrove ecosystems in Thailand. Suratthani. September 25-28. 16 pp.
- Isarakura, K. 1976. Status report on faunistic aspects of mangrove forest in Thailand. The first national seminar on mangrove ecosystem in Thailand. Phuket. January 10-15.
- Jintana, V. 1993. Ecological study on root development of *Rhizophora apiculata*



- seedlings under extremely low oxygen and strong acid. Ph.D. Thesis. Ehime University. Japan. 91 pp.
- Kongsangchai, J. and Prayoonsitti, T. 1990. Vertebrate species in the mangrove forests of Thailand (excluding fish). RFD Report. Bangkok. 37 pp.
- Liewmanomon, K. 1976. Algae in mangroves. The first national seminar on mangrove ecosystem in Thailand. Phuket. January 10-15. 14 pp.
- Macnae, W. 1968. A general account of the fauna and flora of mangrove swamps and forests in the Indo-West-Pacific region. Advance Marine Biology 6: 73-270.
- Monkolprasit, S. 1983. Fish in mangroves and adjacent areas. The UNDP/UNESCO Regional training course on introduction to mangrove ecosystems. NRCT. Bangkok. March 2-30.
- Monkolprasit, S.; Vimollohakarn, S. and Thongsiri, T. 1987. Fishes of Thailand. Faculty of Fishery. Kasetsart University. Bangkok.
- Naiyanetr, P. 1985. Life history of selected species of crabs in mangroves. The UNDP/UNESCO Regional training course on life history of selected species of flora and fauna in mangrove ecosystem, NRCT. Bangkok. October 2-16.
- Naiyanetr, P. and Baphavijit, S. 1979. *Uca* crabs of Thailand. The third national seminar on mangrove ecosystems in Thailand. Prince of Songkhla University. Hatyai. April 8-12.
- Odum, W. E.; McIvor, C. C. and Smith, T. J. 1982. The ecology of the mangroves of south Florida: a community profile. US Fish and Wildlife Services. FWS/OBS-81/24. 144 pp.
- Ratanasermpong, S.; Avakied, S. and Silapathong, C. 1993. A study on change of mangrove forests by remote sensing. The eighth national seminar on mangrove ecosystems in Thailand. Suratthani. September 25-28. 10 pp.
- RFD. 1987. Classification of mangrove forest land use zones in Thailand. RFD Report. Bangkok. 77 pp.
- Sahavacharin, O. and Boonkerd, T. 1976. Flowering epiphytes in mangroves. The first national seminar on mangrove ecosystem in Thailand. Phuket. January 10-15. 9 pp.
- Santisuk, T. 1983. Taxonomy of the terrestrial trees and shrubs in the mangrove formations in Thailand. The UNDP/ UNESCO Regional training course on introduction to mangrove ecosystems. NRCT. Bangkok. March 2-30.
- UNDP/UNESCO. 1991. The integrated multidisciplinary survey and research programme of the Ranong mangrove ecosystem. UNDP/UNESCO Regional Project-Research and its application to the management of the mangroves of Asia and the Pacific (RAS/86/120). Funny Publishing Limited Partnership. Bangkok. 183 pp.



# THAI JOURNAL OF FORESTRY

Volume 15 Number 1, January - June 1996

ISSN 0857-1724

---

Sawntimber and utilization from small logs of <i>Azadirachta excelsa</i> (Jack) Jacob	1
..... Sutee Visuthitepkul, Worakit Soontonbura and Saruntorn Sukwatnijakul	
Chemical constituents and physical properties of <i>Bambusa heterostachya</i>	14
..... Abd. M. Latif, O.Arshad, K. Jamaludin and Mohd. S. Hamami	
Species-area relations of dry dipterocarp forest vegetations	26
..... Pongsak Sahunalu	
Litterfall and nutrient content in Toh-Daeng primary peat swamp forest at Narathiwat Province	37
..... Sarayudh Bunyavejchewin and Tanit Nuyim	
Soil and water losses from different land uses	48
..... Mongkon Vannaprasert and Udhai Thongmee	
Soil moisture variation under teak and <i>Gmelina</i> plantations at Mae Khlong Watershed Research Station, Changwat Kanchanaburi	55
..... Nipon Tangtham and Songtham Suksawang	
Charcoal briquette production from twigs of four exotic tree species	64
..... Preecha Kiatgrajai	
Rehabilitation of mangrove ecosystem in Thailand	73
..... Vipak Jintana	