Identification of Mangrove Patches and its Species Using Remote Sensing and Field Method in Ranong Province, Thailand

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Abstract

Mangrove ecosystem is one of the important coastal ecosystems for biodiversity, coastal protection and daily livelihood of millions of people in coastal developing countries including Thailand. This study was conducted in Ranong Province, Thailand with the aim to identify and determine the mangrove patches distribution and its species. Remotely sensed data was used and revealed that the mangrove forest was existed in each district. Mueng district is considered as the area where the highest number of mangrove patches found with the totale 17 patches. The smallest patch number was identified in Kra Buri district with a total of only 3 patches. Most of the patches were formed clumped, elongated with medium and large sizes and were located along the Andaman seacoast. The Point Centered Quarter (PCQ) field method was employed for floristic inventory. The Result indicated that there were 19 identified mangrove species with 4 dominant taxa namely, Rhizophora, Avicennia, Ceriops and Bruguiera found in Ranong and these types would be considered as the choice for mangrove reforestation. This result derived from this study may useful for various stakeholders in Ranong such as local government units, non-governmental organization and decision-makers and could be served for mangrove management and coastal landscape planning in that area.

Keywords: mangrove patch, coastal environment, biodiversity

INTRUDUCTION

Mangroves, a forested coastal wetland type occupy nearly 75 percent of the world's coastlines, capable of growth and reproduction in areas inundated daily by seawater (Heald and Odum, 1975, Aksornkoae et al., 1992; Smith and Smith, 2004; Doydee et al., 2008). They contribute to habitat complexity and the diversity of the associated fauna of the ecosystem (Hutchings and Saenger, 1987; Othman, 1994; Tri et al., 1998; Lee, 1998). They provide also the protection for habitats which are suitable for breeding and nursery ground for many shrimps, crabs and fish (Sasekumar et al., 1992; Barbier and Stand, 1998). They also have important indirect services such as shoreline stability and water quality (Buot, 1994; Janssen and Padilla, 1999; Anongponyoskun and Doydee, 2006).

Mangrove wetland serves local people with a wide range of species and materials, ranging from mangrove wood products used for fuelwood, fishing gear and housing, to fish, mollusks, crustaceans and other aquatic species which are eaten or sold for income (Immink, 1996; Lee, 1998; Macintosh et al., 2002). Mangrove patches in Ranong are one of coastal features with large areas. Thus, identification and determination of mangrove distribution through the use of effective tool such as Remote Sensing is needed and the field method is also necessary to increase the classification of mangrove species in the study area.

MATERIALS AND METHOD

The study area is located in Ranong Province (9° 43' N to 9° 57' N and 98° 29' E to 9°80 39' E) I in the southwest coast of Thailand (Figure 1) and about 568 km south of Bangkok. Ranong is geographically characterized with long expanses of sandy beaches, unspoiled upland and mangrove forests, waterfalls, parks and a biosphere reserve zone. The remotely sensed data (Landsat-5 TM) was gathered from Geo-informatics and Space Technology Development Agency (GISTDA) on October 10, 2007. In each mangrove patches site, the coordinates were determined using a Global Positioning System (GPS) receiver with estimated accuracy of 10 m or better. To validate the coordinates, georeferencing technique was applied to recheck the collecting localities of study area (Doydee, 2005; Bantayan, 2006).

Landsat-5 TM and field observation were used to identify and examine the mangrove distribution based on the result of False Color Composite method (FCC) in which Red, Green, Blue layers were applied for Infrared, Red and Green band respectively. This FCC was obviously

Figure 1. The study area in Ranong, Thailand composed of 5 districts namely: Kra Buri, Laun, Mueng, Kapoe and Suk Samran.

displayed and separated mangrove areas from other landuse and landcover types. Consequently, FCC was simply counted the number of mangrove patches and described the size, shape and arrangement based on the concept of land mosaics of Forman (1995).

The geospatial method was employed to create the mangrove areas and boundary of study area as vector files. The mangrove species data collection was accomplished using the Point Centered Quarter (PCQ) method of Mueller-Dombois and Ellenberg (1974). This method allowed for a measurement of species composition, density, basal area of forest stands. However, this study emphasized on species abundance (% stand) since the size of mangrove trees was homogeneous. In each sampling site, a point of an area 15-20 m was established for 20 points. In each point, a number of 4 nearest trees from the 4 cardinal directions were identified.

RESULT AND DISCUSSION

The Ranong Province is composed of 5 districts namely: Kra Buri, Laun, Mueng, Kapoe and Suk Samran (Figure 1). The remotely sensed data covered the entire Ranong Province. The satellite image was observed and taken on March 7, 2006. This was an optimal date for the image observation process as the skies were cleared from cloud cover. The FCC technique was used where Red, Green and Blue layers were applied with bands 4, 5 and 2 respectively, with spatial resolution or pixel size of 30 meters. All bands used had performed radiometric and geometric correction. This FCC technique has contrasted the mangrove patches from other land use types. Furthermore, this spatial information is mapped using the Universal Transverse Mercator (UTM) projection with Earth Ellipsoid WGS84. In the area

of study there were mangrove forests in every district (Figures 2).

The attributes of mangrove patches (Table 1) included the number of patches in each district, patch size, shape and its arrangement. In Mueng district, it was the most number of patches found, that is 17 patches. The smallest patch number was found in Kra Buri district with a total of only 3 patches. Most of the patches were in form of clumped and elongated, with medium and large sizes which derived directly from satellite image zooming in of Area of Interested (AOI). Due to the result of unsupervised and supervised classification showed intermixing output posing difficulty in interpretation. Therefore, the mangrove patches were obtained by screen digitizing technique to illustrate mangrove distribution based on FCC of satellite image.

The mangrove patches observed were more concentrated in Mueng, Kapoe and Suk Samran and these sites were selected to investigate the ecological data of mangrove species using PCQ field method.

The mangrove species abundance in terms of percentage stand was examined in the aforesaid area in which 2 sites within each district were selected based on accessibility, size of mangrove patches, and associated elements such as channels and distance. These particular sites were Mueng (Ngaw [1] and Rachakrud [2]), Kapoe (Bangben [3] and Banghin [4]), and Suk Samran (Talaynog [5] and Hadsaykaow [6])

Table 2 presents species abundance (% stand) of mangrove vegetation in 6 coastal sites in Ranong, Thailand. There were a total of 19 species of identified flora. The highest species richness of the mangrove trees was found in Rachakrud site, with 14 species and the lowest was in Banghin and Talaynog sites with only 7 species .
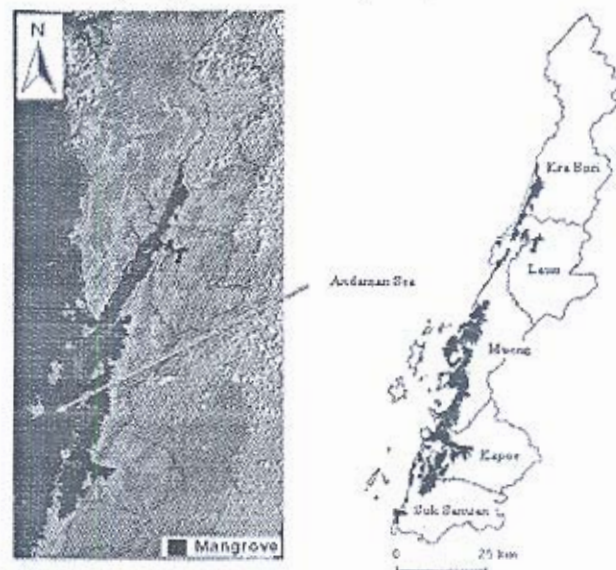

Figure 2. Integration of Landsat image and spatial feature showing mangrove distribution in Ranong, Thailand.

Table 1. The attributes of mangrove patches in Ranong, Thailand (based on Landsat-5 TM 2006).

Districts	Characteristic of Mangrove Patches			
	No. of Patches	Size	Shape	Arrangement
Kra Buri	3	Small	Elongate	Clumped
Laun	5	Small	Polygon	Random
Mueng	17	Large	Elongate	Clumped
Kapoe	5	Large	Polygon	Clumped
Suk Samran	12	Medium	Elongate	Clumped
Total	42			

Table 2. Species abundance (% stand) of mangrove vegetation in 6 coastal sites in Ranong, Thailand.

Name of species (Family)	Mangrove Forest Site											
	Ngaw		Rachakrud		Bangben		Banghin		Talaynog		Hadsaykaow	
	A*	B	A	B	A	B	A	B	A	B	A	B
Aegiceras corniculatum (Myrsinaceae)	1,25			3,75								
Avicennia alba (Avicenniaceae)			1,25	6,25								
Avicennia marina (Avicenniaceae)			37,50	21,25	1,25	8,75						
Avicennia officinalis (Avicenniaceae)	3,75	5,00	1,25	30,00					8,75	7,50	3,75	2,50
Bruguiera cylindrica (Rhizophoraceae)	6,25	2,50	3,75	2,50			1,25	1,25				2,50
Bruguiera gymnorrhiza (Rhizophoraceae)			1,25									
Bruguiera parviflora (Rhizophoraceae)	10,00	21,25	20.00	12,50		3,75	28,75	1,25	43,75	28,75	16,25	6,25
Ceriops decandra (Rhizophoraceae)	2,50	8,75			40,00	40,00					1,25	1,25
Ceriops tagal (Rhizophoraceae)	1,25	3,75					28,75	10,00	8,75	6,25	1,25	
Excoecaria agallocha (Euphorbiaceae)				1,25	2,50	1,25						
Heritiera littoralis (Sterculiaceae)					1,25							
Lumnitzera littorea (Combretaceae)				1,25	2,50							
Lumnitzera racemosa (Combretaceae)					8,75							
Rhizophora apiculata (Rhizophoraceae)	66,25	46,25	26,25	7,50	28,75	37,50	26,25	47,50	15,00	21,25	37,50	65,00
Rhizophora mucronata (Rhizophoraceae)		6,25	1,25				3,75	1,25	13,75	21,25	36,25	21,25
Scyphiphora hydrophyllacea (Rubiaceae)					10,00							
Sonneratia alba (Sonneratiaceae)			2,50	7,50			2,50	12,50				
Xylocarpus granatum (Meliaceae)	8,75		1,25	6,25	5,00	3,75	11,25	15,00	1,25			1,25
Xylocarpus moluccensis (Meliaceae)		5,00	3,75							1,25		3,75

A =PCQ perpendicular to the channel
B =PCQ parallel with the channel

There were 4 dominant taxa found namely, Rhizophora, Avicennia, Ceriops and Bruguiera as presented in the small box of table 2 showing the values of percentage stand. Rhizophora apiculata was the most dominant compared with other mangrove trees species due to the highest percentage stand (66,25), and this found in Ngaw A.

Among mangrove species that form the community, a few are abundant such as Rhizophora, Avicennia, Ceriops and Bruguiera,

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but most of other species are rare. This condition is discovered by counting all the individuals of mangrove trees species along the PCQ plots within a community and determined by counting percentage of each contributes to the total number of all species.

CONCLUSION

This study was conducted in Ranong Province, Thailand with aim is to identify the mangrove patches and its species. Remotely sensed data (Landsat-5 TM) was processed to assess the distribution and form of mangrove patches. The point-centered-quarter (PCQ) was established to determine total number mangrove trees species and species abundance. There were 19 species of mangrove flora and 4 dominant taxa namely, Rhizophora, Avicennia, Ceriops and Bruguiera and these types would be considered as the option for mangrove reforestation initiative. This study may serve as baseline information for the further study of related issues.

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