# A Study of The Sustainability of The Mangrove Between Chao Phraya River and Bang Pakong River by Using Geoinformation Technology

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*Abstract*—This research aims to study the situation and fertility of mangrove between Chao Phraya river and Bang Pakong river in 2002, 2009, and 2017 by using the Geoinformation Technology. Satellite data from LANDSAT-5 in 2002 and 2009 , and LANDSAT-8 in 2017 were used for analysis. The abundance of mangrove forests found that the average value of Normalized Difference Vegetation Index (NDVI) decreased from 0.445 in 2002 to 0.248 in 2017. The result allow to understand mangrove use explicitly which presented in illustrations with the model of the implementation of sustainable mangrove management plan precisely.

**Keyword:** Mangrove**,** Geoinformation Technology**,** Normalized Difference Vegetation Index (NDVI)**,** Sustainable Mangrove Management

## I. INTRODUCTION

The expansion of the world's population leads to increase the demand for living. It is necessary to have manufacturing sectors that change from micro-level to macro level productions. The technology development of industrial sectors are required to produce to meet the needs of the world's population growing. The manufacturing sectors require many resources, such as, food, clothes, and energy.

Nearly half of the world's population (44%) live within 150 km of the coast (Upadhyay, Ranjan, & Singh, 2002)[1]. The densely populated coastal area has prompted extensive mangrove encroachment for coastal development, for example, aquaculture. Animals which live in mangroves have high risk of extinction because of the loss of habitat extensively (Luther & Greenburg, 2009)[2]. In addition, about 26% of mangroves around the world are degraded due to excessive use of timber ( FAO, 2003)[3]. Similarly, shrimp farming contributes the loss of mangrove around the world about 38%(Upadhyay, et.al, 2002). Only more than 40% of mangrove areas on the west coast have been converted to agriculture and coastal town development in India (Upadhyay, et.al, 2002). In addition, FAO (2003) reported on mangrove situation that. 20% of mangrove approximately have been lost since 1980. Mangrove areas will be disappeared at rate of about 1% in every year (FAO, 2003).

Currently, it is expected that land use in the mangrove will continue to exist if the mangroves are protected as valuable resources. Establishment of industrial areas led to encroach forest areas, wetland, and ecologically important sources cause conflict in the land use. People, government, and private sectors have demand in land using differently. Policy announcement of government, the acquisition of private sector for industrial area, and demand of land using of the people cause the invasion to use the land differently.

Therefore, mangroves are area that need to utilize expansion of population and industrial sector.

For example, some industrial sectors need to build factories and piers that close to the sea for maritime transport comfortably, therefore, some areas of mangrove are used for industrial sectors construction. Agriculture is a sector that also transgress mangrove for aquaculture, including salt planting. Tourism also uses mangrove for eco-tourism that will disrupt mangrove.

The mangrove crisis in Thailand, according to FAO (2013)[4] reported that mangrove forests are one of the most effective natural ecosystems and natural resources that are beneficial to nature. However, mangroves are being compromised by human activities. Due to the increasing loss rate, mangrove forests will disappear at least in hundred years probably ( Duke, Meynecke, Dittmann, Ellison, and Anger, 2007)[5]. Mangrove loss has caused serious environmental and economic concerns of Thailand. In addition, this significant reduction in mangrove will decrease the production of land animals and aquatic animals and wildlife habitats. On the border between sea and mangrove plays a vital role in mitigating flood and monsoon. If the mangroves were destroyed, the environmental security of coastal forests which prevent agricultural crops from wind, sea waves, and water erosion will decrease.

As mention above, to study the situation and fertility of mangrove forests can lead to sustainability of mangrove management. Thus, mangrove management is necessary to study about current situation, mangrove management plans for sustainability of mangrove in the future. Moreover, this research aims to study mangrove management by using the Geoinformation Technology. Using Geoinformation Technology allow to understand mangrove use explicitly which presented in illustrations with descriptive and numerical features. Geoinformation Technology can be adopted in the implementation of mangrove management plan precisely.

## II. THE PURPOSE OF THIS STUDY

To study the situation and fertility of mangrove between Chao Phraya river and Bang Pakong river in 2002, 2009, and 2017 by using the Geoinformation Technology.

## III. THE STUDY AREA

The study area in this study was the Chao Phraya River in Samut Prakan to Bang Pakong River in Chachoengsao as figure 1. The study area is 49.7 square kilometers. The length around the area is 83.8 kilometers, with the north adjacent to Highway No. 7, the south, adjacent to the Gulf of Thailand, the east, adjacent to the Bang Pakong market area, and west adjacent to Samut Prakan Municipality area.

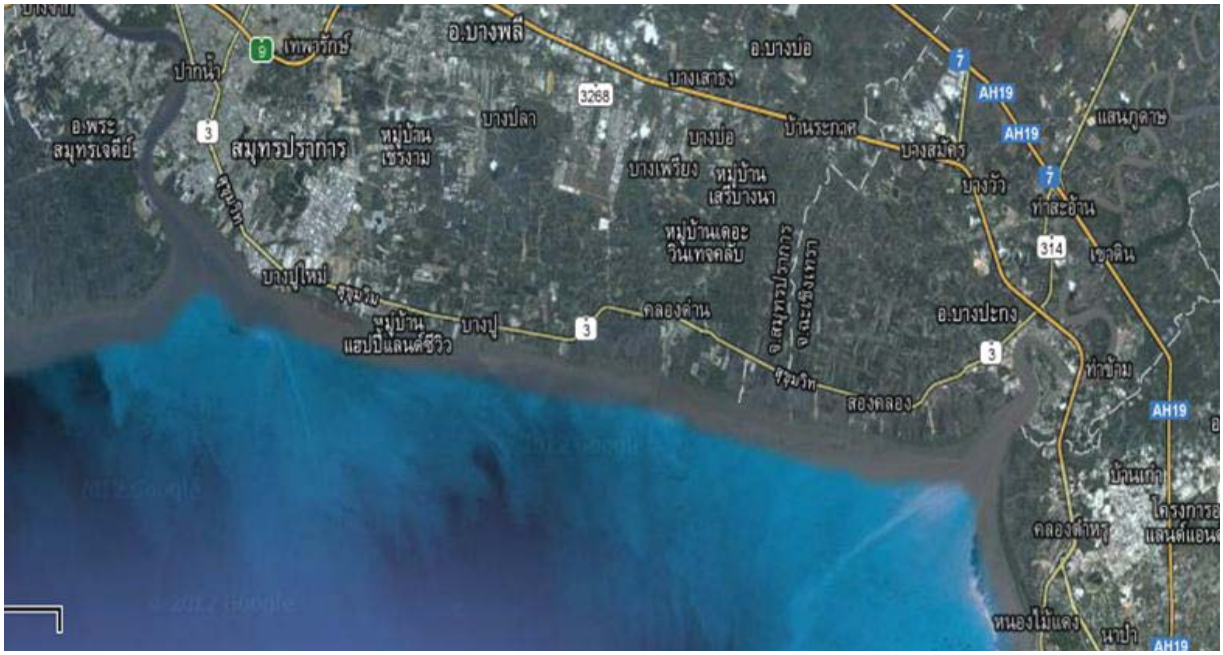


Figure 1. the Chao Phraya River in Samut Prakan to Bang Pakong River in Chachoengsao (Google Earth, 2561)[6]

## IV. METHODOLOGY

1. GIS is used to visualize land use explicitly, whether using aerial photographs and satellite imagery. GIS is used as a tool to translate aerial photographs and satellite imagery accurately to classify areas both residential, industrial and mangrove area.

2. The data were used for analysis, follows:

(1) Orthodontic data in 2002 from the Department of Land Development

(2) Satellite data from GEOEYE in 2017, from Google Earth

(3) Satellite data from LANDSAT-5 in 2002.

(4) Satellite data from LANDSAT-8 in 2017.

3. Normalized Difference Vegetation Index (NDVI) quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). NDVI always ranges from -1 to +1. If NDVI value close to +1, it means that there is a high possibility that it is dense green leaves. On the other hand, when NDVI is close to zero, there isn't green leaves and it could even be an urbanized area.

$$NDVI = \frac{\rho_{NIR} - \rho_{Red}}{\rho_{NIR} + \rho_{Red}}$$

When, $\rho_{NIR}$ is reflects more near-infrared

$\rho_{Red}$ is reflects in red wave

## V. RESULT

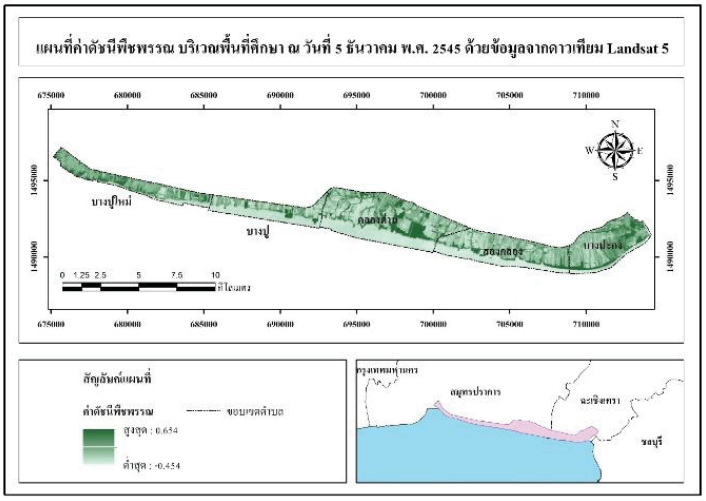


Figure 2. NDVI Map in the study area on 5 Dec, 2002 (Data from Landsat 5 Satellite)

From figure 2, the highest value of NDVI was 0.654, the area is very dense vegetation such as forests. While the lowest of NDVI was -0.454, the area is water and there is not plant or very few plant. Thus, the study area is very different in the density of vegetation in the area.

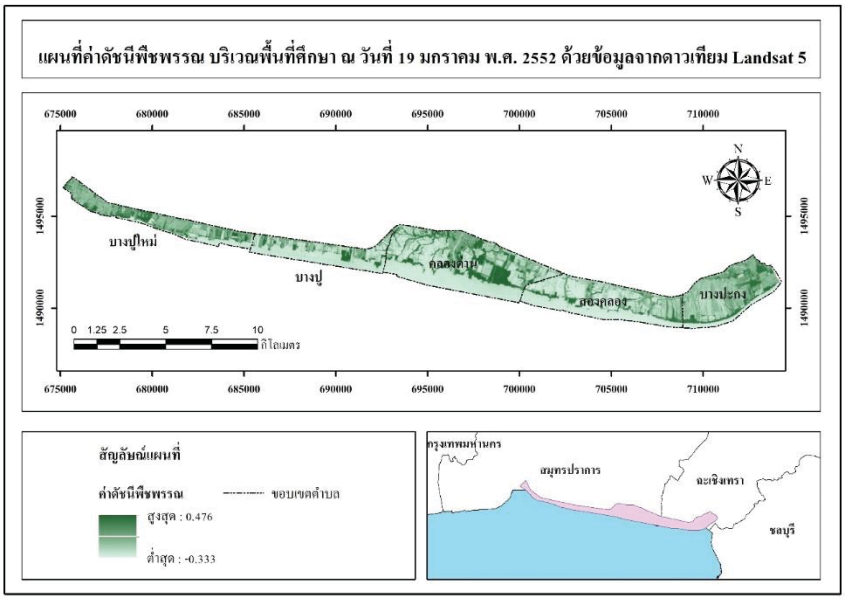


Figure 3. NDVI Map in the study area on 19 Jan, 2009 (Data from Landsat 5 Satellite)

From figure 3, the highest value of NDVI was 0.476, the area is very dense vegetation such as forests. While the lowest of NDVI was -0.333, the area is water and there is not plant or very few plant. Thus, the study area is very different in the density of vegetation in the area.

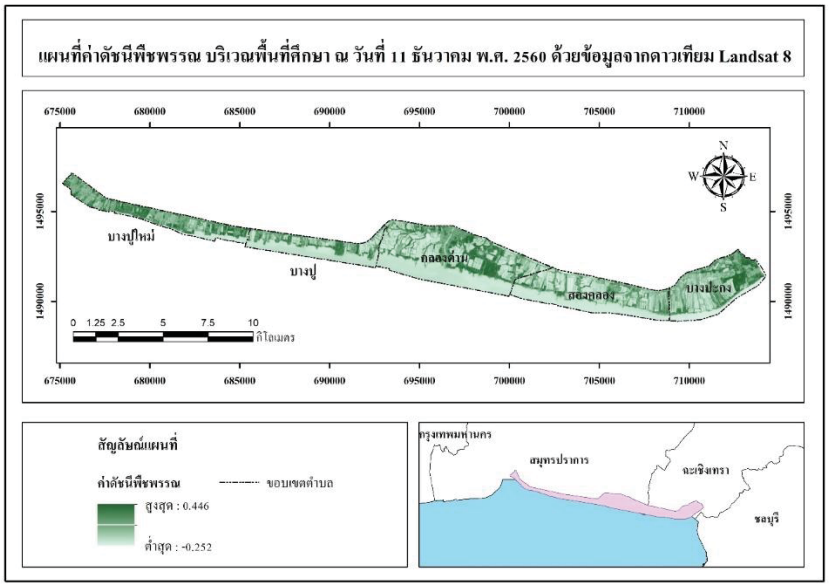


Figure 4. NDVI Map in the study area on 11 Dec, 2017 (Data from Landsat 8 Satellite)

From figure 4, the highest value of NDVI was 0.446, the area is few dense vegetation. While the lowest of NDVI was -0.252, the area is water and there is not plant or very few plant. Thus, the study area is very different in the density of vegetation in the area.

## VI. CONCLUSION

When land use data in 2002-2017 was considered. It found that mangrove had been increased 2,229.54 rais greatly, while NDVI value had been decreased 0.208. The increase in the mangrove area in the study area had been increasing in the spatial area with less dense vegetation. It seems plant trees at a distance in a large area. The mangrove area had been expanded that it is very transparent in the mangrove plot. The result of this research indicated that the increase of mangrove area is not an increase of dense vegetation in mangrove areas.

## VII. DISCUSSION

Mangrove management using Geoinformation Technology is about the study of capabilities, limitation, essential factors, including mangrove management. Mangrove between the mouth of the Chao Phraya River to the mouth of the Bang Pakong River are interesting areas to study of cohabitation of diverse activities in order to achieve sustainability. These areas are used by the public and private sectors that the policy of land use in variety, leading to conflict of stakeholders.

In the areas from the Chao Phraya River mouth to the mouth of the Bang Pakong River were utilize variety of areas, including the area of government, residence, industrial sector, agriculture, fishery, and mangrove. These areas is risk of mangrove degradation or loss. To maintain or increase the mangrove in this area, it will be necessary to integrate the relevant sectors into action to maintain and increase the mangrove.

This paper therefore sets out the point of view that mangrove management by using the Geoinformation Technology. Mangrove situation and mangrove management were studied to create the model for analyzing mangrove forest management between the mouth of Chao Phraya River and Bang Pakong river. The focus will be on the optimal use of the mangrove ecosystem at a sustainable level. After that there is a description of the model and discussion of the results as figure 5

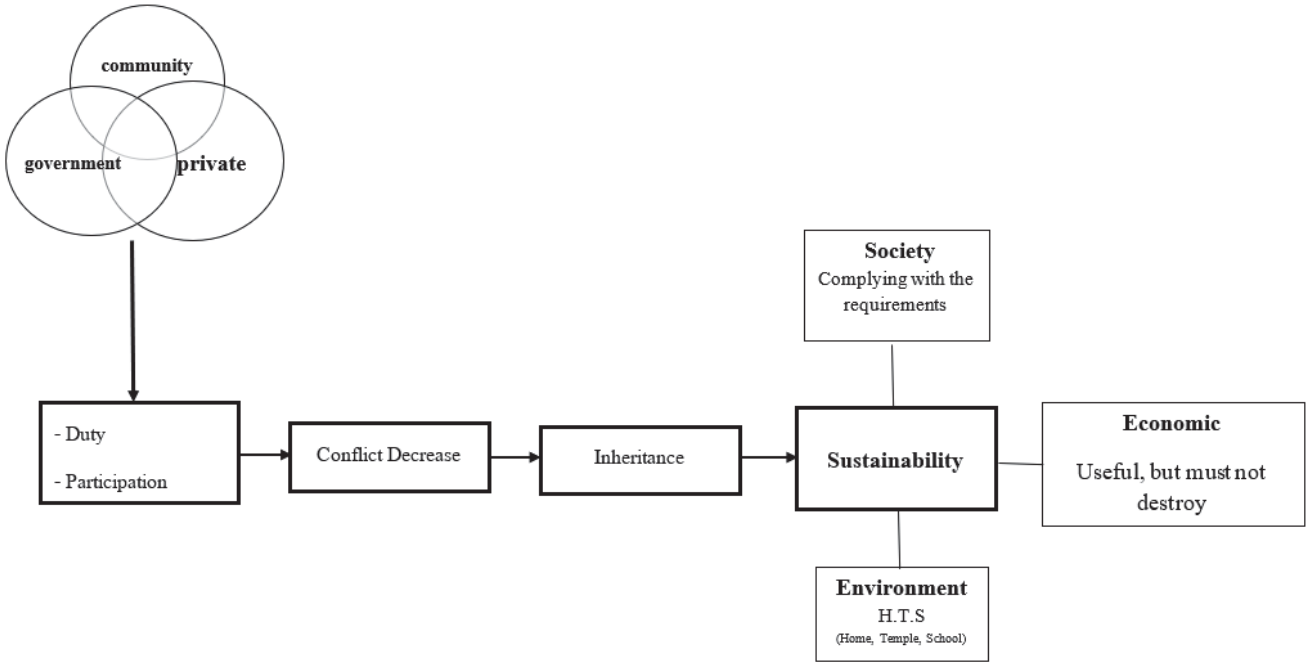


Figure 5. The Sustainable Mangrove Management Model

From the model leads to know capabilities, essential factors, and limitations of mangrove management in the areas from the Chao Phraya River mouth to the mouth of the Bang Pakong River. This model is suggestion for sustainable mangrove management. There must be a strategic plan for the mangrove management by considering the physical aspects, economic and social policies and regulations, identifying problems (dimension analysis, sustainable management), and supporting from stakeholders. Model of guidelines for mangrove management between the mouth of the Chao Phraya River to the mouth of Bang Pakong River is integration between national strategic issues, provisions of local requirements, creating cooperation of government, community and private sectors. Thus, there is a policy clearly for management for coexistence with quality mangrove areas and to eliminate conflict which should start with H.T.S (Home, Temple, School). Community will be driven and supported from the public and private sectors in order to create awareness and consciousness. The stakeholders are able to take advantage of the mangrove area without causing damage to the mangrove which encourage every sector feel that the mangrove forest is valuable. Therefore, it will lead to the sustainable mangrove management

## VIII. REFERENCE

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