USING REMOTE SENSING TO DETECT THE COASTLINE CHANGE FOR MANGROVE REPLANTATION AT BAN LAEM SING, CHAO PHRAYA RIVERMOUTH, IN THE GULF OF THAILAND

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ABSTRAT. The coastline of the Choa Phraya Rivermouth in the Upper Gulf of Thailand has been changed drastically. The western side especially at Ban Laem Sing was eroded for 400 meter in 26 years or with the rate of 15 meter per year on the average. The Metropolitan Electricity Authority has granted five years research project to us to study the efficiency of the electric pole fence as a mean to reduce the wave force and increase sedimentation rate inside for mangrove replantation. If the method works efficiently, it will be used to reclaim the coastal land loss in other areas in Thailand.

The project was done since 2005 after the fence was constructed completely in October 2005. The oceanographic surveys were conducted before and after the construction in northeast monsoon season to study the impact of physical oceanographic forces on the coastline change. The sedimentation rates were measured each month. It is rather low about 2 cm/month. The subsiding rate from the load of deltaic sediment and groundwater withdraw using boring data is about 30 mm/year. The cumulative sinking rate is 55.8 cm from 1978 to 1995. We have tried to design the method of mangrove plantation in this area.

The remote sensing data such as LANDSAT and aerial photos from 1987 to 2002 for 15 years were used to compute the rate of coastline change at each 50 m section along the western side of the rivermouth.

KEY WORDS: Mangrove replantation, coastline change, remote sensing, PORSEC, Chao Phraya Rivermouth.

1. INTRDUCTION

Along the 45 km coastline, of the Samutprakarn province coast of the Chao Phraya Rivermouth, the coast here has been eroded for 7.2 km^2 or 30 km or 67% of the whole length during 1969 to 1987 or 18 years. The western side especially Ban Laem Sing was eroded for 400 meter in 26 years or with the rate of 15 meter per year on the average (Figure 2).

This project is to study the rate and the amount of the coastline change at Ban Lame Sing from 1987 to 2002 using 16 Landsat TM data.

2. METHODS OF STUDY

The sixteen Landsat TM from 1987 to 2002 were used in this study, using ERDAS image Version 8.7. The diagram of remote sensing technique is shown in Figure 1.

2.1 The Preprocessing.

The radiometric correction was performed at the receiving station. The geometric correction from internal and external distortions was done by combined method of systematic and non-systematic corrections with registration to the ground control points more than 50 points per image. The digital data were corrected geometrically into:

a) Image to map registration, using topographic map scale 1: 50,000 with Universal Transverse Mercator (UTM) coordinate system. The geo-reference image was on 24 January 2002 for mostly cloud free image.

b) Image to image registration for the rest 16 images. The uncorrected images were registered to the geometric corrected or geo-reference image.

The RMS error should not be over 1 pixel resolution or 30 meters.

2.2 Image Enhancement.

In order to increase the quality and more understanding for extract the wanted information, we used the following procedures:

a) Color composition. It will make the image more beautiful and more interpretation.

b) False color composite or FCC.

c) Linear contrast stretch.

d) Normalized Different Vegetation Index (NDVI) to extract the different characteristics of vegetation using the formula:

$$NDVI = \frac{band4 - band3}{band4 + band3} * 128 + 127.5$$

2.3 Image Classification

First using the unsupervised classification method with maximum likelihood computation.

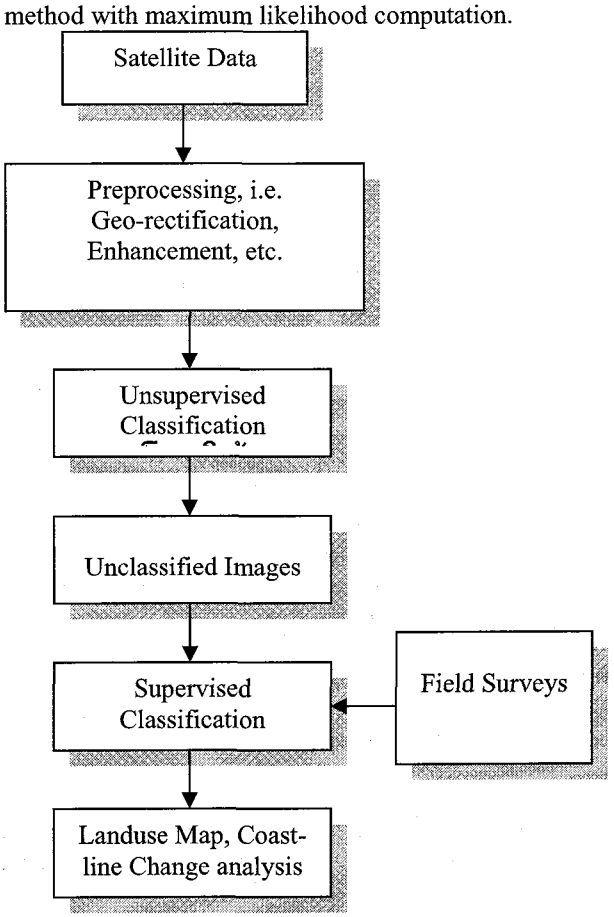


Figure 1. Remote sensing method for coastline change detection.

The next step is the supervised classification with matrix overlay on landuse map in 1995.

The coastline was divided into 31 sections (Figure 4). Each section at 15 dates were compared with the data on 25 December 1987 (Figure 3) as base map. The example of the study area was shown in Figure 5.

2.4 Field Surveys

The field survey data were collected on 13 November 2004 with GPS to compare with the classified images.

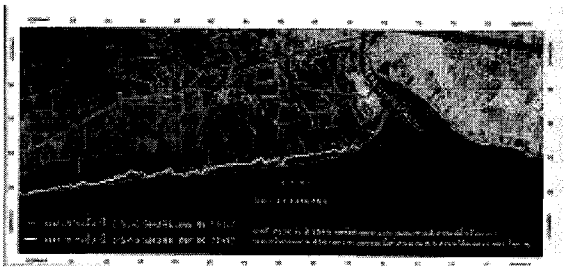
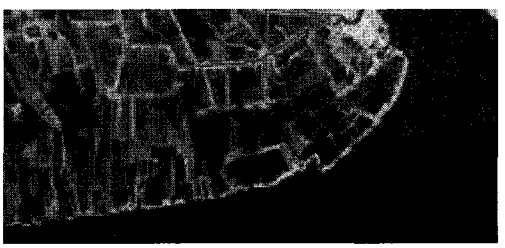
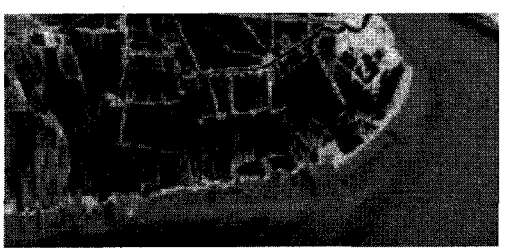


Figure 2 Map of coastline change in 2002 and 1987.



25 December 1987, as reference for comparison.



2 September 2002.

Figure 3. The comparison of the two coastline on 1987 to 2002 by Landsat TM resolution 30 m.

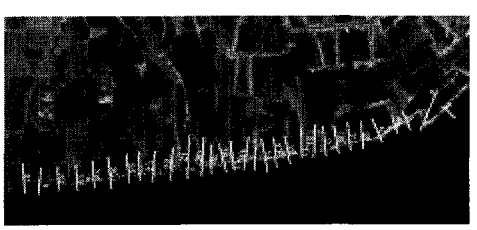


Figure 4. The coastlines were divided into 31 sections.

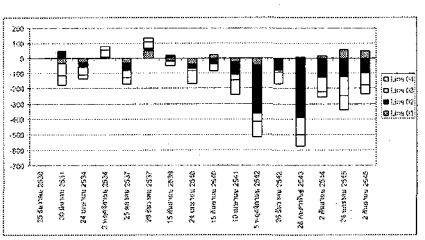


Figure 5. The comparison of the coastline change at different dates at sections 1st to 4th, Ban Laem Sing.

3. RESULTS

The coastlines have been changed during 16 years from 1987 to 2002. Figure 6 is the summary of the coastline change along 31 sections during 15 years. The rate is highest approximately 550 meters at Ban Laem Sing in 1999 and 2000 (El Nino years).

Figure 5. The rate of coastline change during along thee 31 sections.

4. REMEDY

The Metropolitan Electricity Authority granted the budget to construct the fence using, 1,200 old electric poles and rubber tires completely in October 2005 (Figures 6 and 7). They also granted research fund to study the efficiency of this fence on coastal erosion and promote the mangrove replantation.

Figure 6. The fence using old electric pole and rubber tire.

The field surveys on sea current, wave and sediment concentration were conducted before and after the construction. During 14 to 16 September, an experiment was done to measure the efficiency of the fence to reduce the wave and current (Figure 7). The analysis is not complete yet.

Figure 7. The wave gage was deployed on 12 September 2006.

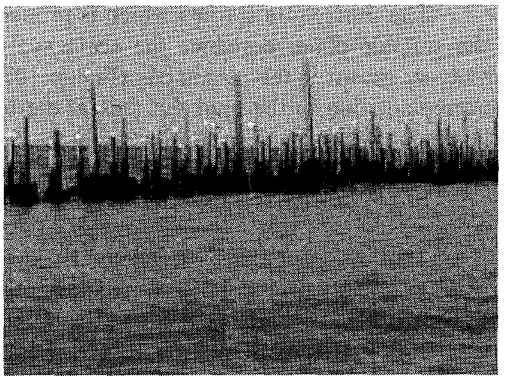


Figure 8. The fence which is made from old electric pole and rubber tire.

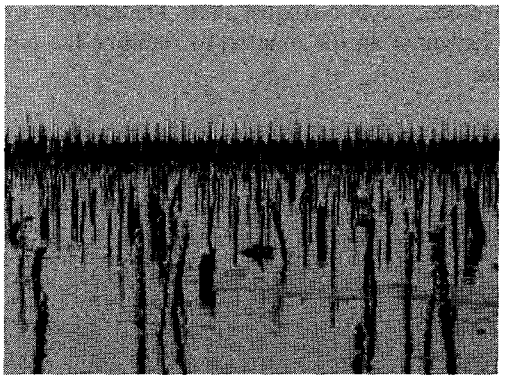


Figure 9. The mudflat at the back of the fence which shows calm sea and a site for mangrove replantation.

The study on the efficiency of the fence on promoting the sediment deposition at the back of the fence were conducted from November 2005 to August 2006. The deposition during this period is 24 cm.

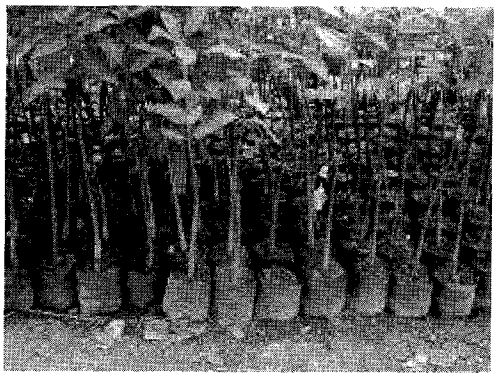


Figure 10. The young rhizophora in the plastic bag for replantation.

The rhizophora sprouts which is proved to be the suitable plant to reduce the sea wave and current are grown in the plastic bag (Figure 10) for future replantation in the mud flat area at the back of the fence (Figure 9).

5. **CONCLUSION**

The Metropolitan Electricity Authority has tried to solve the severe coastal erosion at Ban Laem Sing on the western coast of the Chao Phraya Rivermouth by construction of the old electric poles and rubber tires. This coastal defense has proved to reduce the power of coastal wave and current and promote sediment deposition at the back of the fence. The sediment was deposited for 24 cm from November 2005 to August 2006. The mangrove will be replanted on the mudflat to stabilize the eroded coast.