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Changes of the land cover and land use in Can Gio area, Vietnam from 1997 to 2003

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1. Background

Since the late 1990's, ESCAP has undertaken a project to monitor the environment plans using remote sensing and GIS technologies.

Can Gio district in a part of Ho Chi Minh City was one of the pilot areas for ESCAP project. The pilot study used digital satellite data of SPOT (1997) and MESSR (1992) to analyze land-use / land-cover change of Can Gio mangrove area belonging to Ho Chi Minh city, Vietnam. The pilot research project resulted in evaluating coastal zone environment and presenting a management model for the area.

Some researchers reported about the land cover change in this area such as in the report at ESCAP workshop in 2003, Hang et al. (2003), and Hirose (2005). Hang et al. (2003) reported on the change of riverside by sedimentation and erosion, but they have only studied land cover change in the whole area. The result shows a trend of forest ecosystem change, and after that, forest management zones were defined for sustainable use of resources. Although, the local land cover change in this mangrove forest area has not been focused on. We have to understand the land cover change up to date around Can Gio mangrove forest area locally. Then, we have to catch up with the recent environmental change and land cover / land use change in the area.

2. Objectives of the research

In order to understand the present situations of the shrimp ponds development in Can Gio area, we will study the pattern of land use change from 1997 to 2003 using satellite remote sensing images, and then, we will answer the question on whether the sustainable development in this area is possible or not possible the view point of mangrove dynamics.

Can Gio mangrove forest distribute on the deltaic area in and around Dong Nai river and Sai Gon rivers, with an area of 71,400 ha including water surface.

3. Land cover classification

Data for analysis: One is VNIR data, one of the OPS data acquired on January 16 in 1997 mounted on the JERS-1. The other is ETM+ data of Landsat-7 acquired on January 24 in 2003.

Ground information: Ground information such as one topographic map and ground photos taken in 2003,2004 and 2005 with GPS camera for the record of ground truth are used.

Process of land cover classification: The processes to make land cover classification maps in Can Gio area in 1997 and 2003 using satellite images are shown in the following flowchart.

- 1: Geometric correction for VNIR image referred with ETM+ image
- 2: Partially extraction for each forest management block scene by scene
3. Unsupervised classification with ISODATA algorism for each management block
4. Interpretation of land cover categories for each block with land cover classification systems
5. Grouping and reclassifying to make land cover maps

Category name	Description & Interpretation Key
River	Water in the river
Water	Natural water surface
Inland water/Pond	Wet bare soil land ; looks very dark in the image
Wet bare soil land	Dry bare soil land ; looks bright in the image
Grass land	Some vegetation are expected
Mangrove01	Forest with pale green
Mangrove02	Forest with dark green
Tidal flats	Lands near the sea ; looks very dark
Road	Apparently look road : linear lines
Salt pan/House	Brightest lands with artificial shapes
Unknown	Lands ehich can not be defined

Table 1 Land cover categories for image interpretation

Land cover classification: The twelve land cover categories were defined for maps by interpreting unsupervised classification images.

4. Vector analysis of the land cover changes between 1997 and 2003

Process of the land cover change analysis:

- 1: The land cover categories synthesized to four groups i.e. (a) Water area, (b) Developed area, (c) Mangrove forest and (d) Background.
- 2: Compare the land cover map in 2003 with the land cover map in 1997, one digit number from 1 to 15 were assigned to each pixel in the image as depending on this land cover change patterns.
- 3: A map of land cover change vector is drawn.
- 4: Summarize the results.

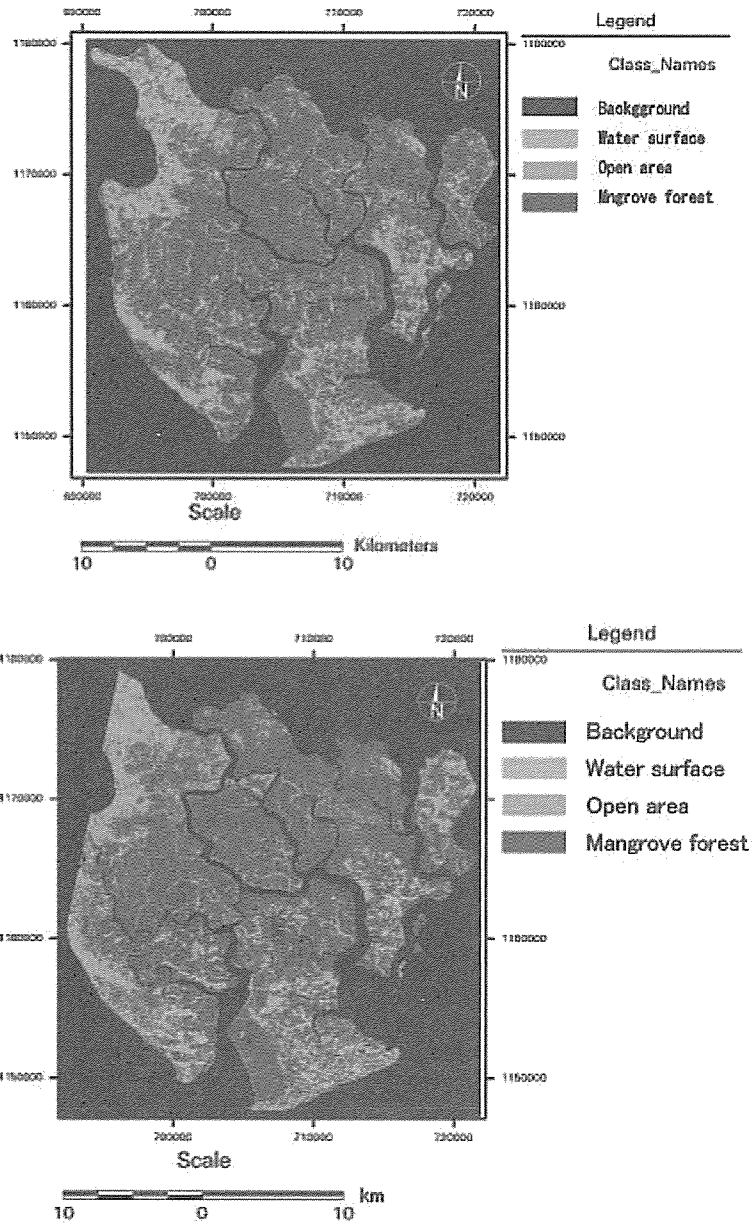


Fig. 1 Reclassified map (1997) with four categories a: 1997, b: 2003

Fig. 1 a and b shows reclassified land cover maps of VNIR image in 1997 and ETM+ image in 2003 with only four land cover categories. Apparently, there are a lot of differences in the two periods.

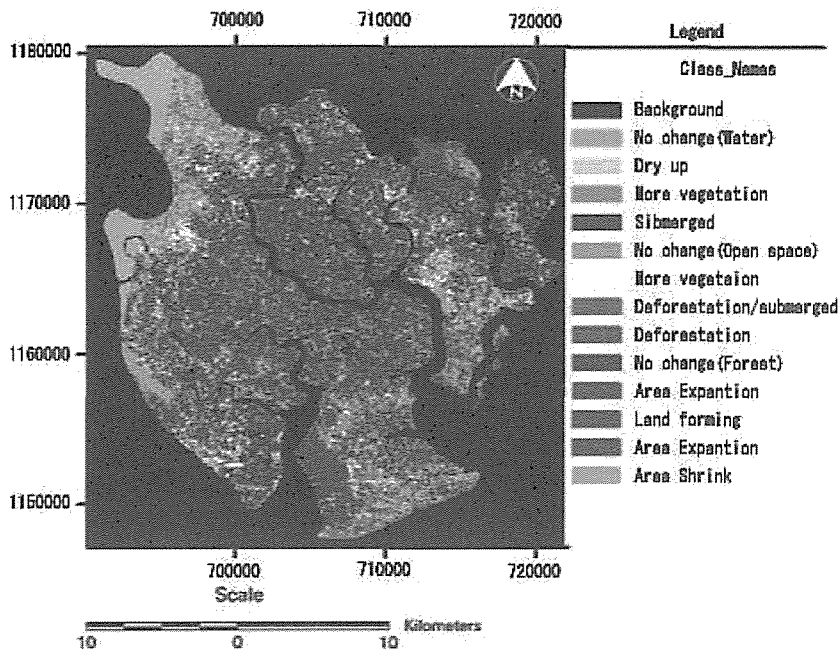


Fig. 2 Image of the change vector analysis between the two periods.

Fig. 2 shows the land cover change pattern between 1997 and 2003. In the figure, the land cover change patterns were indicated by colors. The unchanged lands of water surfaces, developed lands and mangrove forest were colored in pale blue, orange and green respectively. The lands where forests were lost were colored in red. The land where dried lands changed to submerged land were colored in yellow. The lands where new lands were formed were colored in purple and the lands of eroded were in gray.

The land cover changes in the two periods were summarized in Table 2. The diagonal columns mean the acreage of still remained same land cover types in 2003 as they were in 1997. 1,268 ha of water surface in land were remained. 3,618ha of developed land has remained. And 26,355ha of mangrove forest has remained.

1997	2003				Total
	Water Surface	Developed Land	Mangrove forest	Backfound	
Water Surface	1267.74	641.54	537.09	352.88	2799.26
Developed Land	1820.13	3618.19	3841.27	337.98	9617.56
Mangrove forest	925.17	1466.52	26354.72	152.99	28899.40
Backfound	346.45	323.75	156.86	X	827.06
Total	4359.58	6050.00	30889.94	843.85	42143.28

Unit:ha

Table 2 Summary of land cover change in Can Gio district, Vietnam

Fig. 3 shows the balancing between the four land cover types i.e.,

- 1: 641.5ha of water surface has dried up and has changed to the developed area.
- 2: 537ha of water surfaces has newly covered with mangroves.
- 3: 1,820ha of developed land has submerged in 2003. At the same time, mangrove has recovered in 3,841ha of the developed area.
- 4: On the other hand, 925ha of mangrove forest changed into water surface. Most of newly submerged area might be used as shrimp ponds.
- 5: 1,467 mangrove forests was developed and changed into developed land. Severe deforestation has occurred agricultural area and urban area.
- 6: As balance between the developed land and mangrove forest, 2,374ha of mangrove forest has increased in Can Gio for these 6 years.
- 7: As for the area change of background, 18ha of land has increased. This is due to the dynamics of the deltaic situation.
- 8: As the result of land cover change, 1,558 ha of water surface, 1,990ha of mangrove forest has been increased, while 3,556ha of developed land has decreased. Thus the shrimp ponds not only intensive type but also extensive types were stretched behinds and along the mangrove forest. And same time a large part of the submerged area is influenced by the tidal differences in ebb and flood.

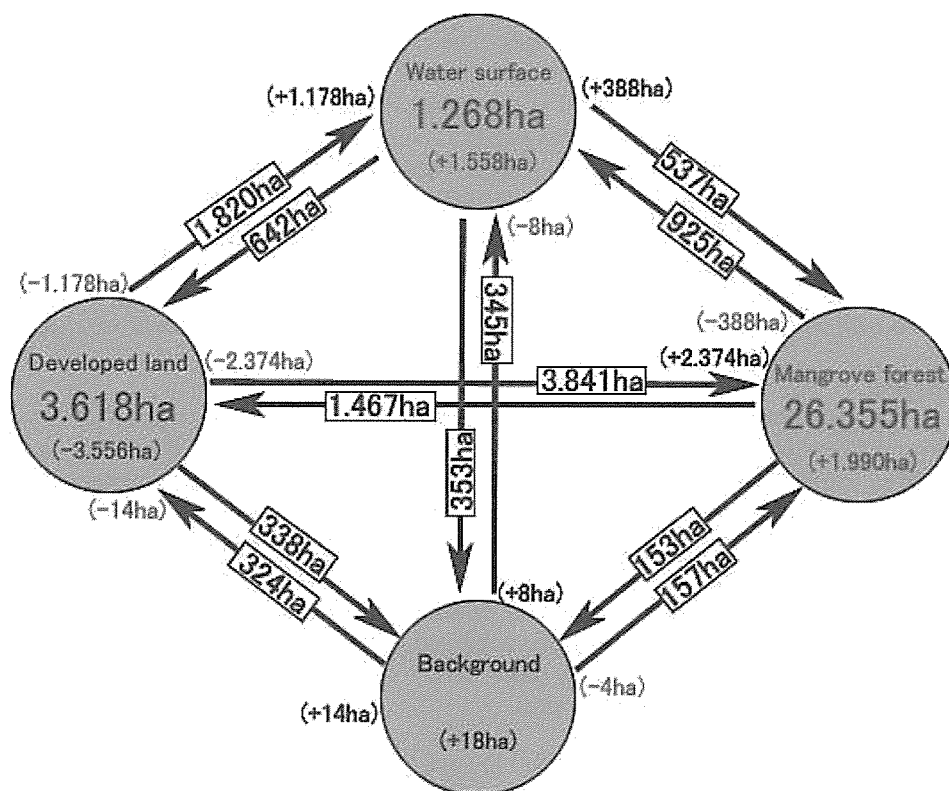


Fig.3 Land cover changes vectors between 1997 and 2003 in Can Gio
 “The numbers in the boxes are acreages in ha of un changed land covers.”