Land Cover Change Detection using ALOS and LANDSAT Data in Thailand

Surassawadee Phoompanich [(1)] and Amornchai Prakobya [(2)]

Geo-Informatics and Space Technology Development Agency (Public Organization),
196 Phahonyothin Road, Chatuchak, Bangkok, Thailand 10900
Tel. 66 2940 6420-9 ext. 216, 213 Fax 66 2561 4326
E-mail: surassa@gistda.or.th[(1)], amornprk@gistda.or.th[(2)]

Abstract
Land cover change detection is necessary for updating land cover maps. The two multi-date images from remotely-sensed data of ALOS AVNIR-2 and LANDSAT-5 TM were used to detect land cover. These images covered in part of Phitsanulok Province, Lower Northern Thailand, which is one of the fertility areas for rice production. These data have been used to classify land cover with supervised classification by maximum likelihood, and being adopted by using the training samples obtained from the ground truth. The results showed the preliminary changes of land cover over a 3-year period, and displayed the difference of land cover map in the study area. These maps are utilized for stratification approach and land use planning in Thailand.

Keywords: ALOS AVNIR-2, Land Cover Change Detection

1. INTRODUCTION

Land cover change detection is necessary for updating land cover maps and managing of natural resources. The change is usually detected by the comparison between two multi-date images, or sometimes between an old map and an updated remotely-sensed data. Advanced Visible and Near Infrared Radiometer type 2 (AVNIR-2) is one of the three instruments of The Advanced Land Observing Satellite (ALOS) for precise land coverage observation. It consists of visible and near infrared, which are better for land cover detection. Phitsanulok province which is located in lower northern Thailand is one of the fertility areas for rice production, especially Mueang Phitsanulok, Phrom Phiram and Wat Bot districts. This study has been applied the remotely-sensed data for land cover change detection and then generated land cover maps.

2. OBJECTIVES

2.1 To apply the remotely-sensed data of ALOS AVNIR-2 and LANDSAT-5 TM for land cover change detection in Thailand.
2.2 To generate land cover change map.

3. STUDY AREA

Three districts of Phitsanulok province, lower northern Thailand are chosen as study area (see *Figure 1*). It is suited in Mueang Phitsanulok, Phrom Phiram and Wat Bot districts, with an area 250,970 ha.

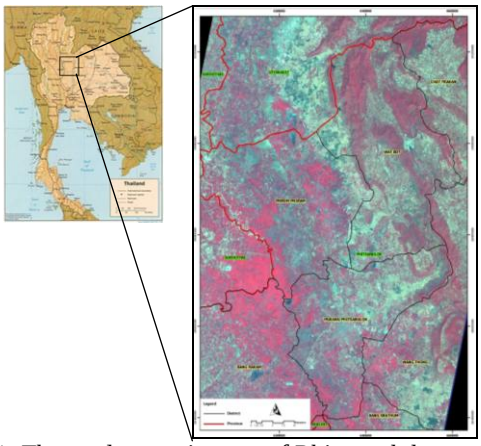
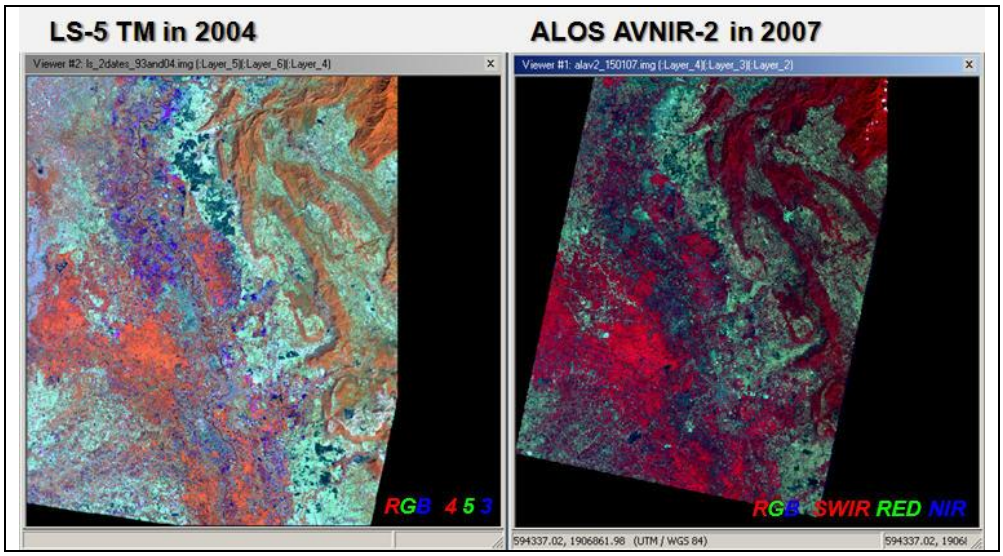


Figure 1. The study area in part of Phitsanulok province

4. METHODOLOGY

The remotely-sensed data of ALOS AVNIR-2 and LANDSAT-5 TM, which covered 3 districts of Phitsanulok province (see *Figure 2*). These data were used to analyze with GIS layers (see *Table 1*). The maximum likelihood method has been applied for land use classification. Then, each land cover maps were compared the land cover change detection. The procedure of methodology shown in *Figure 3*.



(A) (B)

Figure 2. LANDSAT-5 TM (A) and ALOS AVNIR-2 (B) data

Table 1. Data used in the study

Data	Available Sources
1. ALOS AVNIR2 image acquired in January 2007	JAXA
2. LANDSAT-5 image acquired in December 2004	GISTDA
3. Administrative Boundary	Royal Thai Survey Dept.
4. Stream and Water body	Royal Thai Survey Dept.
5. Road	Royal Thai Survey Dept.
6. Elevation	Royal Thai Survey Dept.
7. Existing Land Use in 2000	Land Develop Dept.
8. Soil series	Land Develop Dept.
9. Forest zoning	Royal Forest Dept.

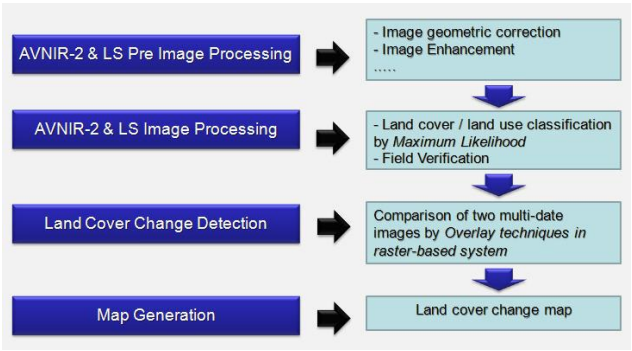


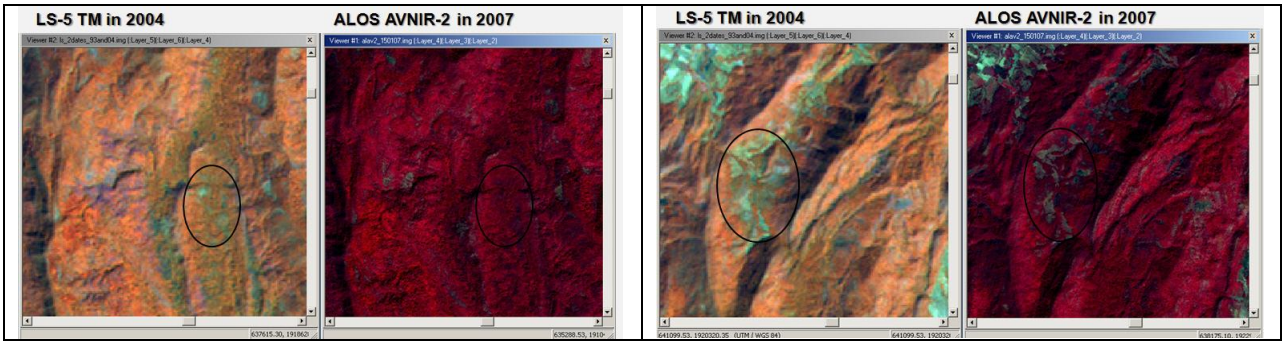
Figure 3. The methodology of land cover change detection

5. RESULTS

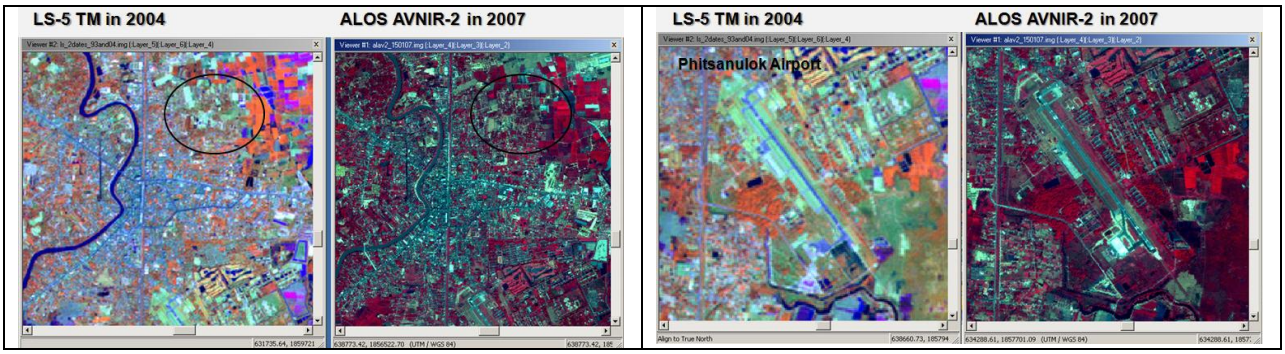
The results showed that the study area which has been observed with from the remotely-sensed data could be mainly divided 3 zones namely, forest, agriculture and built-up area. Then, two multi-date images were classified into 4 main categories; forest, agriculture, built-up, and water body. The forest areas were covered by deciduous forest and deciduous disturbed forest. The agricultural areas have been used to plant paddy field (both rainfed and irrigation) and crop (cassava and sugarcane) (*shown in Table 2 and Figure 4*). The land cover change detection mostly found in urban area. The accuracy assessment was conducted for both classified data to obtain an accuracy level of 81% and 84% for the 2004 and 2007 respectively. Then, these results could be generated land cover maps (see *Figure 5*).

Table 2. Land use classification from LANDSAT and ALOS

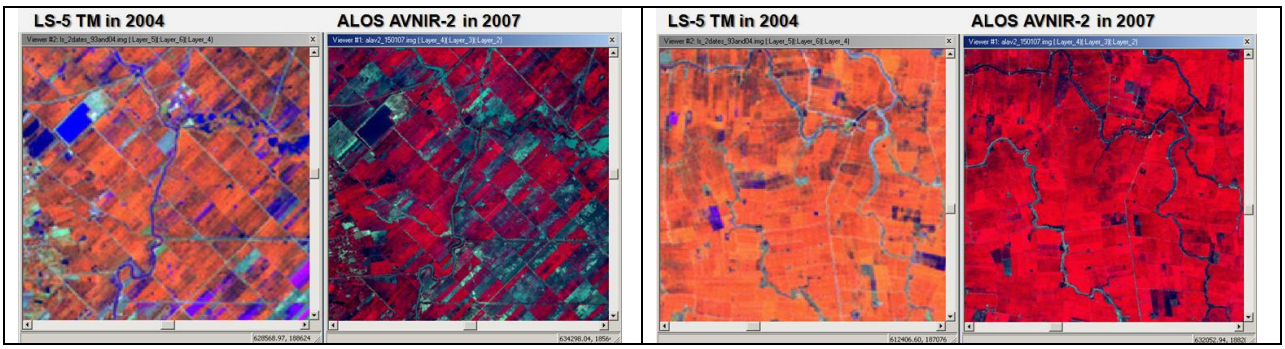
Land Use	Area (ha)		
	2004	***2007***	***Change***
Deciduous forest	32,887.56	31,080.62	-1,806.94
Deciduous disturbed forest	50,596.71	25,949.98	-24,646.73
Paddy field	76,654.65	83,332.25	+6,677.60
Cassava	18,730.16	16,178.59	-2,551.57
Sugarcane	34,887.29	44,329.41	+9,442.12
Built-up	34,181.56	47,393.78	+13,212.22
Water body	3,033.09	2,706.39	-326.70
Total	**250,971.02**	**250,971.02**	



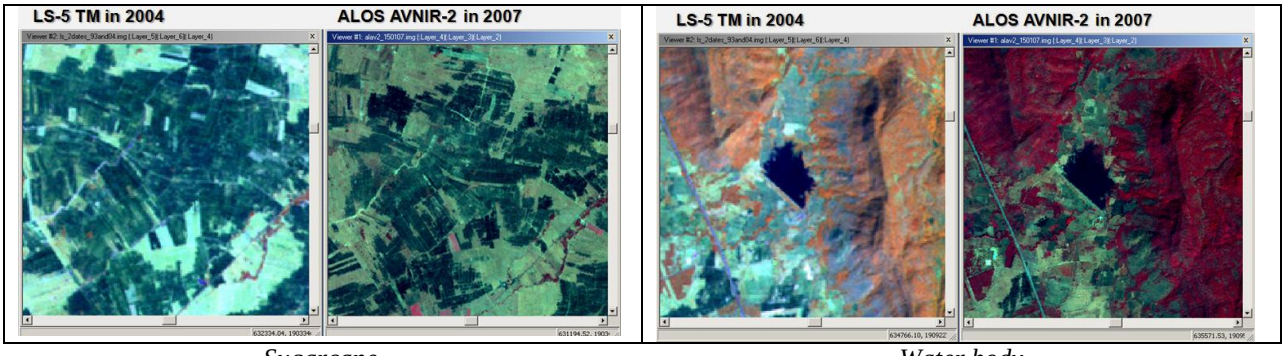
Deciduous forest *Deciduous disturbed forest*



Urban area *Built-up area*

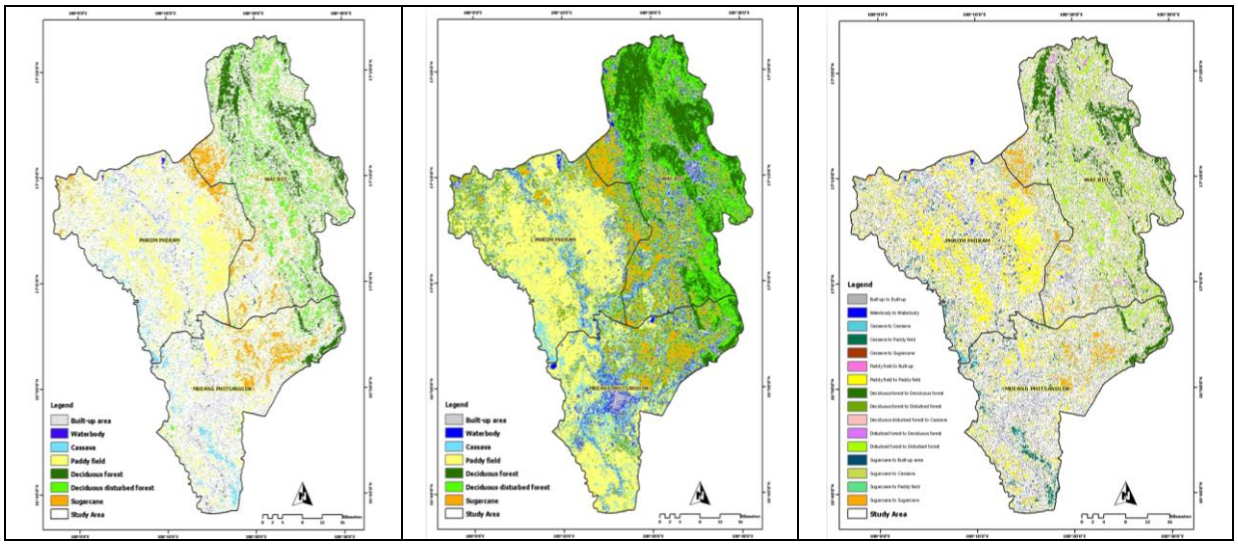


Paddy field *Cassava*



Sugarcane *Water body*

Figure 4. Comparison of land use types between LANDSAT and ALOS data



(A) (B) (C)

Figure 5. Land cover maps in 2004 (A), 2007 (B) and land cover change detection map (C)

6. CONCLUSION

The results indicated that the high spatial resolution of ALOS AVNIR-2 data is available for land cover change detection. These data could be accurately generated land cover maps. Moreover, these maps are utilized for stratification approach and land use planning in Thailand.

7. ACKNOWLEDGEMENT

On behalf of GISTDA, the authors would like to thank for supporting ALOS data from JAXA for this study. Further work, these data would be useful for land cover monitoring and mapping in Thailand.

8. REFERENCES

[1] Jia-Cun, L., Q. Shao-Meng and C. Xue**,** Object-oriented method of land cover change detection approach using high spatial resolution remote sensing data, **Geoscience and Remote Sensing Symposium Proceedings 2003 IEEE International Volume**, Vol. 5, pp. 3005 – 3007, 2003.

[2] NASA Land-Cover and Land-Use Change (LCLUC) Program, **Detection and Monitoring,** http://lcluc.umd.edu/index.asp, 2007.

[3] Shi, Z. and R. Shibasaki, **Dynamic Simulation Of Land Use/Cover Change Based On Time Series Satellite Images,** http://www.gisdevelopment.net/aars/acrs/2000/ps3/ps317.shtml, 2000.