A Geographical Analysis on Land Cover Changes in Kyaingtong Township

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Abstract

Kyaingtong Township lies on the eastern part of the Shan State. The main aim of this research paper is to analyse landcover changes in Kyaingtong Township. In this research paper, the analysis of landcover changes in Kyaingtong Township is conducted using the remotely sensed data. To classify the landcover changes of this area within period of 2005 and 2015 and to observe the changes from landcover type to another. The study area was done using DEM for the elevation. The study area is classified by means of the five types of landcover based on the supervised classification using of maximum likelihood classifier with the series of Landsat 8 TM images and topographic maps during 2005 and 2015.The change detection techniques in ENVI software is applied of landcover changes within two years covering 2005 and 2015. The finding of research paper indicates that landcover types of the study area have been changed, especially from closed forest to agricultural land, build up area and water body.

Keywords: DEM, landcover type, change detection, maximum likelihood

INTRODUCTION

Land is the most important natural resource and is the principal upon which the whole superstructure of social and political power rests. That is why the struggle for control over land is endemic in an agrarian society. The change of land cover was to human activities and increased of infrastructure. Land cover is ever changing either gradually or abruptly largely due to human activities. Although the greater proportion of natural forest land cover is still remains as origin, the forest land cover changes to other types of land cover is the most conspicuous.

Objectives

- To study the past and present condition of the study area.
- To analyze the extent of land cover changes by using Satellite Images
- to apply GIS and RS techniques for land cover classification of Kyaingtong Township.

Sources of Data and Methodology

To classify the land cover changes of this area within period of 2005 and 2015 and to detect the changes from land cover type to another, the study area was done using DEM for the elevation. The study area is classified by means of the five types of land cover based on the supervised classification using of maximum likelihood classifier with the series of Landsat 8 TM images and topographic maps during 2005 and 2015.The change detection techniques in ENVI software is applied of land cover changes within two years covering 2005 and 2015. Google Earth Image, UTM Topographic map, DEM map, data from field survey of Kyaingtong Township.

Geographical Factors of the Study Area

Kyaingtong Township lies on the eastern part of the Shan State. It is located between north latitudes 21° 05’ and 21° 35’ and also east longitudes of 99° 15’ and 101° 15’. It is bounded on the east by Maing Lar Township, on the north by Maing Hkat and west by Maing

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Pyin Townships and the south by Maing Phyet and Maing Sat Townships. This township is compact shape. This area is 1474.97 sq miles (3820.16 sq km) (Figs. 1 and 2).

The elevation of Kyaingtong is about 2700 feet above sea level. The Kyaingtong Valley, the land is not flat, but undulating with low hills. The Nark Woke Creek flows through the northern part and Nanlatt Creek which is used for the drinking water and irrigation flows across the north-eastern part. The two chaungs eventually join as the Nanlway River which is one of the main tributaries of the Mekong River (Fig.3).

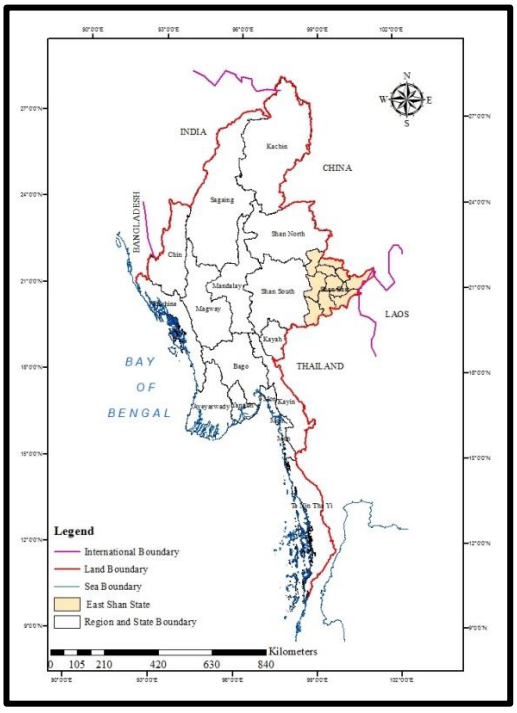

Figure (1). Location Map of the Union of Myanmar. (Source: Agriculture Atlas, 2002)

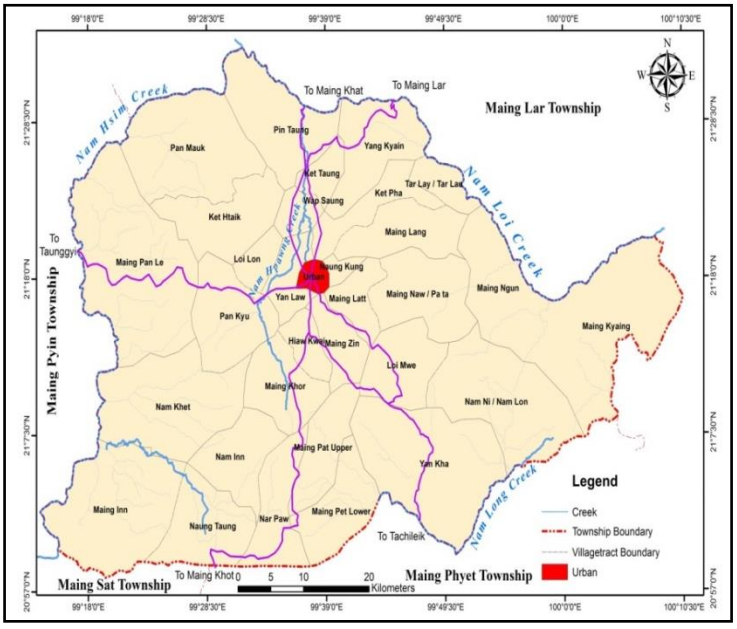

Figure (2). Location Map of Study Area. (Source: Survey Department, Yangon)

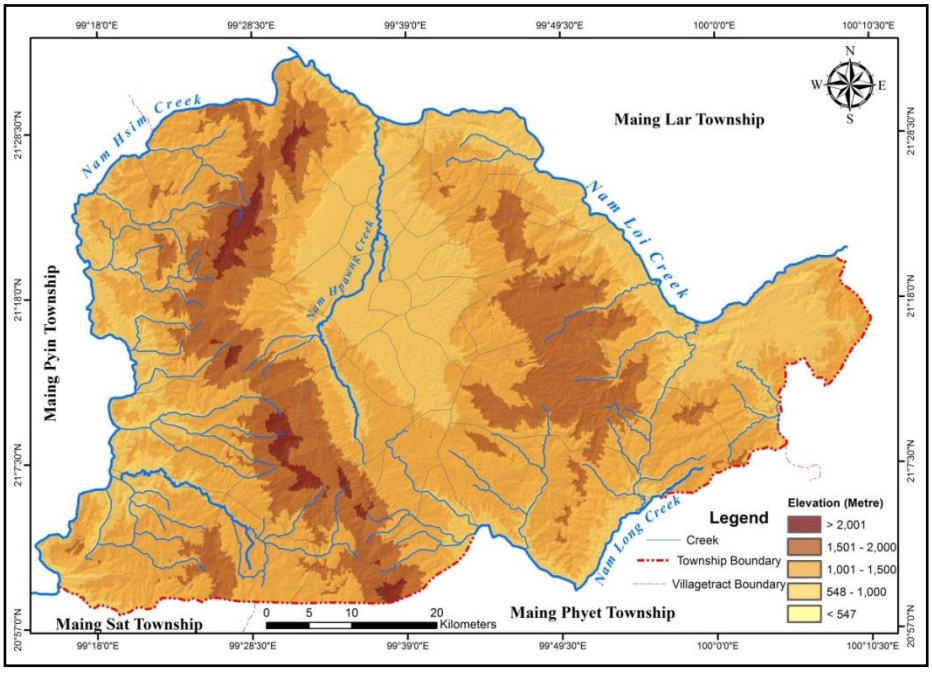

Figure (3). Relief and Drainage of Study Area. (Source: Survey Department, Yangon)

This area experiences Temperate Mountain Climate; April was the hottest month with 33.3°C and the coldest month was December and January with 10.20°C. The rang of temperature was 11.10° C . The total rainfall was 1236.89 mm.

The temperate evergreen forests are found in some area. The most common trees are Mazali, bamboos, taungthayet, cherry, pine and oaks.

The predominant bedrocks of Kyaingtong Township are limestone. The major soil types are red earth and yellow earth, madow soil, alluvial soils and mountain red soil are found in the low land of the study area.

CLASSIFICATION OF LANDCOVER IN KYAINGTONG TOWNSHIP

In this study area the five types of land cover classification during February and June of 2005 and 2015 data are derived from Landsat TM 5 to Landsat 8 Images. In 2000, the study area is estimated 374836.36 hectares. The image classification is generated by supervised method which is based on objected oriented classification. The five types of land cover are calculated from remote sensed data and expressed as with percentage of land cover in Table 1 and Figure 4 & 5. In Kyaingtong Township, the closed forest area was 99400. 78 hectares which amounted to 26.52 % of the total area of the study area in 2005. During the year 2005, the area of open forest in Kyaingtong Township was 206245.47 hectares which amounted to 55.02% of the total forest area in this Township. Agricultural land which constitutes 17.30 % of this area and its land always changes for cultivated area in this study area. Water bodies and built up area occupied 0.75% and 0.42% respectively.

Table (1). Land Classification in Kyaingtong Township (2005& 2015). (Source: Based on Landsat TM 5 Images 2005 & 2015)

No	Type of Land Cover	2005 Area (Hectares)	2005 Percentage	2015 Area (Hectares)	2015 Percentage
1	Closed Forest	99400.78	26.52	32297.77	8.62
2	Open Forest	206245.47	55.02	244012.13	65.10
3	Agricultural Land	64822.74	17.30	92334.55	24.63
4	Built Up Land	1545.28	0.41	1821.72	0.49
5	Water Bodies	2822.09	0.75	4370.19	1.17
	Total	**374836.36**	**100.00**	**374836.36**	**100.00**

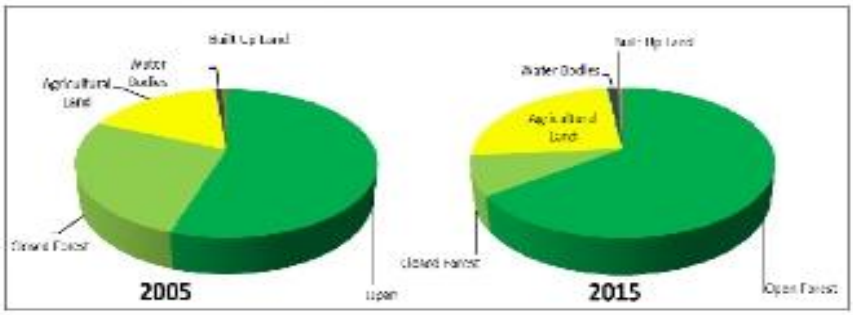

Figure (4). Types of Land Cover Classification Shown by Comparative Circle with Sectors Method. (Source: Based on Table 1)

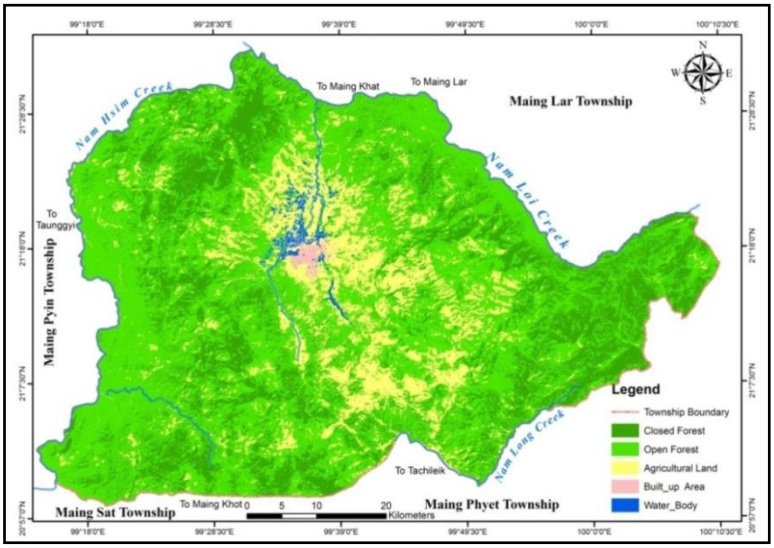

Figure (5). Land Cover Classification in Kyaingtong Tong (2005). (Source: Landsat TM 5 Images 2005)

The type of land cover is divided into the basis of satellite image data. In 2015, closed forest type was found in the northern part and middle part of the township. This type occupied 32297.77 hectares, covering 8.62 percent of the township area. The area occupied by open forest type was large with 244012.13 hectare, covering 65.10% , appeared extensively in this forest type situated in eastern part, along the Nam Loi creek. Agricultural land covers extensively in the middle part and western part occupying 92334.55 hectares, covering 24.63% in this area. Water bodies which represented by creeks and lakes covered 4370.19 hectares, covering 1.17% in 2015.Build up type occupied by settlement area in 2015

was 1821.72 hectares ,covering 0.49 % of the township area. Table (1) and figures (4) and (6) presents the five types of land cover in the study area in 2015.

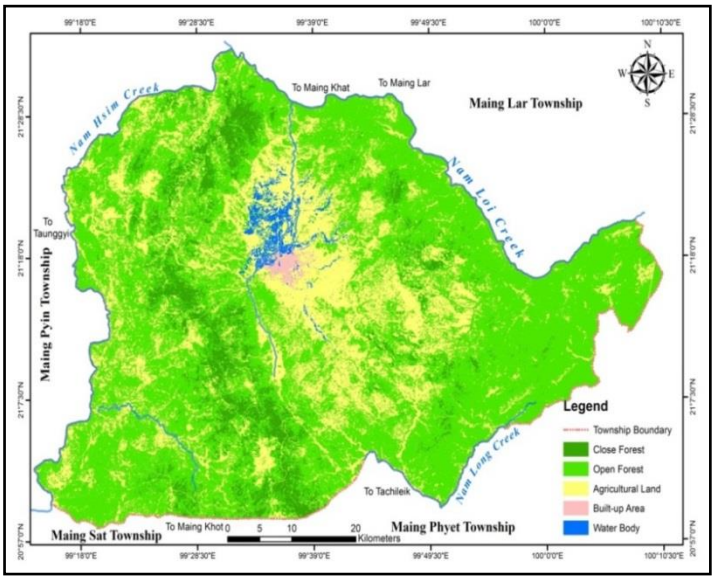

Figure (6). Land Cover Classification in Kyaingtong Township (2015). (Source: Landsat 8 Images 2015)

ANALYSIS OF CHANGES IN LAND COVER (BETWEEN 2005 AND 2015)

The analysis of landcover changes mainly focuses on five types of land cover in the study area. The period of landcover change analysis covered 10 –year time frame from 2005 to 2015.

Land cover types in the study area are presented in Table (2) based on 2005 and 2015 Landsat TM Images classification. During the 10 –year period from 2005 to 2015, the open forest had increased to 37766.66 hectares, the highest changes of land cover among the five types.

The change in agricultural land was the second largest change of land cover during the 10-year period from 2005 to 2015, the agricultural land of the study area was 27511.81 hectares which accounted for 40.95% of the study area. The decreased of closed forest land during the 10 –year period from 2005 to 2015 was 67111.42 hectares, which was a large decrease for land cover in the study area. With the increasing population, more residential land plots are necessary for settlement. Therefore, the built up area increased 276.44 hectares in 2015.

Table (2). Changed of Land Cover in Kyaingtong Township (2005 & 2015). (Source: Landcover Classification in Landsat TM Images 2005 & 2015)

No	Type of Land Cover	2005 Area (Hectares)	2005 Percentage	2015 Area (Hectares)	2015 Percentage	Difference
1	Closed Forest	99400.78	26.52	32297.77	8.62	-67111.42
2	Open Forest	206245.47	55.02	244012.13	65.10	38239.66
3	Agricultural Land	64822.74	17.30	92334.55	24.63	27511.81
4	Built Up Land	1545.28	0.41	1821.72	0.49	276.44
5	Water Bodies	2822.09	0.75	4370.19	1.17	1083.51
	Total	**374836.36**	100.00	**374836.36**	100.00	

Areas of water bodies were 1083.51hectares which accounted for 2.36 percent of the study area. In 2015, areas of the water bodies 4370.19 hectares which accounted for 1.17 percent of the study area.

Land Cover Change Detection in the Study Area (2005 & 2015)

Table 3 shows the changes of land cover in the study area during the period from 2005 and 2015. Figure 7 ,8, 9, 10 and 11 illustrates the land cover change detection result of Landsat 5 and 8 TM Images 2005 and 2015 for the study area. The characteristic of changes occurring over a period of ten year in the study area.

During the 10 year period from 2005 to 2015, 20493 hectares of the closed forest in 2015. In the study the changing pattern, converted from closed to open forest land is highest. In this period open forest occupied 172160.13 hectares in this study area. During this year, there is 40408 hectares of agricultural land. During the 10 years from 2005 to 2015, 1545.28 hectares of the area of total areas of built up land. The area of water body that remained unchanged in the 10 year period was 170 hectares.

The change of land cover was due to human activities and increased of new roads. With the increase of population, agricultural land has increased year after year. The increase in the open forest is more significant than others. The decrease of closed forest land was due to deforestation, over logging and encroachment of human dwelling.

Table (3). Land Cover Changes Matrix in Study Area. (Source: Land Cover Classification in Landsat TM 5 and 8 Images, 2005 and 2015)

		2015					
2005	**Types**	**Closed Forest**	**Open Forest**	**Agricultural Land**	**Build Up Area**	**Water Body**	**Total**
	Closed Forest	20493	49457	29394.06	56.72	0	99400.78
	Open Forest	11525.34	172160.13	21936	442	182	206245.47
	Agricultural Land	37.74	22787	40408	728	862	64822.74
	Build Up Area	230.28	32	58	170	1055	1545.28
	Water Body	3	49	538.49	425	1806.6	2822.09
	Total	32289.36	244485.13	92334.55	1821.72	3905.6	374836.36

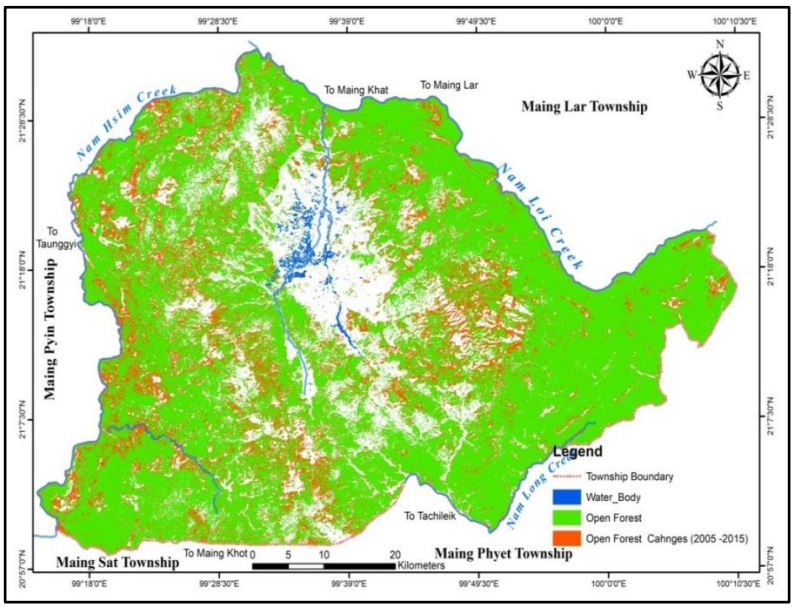

Figure (7). Open Forest Changes Detection Result from 2005 to 2015 Images of the Study Area. (Source: Landsat TM 5 and 8 Images, 2005& 2015).

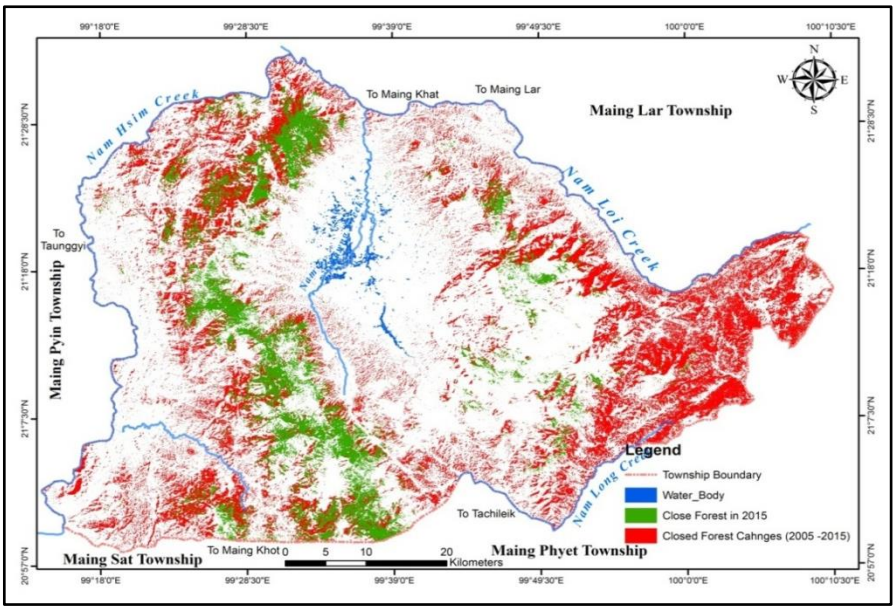

Figure (8). Closed Forest Changes Detection Result from 2005 to 2015 Images For the Study Area. (Source: Landsat TM 5 and 8 Images, 2005& 2015)

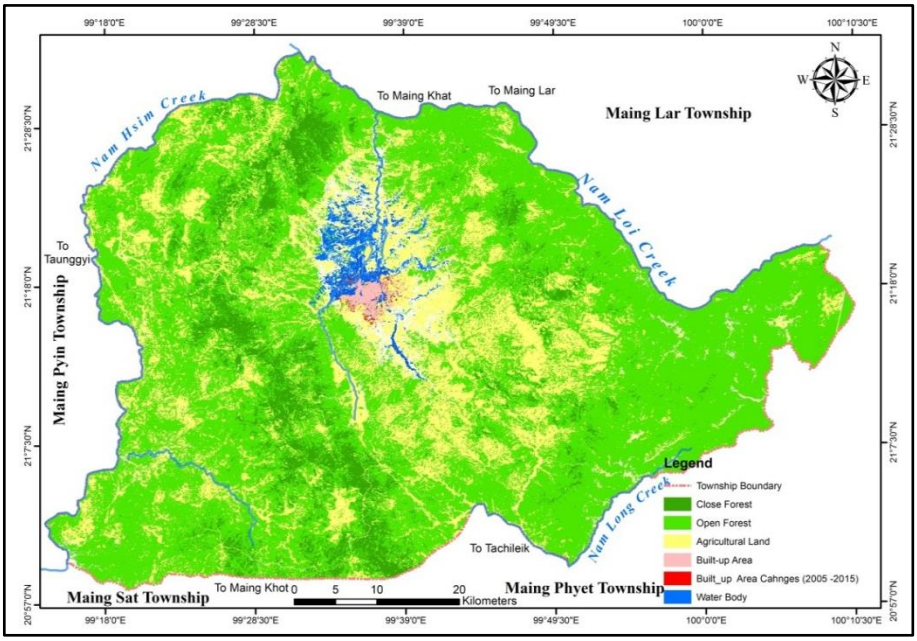

Figure (9). Built Up Area Changes Detection Result from 2005 to 2015 Images of the Study Area. (Source: Landsat TM 5 and 8 Images, 2005& 2015).

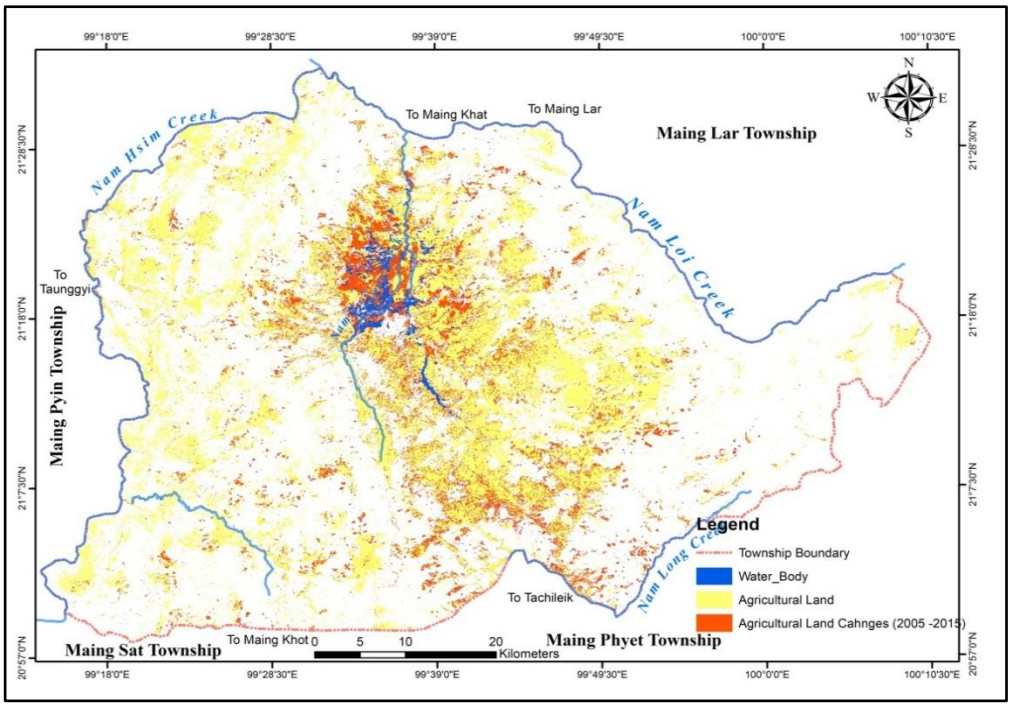

Figure (10). Agricultural Land Cover Changes Detection Result from 2005 to 2015 Images of the Study Area. (Source: Landsat TM 5 and 8 Images, 2005& 2015).

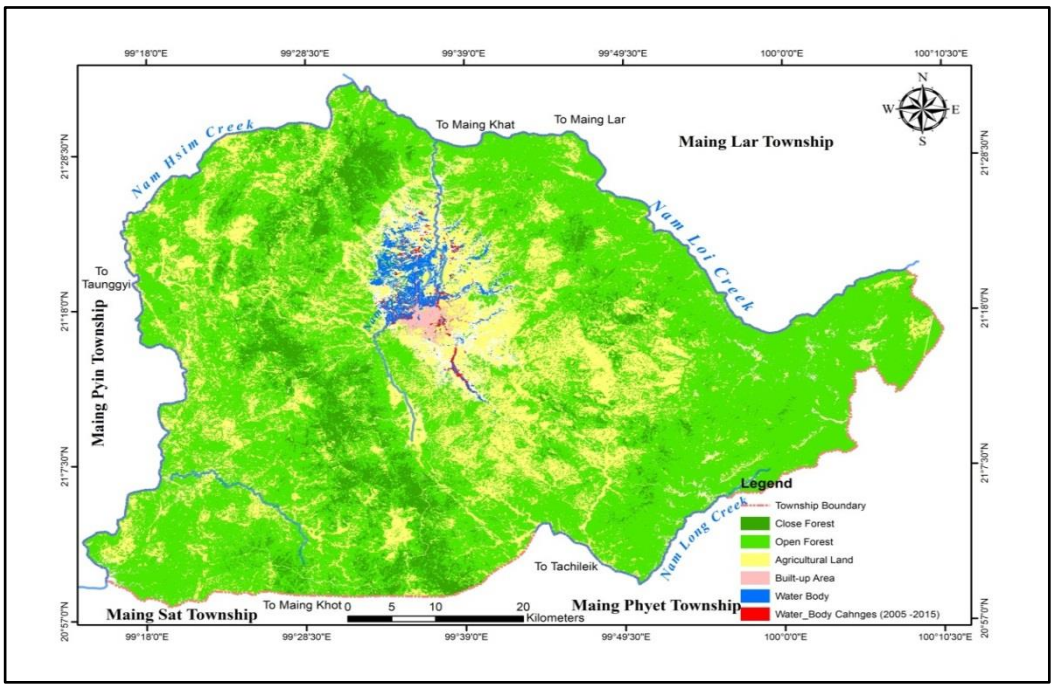

Figure (11). Water Body Changes Detection Result from 2005 to 2015 Images For the Study Area. (Source: Landsat TM 5 and 8 Images, 2005& 2015).

FINDINGS AND SUGGESTIONS

Findings

Land cover changes in Kyaingtong Township occurred in 2005 and 2015 period. Based on Landsat 8 TM Images of 2005 and 2015, five types of land cover were classified for land cover analysis in Kyaingtong Township. Changes in the four major land cover types were found in this period for closed forest, open forest, agricultural land and water bodies. The maximum likelihood supervised classification techniques was used to extract information from satellite data and post-classification change detection method was employed to detect and land cover change. The change of open forest land was increased during study period. The decreased of closed forest land was due to deforestation, over logging and encroachment of human dwelling.

Suggestions

It is hoped that this paper is an educative talk to local people for the awareness of the environmental quality. Most native people lack knowledge on environmental awareness, so educational talks and sustainable management should be conducted for environmental conservation. To maintain environmental conservation, systematic timber logging system, replantation and forest management system which need to be planned to sustain the deterioration of closed forest area are required.

CONCLUSION

Kyaingtong Township lies on the eastern part of the Shan State. This area is 2100.46 sq miles (5440.17 sq km). A study covering 10 year span (2005-2015) has carried out on land cover changes in Kyaingtong Township using topographic maps and multi-temporal remotely sensed data. The land cover change of Kyaingtong Township is the main pressure of growing people, the need agricultural land, increasing demand for fuel and commercial wood. Land cover change has important impacts on the functioning of socio-economic and environmental systems. And land cover change refers to the complete replacement of one cover type by another.

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