

## **Analysis on Land Use and Land Cover Changes in Tabayin Township**

**Aye Aye Moe\***

### **Abstract**

Tabayin Township is located in Shwebo District of Sagaing Region. Land use and Land cover (LULC) pattern of an area is an outcome of natural and socio-economic factors. The main aim of this analysis is to study the changes in land use and land cover in Tabayin Township. To attain this, satellite data of Landsat 2013 and 2020 were downloaded from USGS Earth Explorer and processed using Remote Sensing (RS) and Geographical Information System (GIS). The supervised classification in Maximum Likelihood Algorithm method was mostly employed for the LULC classification. This has been used to prepare the base maps with four land cover classes that are used to generate LULC maps. This research shows that barren land between 2013 and 2020 decreased from 61 percent to 27 percent; built up area changed from 9 percent to 20 percent; vegetation cover increased from 9 percent to 48 percent; while water body area decreased from 21 percent to 6 percent of the study area.

**Keywords:** land use, land cover, change, Remote Sensing, Geographic Information System

### **Introduction**

Land use usually refers to the changes by way of increasing human activities whereas land cover refers to the physical manifestation of the surface of the earth; the distribution process of water, soil, vegetation or urban area arrangement. Land cover and land use variations are concerned with the major human activities changing hydrology. Land use and land cover (LULC) change have become a vital factor in managing natural resources and monitoring environmental changes. Moreover, LULC changes are one of the major driving forces of changes particularly climate, also an essential variable that affects on many parts of the human and physical conditions. Furthermore, today, the focus is more on preserving the environment for the future generations. Due to the lack of suitable land use development and the measures for sustainable development, widespread urban growth and loss of agricultural land have had severe environmental magnitudes. These changes are likely to challenge the man-environmental relationship. Therefore, it is necessary to assess the magnitude, outline, and type of land use and land cover changes, mainly in regard to physical changes for future and developmental purposes. However, this paper aims to analyze the classification of LULC changes using RS and GIS. The researcher has conducted a research on land use and land cover changes in Tabayin Township which has been chosen as the study area.

---

\* Associate Professor, Dr, Department of Geography, Yadanabon University

### **Study Area**

Tabayin Township is situated in Shwebo District within Sagaing Region. It lies in the Central Dry Zone of Myanmar Naing Ngan between north latitudes of 22° 22' and 22° 43' and east longitudes of 94° 55' and 95° 32' (Figure 1).

The township is bounded on the north by Ye-U Township, on the west by Kani Township, and on the south by Ayadaw and Budalin Townships. The eastern boundary of the township is demarcated by Mu river which flows from north to south. This boundary is connected for about 16 miles with the townships of Khin-U, Shwebo and Wetlet.

Tabayin Township is narrow north to south and long in east-west direction with 6 miles at its narrowest and 16 miles at its widest. It has an area of 511.85 square miles (1325.68 square kilometers) or 327,583 acres. It is 50 miles in length from east to west. The township is formed by 2 wards and 197 villages lying within 56 village tracts.

The relief of Tabayin Township can be divided into two parts: a wide plain in the eastern part and hilly region in the western part (Figure 2). Mu River flows along the eastern boundary. It is widely accepted that climatic conditions of a region influence not only its topography and drainage but also the socio-economic factors.

Since there is no meteorological station in Tabayin except for a rain gauge, data on temperature and humidity of Ye-U which is 9 miles northeast of Tabayin, are used for this township in consideration of the similarity of relief between the two townships. According to the 1991-2020 Meteorological data in the study area, the hottest month is April and the coldest month is December, 102.8°F and 85.5°F in average maximum temperature and 68.2°F and 55.8°F in average minimum temperature and 85.5°F and 70.6°F in average mean temperature, respectively. During this period yearly temperature were 94.6°F in maximum, 67.1°F in minimum and 80.8°F in mean temperature. According to 1991-2020 climatic data, the study area has an average annual rainfall of 39.7 inches. During this period, the highest annual rainfall occurred in 1994, amounting to 60.66 inches and the lowest annual rainfall was found in 2012 with 14.19 inches. The least average monthly rainfall was recorded in December with 0.17 inch and the heaviest monthly rainfall in September with 9.54 inches. According to Koppen's classification, the 30-year data from 1991 to 2020 show that Tabayin Township has an Aw type of climate or Tropical Savanna.

### **Aim**

The main aim is to study changes in land use and land cover in Tabayin Township.

### **Objectives**

The analysis will cover the following objectives

- to study the spatial distribution of land use and land cover
- to describe the distribution of land use and land cover in 2013
- to find out the land use and land cover in 2020

to analyze detection in land use and land cover between 2013 and 2020.

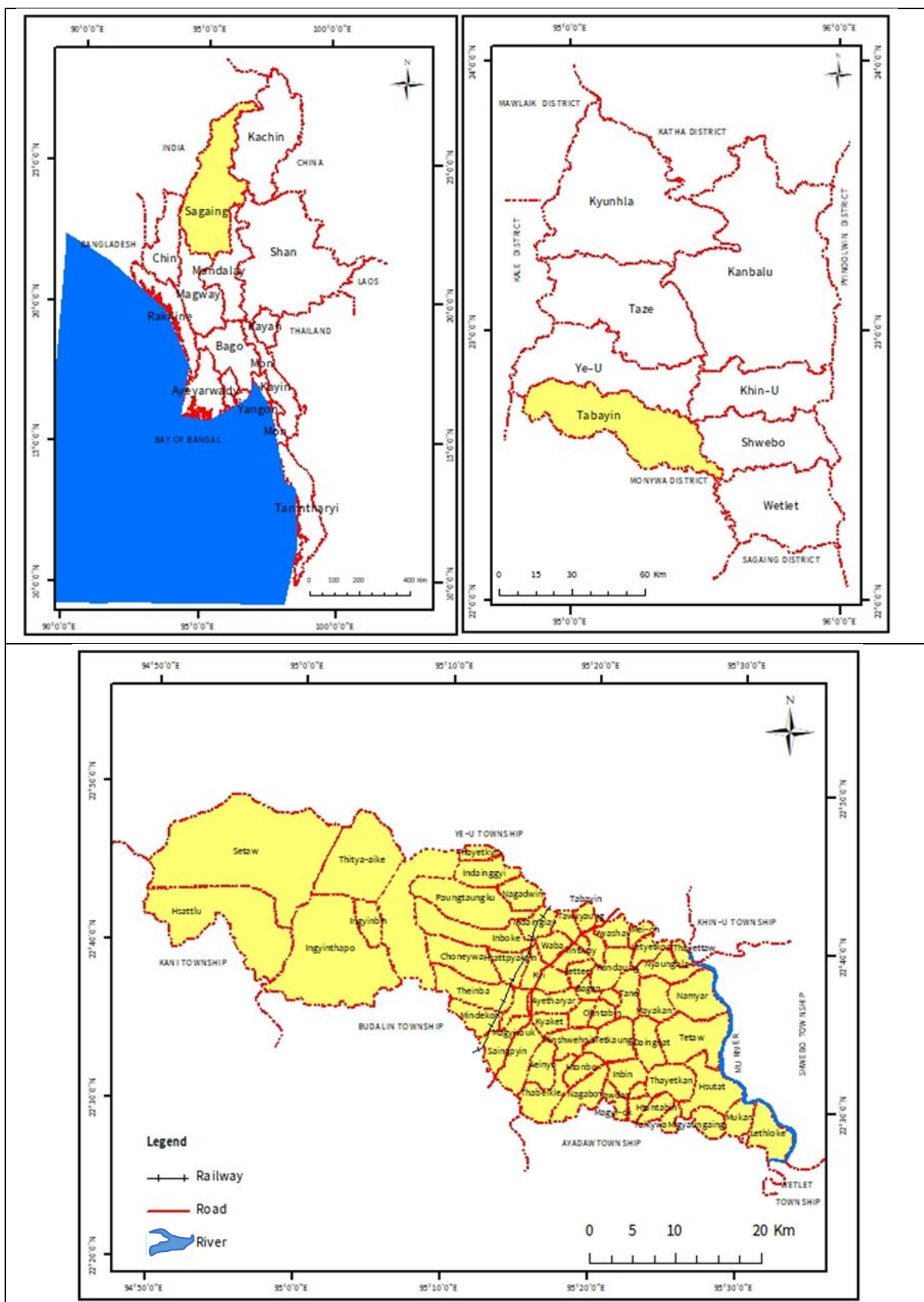


Figure 1. Location of Tabayin Township

Source: UTM Map No. 2295-01,2295-02,2295-05,2295-06.

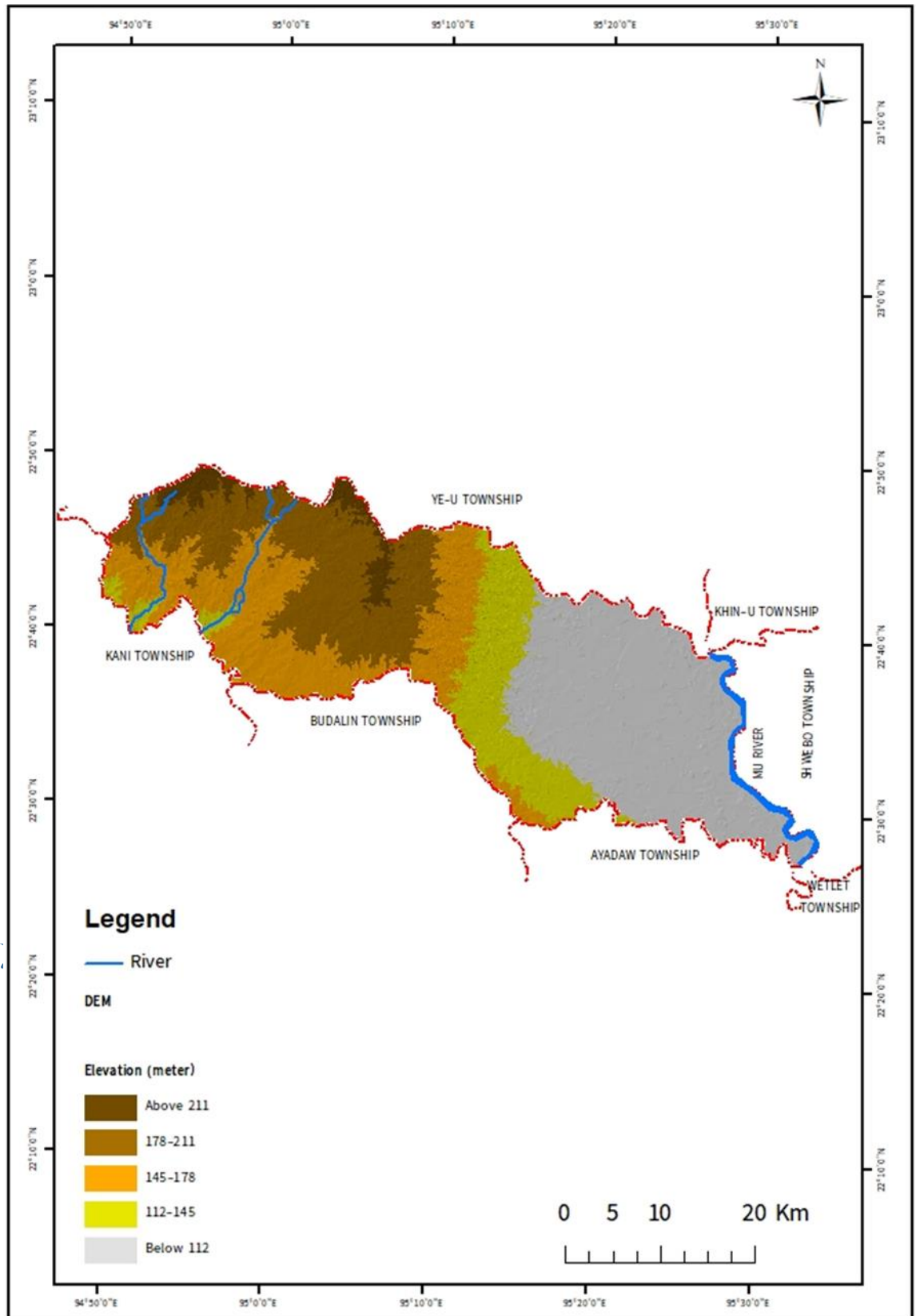


Figure 2. Relief of Tabayin Township

Source: Digital elevation model (DEM)

### Data Collection and Method

In this study, data use was downloaded using satellite images from the USGS website (<http://glovis.usgs.gov>) covering the 7-year time frame between 2013 and 2020. It is clear that satellite images of different years were taken during the same season, which permits easy differentiation between land cover and land use. Data sets are projected in UTM projection with zone number 47 and WGS datum. Mosaic was created to cover the whole area. The number of satellite image downloaded were eight in the same month for mosaic.

Table 1. Description of data

Sensor category	Acquiring date	Spatial resolution
Landsat OLI 8	20130325	30m
Landsat OLI 8	20200325	30m

### Image Preprocessing

In this study, totally, four LULC classes were established as built up area, vegetation cover, barren land, and water body area. Two period Landsat images were compared using supervised classification technique. In the supervised classification technique, two images with different years are independently classified. The aim of this research is to describe changes in Tabayin Township, using multi-temporal satellite imaging, with digital image processing such as geometric correction, radiometric calibration, image sub setting and classification. ENVI software was used. Supervised classification using a maximum likelihood method was used to categorize areas of interest.

### Analysis on Land Use and Land Cover Changes

Tabayin Township has an area of 511.85 square miles or 327583 acres (197.63 square kilometers). It is in Sagaing Region and is moderately populated. According to the censuses, the township's population totalled 139,479 in 2020. The population in the plain area was 130918 or 93.86 percent of the total population while the western hilly region was 8561 with population or 6.14 percent of the total population. According to 2020 data, the population density of Tabayin Township was 273 per square mile. The population density of the plain area was 427 per square mile and the western hilly region was 42 per square mile.

Land use and land cover are the most prominent landscape symbols of the earth surface system (Shi,1887; Xu and Wang, 1993; Yu, 2004; Li, 2004). Moreover, land use and land cover are continuously changing under the influence of man and nature. This land use and land cover changes of Tabayin Township are being studied by statistical data from satellite images. After studying these data, the various categories of land use and land cover observed in Tabayin Township were classified into four major groups, namely, built up area, water body area, vegetation cover and barren land.

According to figure 3, built up area of Tabayin Township in 2013 occupied 113.29 square kilometers (43.74 square miles) or 9 percent of the total area. This area was found in the plain

area. Water body area of this region was 270.44 square kilometers (104.42 square miles) or 21 percent of the township area. It was mostly found in the eastern part and the western part of this region. Vegetation cover had 109.86 square kilometers (42.42 square miles) or 9 percent of the total area. It was found in the western hilly region. Barren land was 832.09 square kilometers (321.27 square miles) or 61 percent of the observed area. It was mostly found in the middle and western parts. In this year, barren land was the largest land cover type in Tabayin Township. The vegetation cover had the least land cover type.

According to figure 4, built up area of Tabayin Township in 2020 occupied 275.29 square kilometers (106.29 square miles) or 20 percent of the total area. This area was mostly found in the plain area and was sparsely found in the western hilly region. Water body area of this region was 78.04 square kilometers (30.13 square miles) or 6 percent of the township area. It was found in the eastern part and the western part of this region. Vegetation cover had 613.6 square kilometers (236.91 square miles) or 48 percent of the total area. It was found in the western hilly region and middle part of the study area. Barren land was made up of 358.75 square kilometers (138.51 square miles) or 27 percent of the observed area. It was sparsely found in the middle part and western part. In this year, vegetation cover was the largest land cover type in Tabayin Township. The water body area had the least land cover type.

According to figures 3 and 4 , between 2013 and 2020 built up area increased from 113.29 square kilometers (43.74 square miles) to 275.29 square kilometers (106.29 square miles) or from 9 percent to 20 percent; water body area decreased from 270.44 square kilometers (104.42 square miles) to 78.04 square kilometers (30.13 square miles) or from 21 percent to 6 percent; vegetation cover increased from 109.86 square kilometers (42.42 square miles) to 613.6 square kilometers (236.91 square miles) or from 9 percent to 48 percent; while barren land decreased from 832.09 square kilometers ( 321.27 square miles) to 358.75 square kilometers (138.51 square miles) or from 61 percent to 27 percent of the total area (Table 2).

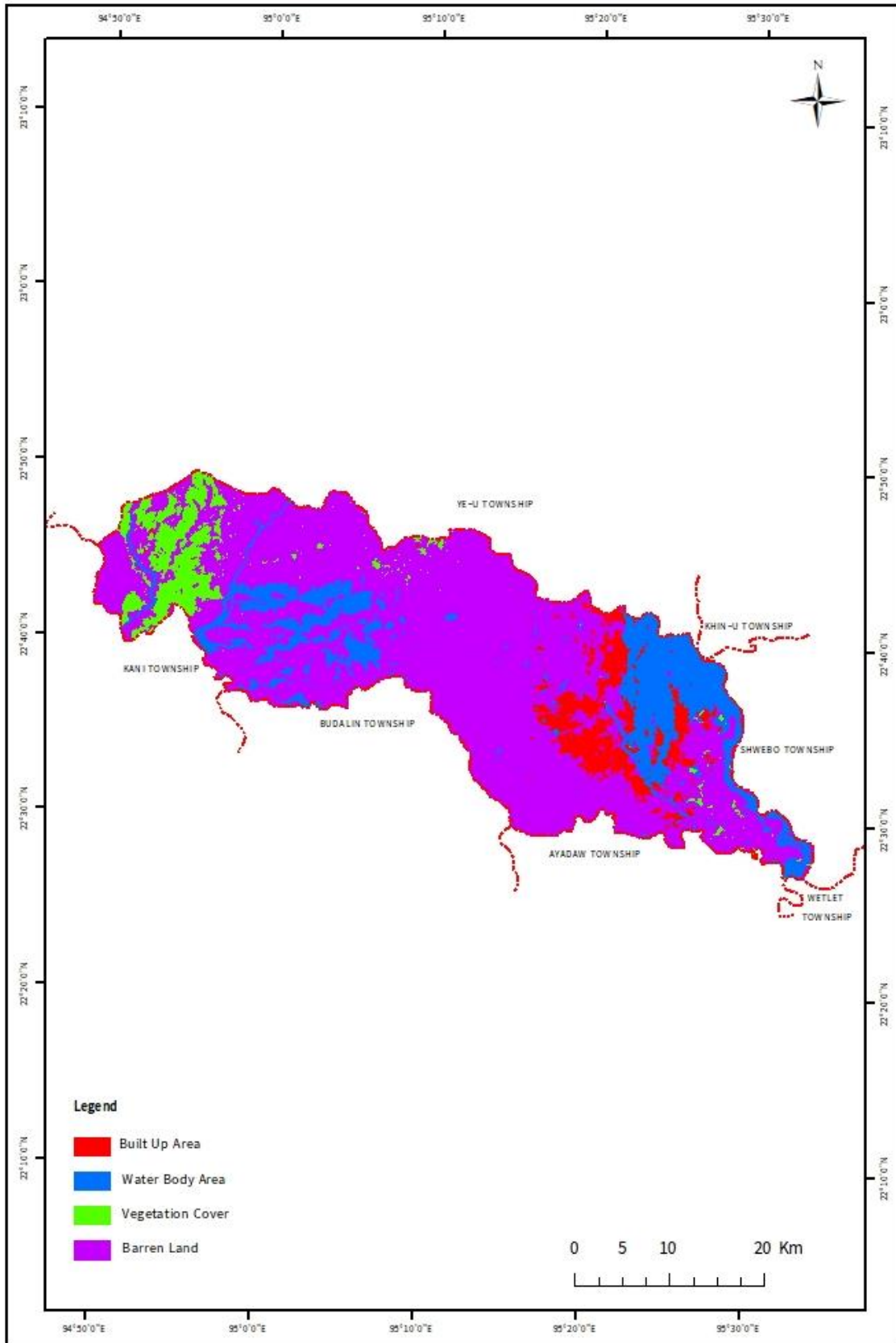


Figure 3. Land Use and Land Cover Distribution in Tabayin Township (2013)

Source: Landsat 8

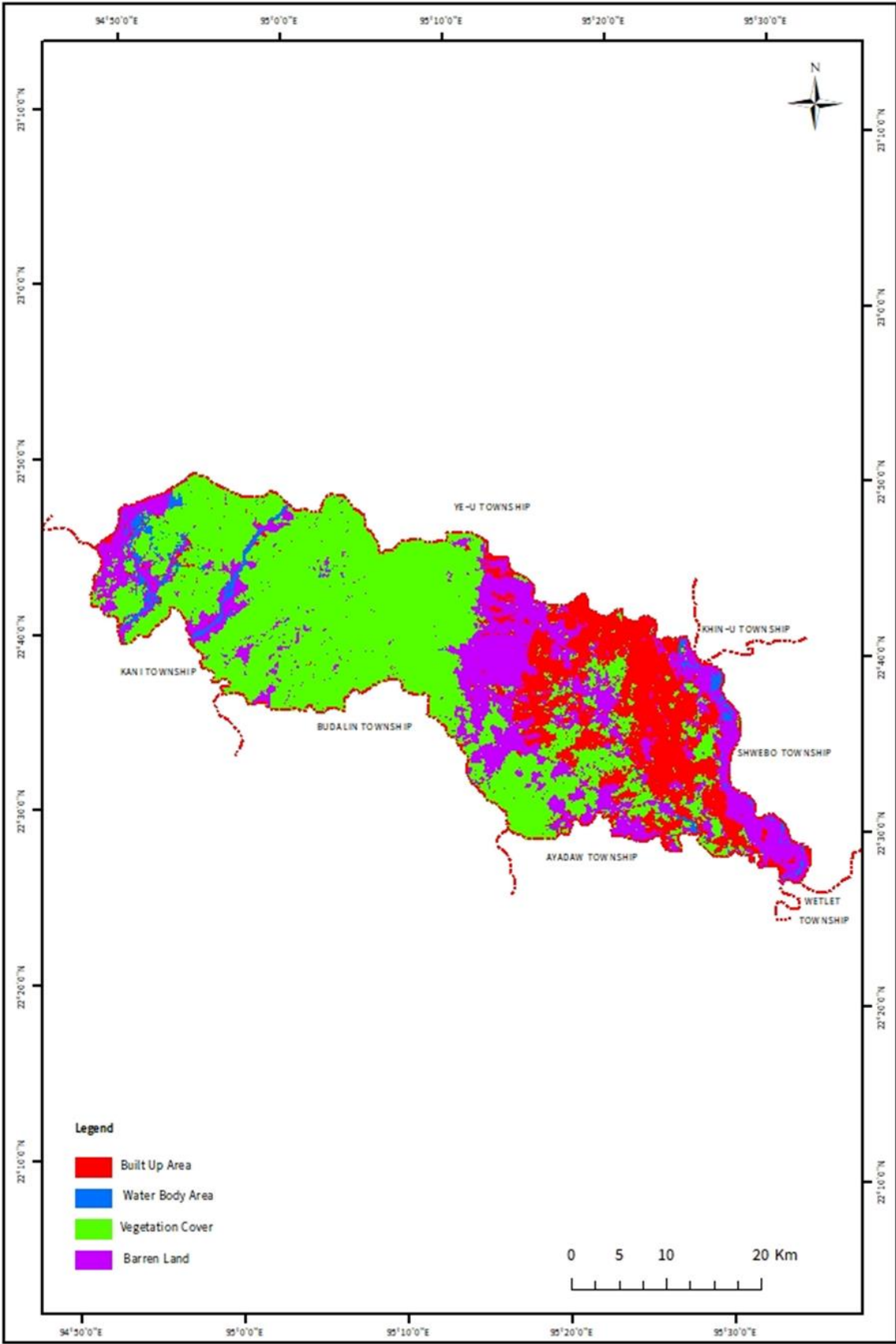


Figure 4. Land Use and Land Cover Distribution in Tabayin Township (2020)

Source: Landsat 8



Table 2. Land Use and Land Cover Changes in Tabayin Township (2013 and 2020)

No.	Types of Land Use/ Land Cover	Land Use/ Land Cover in Square Kilometer		Changes
		2013	2020	
1	Built Up Area	113.29	275.29	+162.00
2	Water Body Area	270.44	78.04	-192.40
3	Vegetation Cover	109.86	613.6	+503.74
4	Barren Land	832.09	358.75	-473.34
	Total	1325.68	1325.68	

Source: Calculated by the researcher

According to table 2, from 2013 to 2020 built up area increased to 162 square kilometers. The increased rate of the study area is 1.75 percent each year during the seven-year period. Water body area decreased to 192.4 square kilometers. The decreased rate of water body area is 2.07 percent each year during the seven-year period. Vegetation cover increased to 503 square kilometers. The increased rate of the study area is 5.43 percent each year during the seven-year period. Barren land decreased to 473.34 square kilometers. The decreased rate of the barren land is 5.1 percent each year during the seven-year period.

### Findings and Results

Finally, this research provides the following findings and results.

- (1) The increased rate of the built up area is 1.75 percent every year during the seven-year period from 2013 to 2020. A comparison of built up area in 2013 and 2020 has shown that the plain area is mostly inhabited while the western hilly region is sparsely inhabited.
- (2) The decreased rate of water body area is 2.07 percent every year during the seven-year period from 2013 to 2020. A comparison of the water body in 2013 and 2020 shows that the water body area in the western hilly region has decreased.
- (3) The increased rate of the vegetation cover is 5.43 percent every year during the seven-year period from 2013 to 2020. A comparison of the vegetation cover has shown that the vegetation cover in the western hilly region has increased while some vegetation cover is also found in the plain area.

The decreased rate of the barren land is 5.1 percent every year during the seven-year period from 2013 to 2020. A comparison of the barren land has shown that the barren land in the western hilly region has mostly decreased.

### **Conclusion**

The causes of land use and land cover changes were due to natural and social factors. In particular, socio-economic factors may play a leading role rather than the natural factors in regional land use changes. Socio-economic factors include increasing population (population growth), human activity, government policy, market price, technological level, etc. Changes in land use and land cover have significant impacts on a variety of environmental, ecological, economical and social conditions and processes. These consequences of changes are both direct and indirect, and also are manifested at a range of spatial and temporal scales. The changes can have advantages or sometimes disadvantages for Tabayin Township. The increasing population is expanding built up area or settlement. Water body area and barren land are decreased while vegetation cover is increased. Therefore, it can be said that the public are more aware of forest conservation and knowledge about the value of forests in a particular locality and its environment.

### **Acknowledgements**

I would like to thank all the people who directly or indirectly contributed towards the success of this paper, for their support, encouragement, useful ideas, valuable guidance and help in preparing this paper.

### **References**

1. Kr. Sarma, P. & et. Al. (2008): Land Use and Land Cover Changes and Future Implication Analysis in Monas National Park, India, using Multi-Temporal Satellite, the Current Science Journal, vol.95. No.2-25 July.
2. Weng Q. (2001): Land Use Changes Analysis in the Zhujiang Delta of China using Satellite Remote Sensing, GIS and Stochastic Modelling, Journal of Governmental Management (2002).
3. William Acevedo (1999): Analyzing Land Use Changes in Urban Environments, US Department of the Interior, USGS.
4. <http://glovis.usgs.gov>