

Land cover changes in Selenge aimag

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ABSTRACT

Land use and land cover change are important drivers of climate change. Land use/land cover change has important consequences for global and regional climates and global biogeochemical cycles such as carbon, nitrogen and water, and biodiversity (Kees et al, 2004). Driven by anthropogenic and climatic factors, land use/land cover has been changing. In Mongolia, for instance, due to mining activities, approximately 400 hectares of land was damaged and left without proper rehabilitation in 2016. Consequently, the monitoring of land use/land cover change has gained importance. The application of satellite imagery and remote sensing technology in the land use and land cover change analysis was revolutionary in conducting a monitoring of changes in the earth surface. In the land surface monitoring through remote sensing, both the spatial and temporal variables are equally important indicators. Landsat satellite image can qualify this requirement. Hence, in this research, Landsat-8 OLI satellite images of the period between 2010 and 2019 were used to analyse the land use and land cover changes in Selenge province, which is the primary agricultural region of Mongolia. The maximum likelihood classification technique, which is one of the most popular classification techniques, is applied to the research. Under this, classes are identified based on the pixel, belonging to a particular class (Xiong, J et al, 2017). The research results show that in accordance with the land use and land cover classification, between 2010 and 2019, the urban land was expanded by 0.11% (4649.9 ha), arable land by 0.13% (5236.6 ha), sparse vegetation and barren land by 0.01% (9377.50 ha), and mining area by 0.03% (1272.7 ha) respectively in Selenge province. On the other hand, during the period, lake areas are reduced by 0.01% (425.1 ha), evergreen forest by 0.02% (938.8 ha), mountain steppe by 0.1% (4181.5 ha), and meadow and river valleys by 0.15% (6309.9 ha). The most significant reduction of 0.9% (37584.2 ha) is recorded in the coniferous and deciduous forests. Moreover, the results show that 36406.5 ha land was affected by the forest and steppe fire. This is because of increased dryness due to climate change and other negative human activities. To conclude, the dramatic land cover changes in Mongolia's main agricultural region have adverse impacts on Mongolia, which has dry, continental climate; hence, it's important to implement appropriate land use policy in the country.

Keywords: Land cover, land cover changes, Selenge aimag

1. INTRODUCTION

The land cover is defined as a layer of soil and biomass, including natural vegetation, crops, and man-made surface cover Dolman et al. 2003.

Today, the land cover has been used as a key indicator in determining how space and time changes in ecosystems are taking place around the world. Therefore, land cover information is widely used in research such as agriculture, hydrology, forestry, land planning, and environmental impact assessment. In recent years, researchers have been improving databases using remote sensing data to determine the geographical distribution of the land cover at the regional and international levels. (Townshend et al.1991, De Friesand Townshend 1994a). Satellite data can cover a large area at a time in terms of accuracy and data storage capacity. Thus, it can save time, manpower, and costs by using them to study land cover and land use (D.Dash, 2010). We selected Selenge aimag as our study object. Selenge aimag is considered as a main agricultural region of Mongolia. Selenge aimag has a population of 97,876 in 2010 and increased to 110,110 in 2019. This study aims to estimate land cover changes in 10 years (2010-2019) in Selenge aimag using Landsat 8 data.

2. STUDY AREA

Selenge aimag is located in the northern part of Mongolia, middle mountainous area in the Orkhon-Selenge basin. Selenge aimag is an administrative unit with 17 soums, 57 bags and 6 villages and covers an area of 42.2 thousand square kilometers. It is a predominantly agricultural aimag, producing about 45 percent of the country's grain and having more than 570,000 livestock. The Selenge aimag is abundance of coal, gold and construction materials. Selenge aimag has major rivers in Mongolia such as Selenge, Orkhon, Kharaa and Yeru. In Mandal soum, 80% of Mongolia's medicinal plants grow. In Mandal soum, 80% of Mongolia's medicinal plants grow.

3. METHOD AND DATA

In our study, we used Landsat 8 satellite images in period of 2009, 2010, 2018 and 2019 <https://earthexplorer.usgs.gov/>. Selenge aimag is covered by six rows /number131, 132, 133 25-26/. Land 8 image processed by ENVI program to combine bands of 4, 3, 2 (natural colour) and 7, 5, 2 (false colour). Atmospheric and radiometric corrections were conducted to fix errors caused by geographical location, weather conditions, and atmospheric transparency using ENVI 5.1 programme.

In addition, these images were mosaiced into one image, and conducted supervised classification using Maximum Likelihood Classification method to mapping the land cover of Selenge aimag. Moreover, digitization method were used to improve land cover classification resolution due to Maximum Likelihood Classification methods limitation which some different objects in the same spectral region were classified into the same objects.

Produced maps which shows the results of land cover classification in Selenge aimag using satellite data, supervised classification methodology, and knowledge-based methodology.

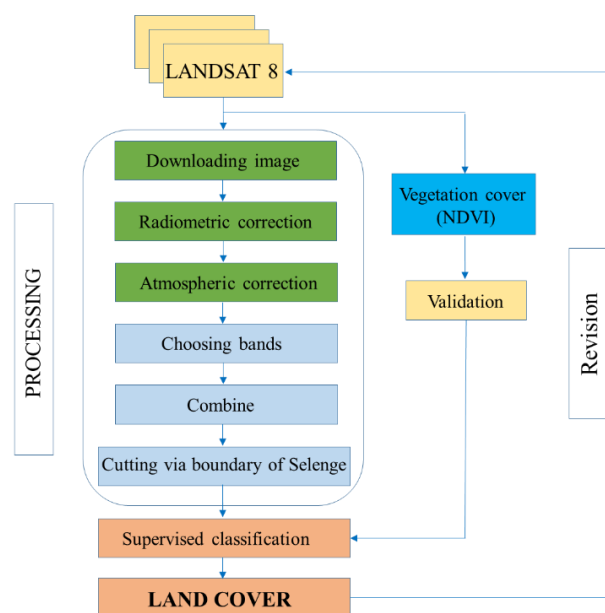


Figure 1. Schema of study

4. RESULTS

Land cover in Selenge aimag divided into 9 general categories, and land use in 2010 is shown in Figure 2.

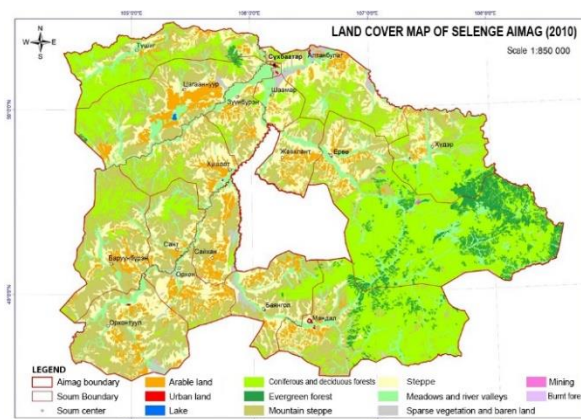


Figure 2. Land cover of Selenge aimag /2010/

As shown in the figure 3, Tushig, Tsagaannuur, Baruunburen, Khushaat, Altanbulag, Mandal, Khuder and Yeruu soums of Selenge aimag are more covered with forests. However, Saikhan, Orkhon, Orkhontuul, Javkhant and Zuunburen have more agriculture, and other soums are mostly covered by agricultural land around the city center. The following table shows the area and percentage of land cover in Selenge aimag (Table 1).

Table 1. Area of Land cover /2010/

Land cover classification	Area coverage /km ² /	Percentage
Evergreen forest	1894.97	4.56
Coniferous and deciduous forests	13500.40	32.47
Mountain steppe	7746.21	18.63
Steppe	10487.37	25.23
Meadows and river valleys	4211.12	10.13
Sparse vegetation and barren land	376.81	0.91
Arable land	3228.41	7.77
Urban land	51.86	0.12
Lake	13.64	0.03
Mining	25.86	0.06
Burnt forest	38.43	0.09

The land cover and size of area of Selenge aimag in 2019 is shown in Figure 3, and Table 2.

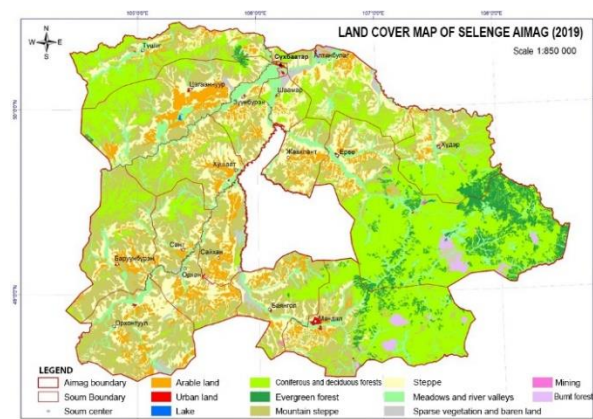


Figure 3. Land over of Selenge aimag /2019/

Table 2. Area of Land cover /2019/

Land cover classification	Area coverage /km ² /	Percentage
Evergreen forest	1885.58	4.54
Coniferous and deciduous forests	13124.56	31.57
Mountain steppe	7704.40	18.53
Steppe	10505.27	25.27
Meadows and river valleys	4148.02	9.98
Sparse vegetation and barren land	380.59	0.92
Arable land	3280.77	7.89
Urban land	98.36	0.24
Lake	9.39	0.02
Mining	38.58	0.09
Burnt forest	402.50	0.97

Land cover change

The following figure shows the percentage of each land cover category in Selenge aimag in 2010 and 2019 (Figure 4).

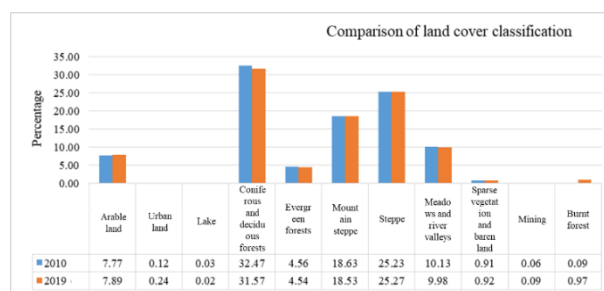


Figure 4. Percentage of land cover classification in 2010 and 2019 in Selenge aimag

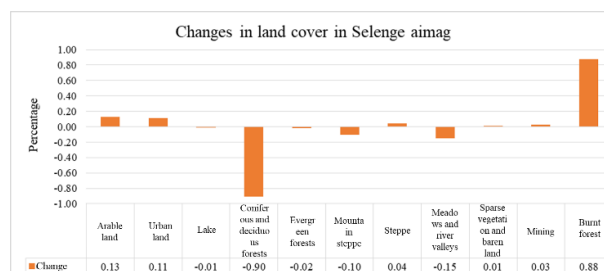


Figure 5. Percentage of land cover classification in Selenge aimag

In 2010 and 2019 land cover changes in Selenge aimag's reveals that cropland increased by 0.13%, urban area by 0.11%, steppe area by 0.04%, bare vegetation area by 0.01%, and mining area by 0.03%, respectively. The burnt forest area increased by 0.88% which is the highest growth from other land use types. Moreover, the area of lakes decreased by 0.01%, evergreen forests by 0.02%, mountain steppes by 0.1%, meadows and river valleys by 0.15%, of which the largest coniferous and deciduous forests decreased by 0.9%.

5. CONCLUSION

In recent years, urban land and cropland area has been increasing due to population growth. Evergreen forests, coniferous and deciduous forests area covers more than 30 percent of the total area, which shows that abundant of forest resources. Moreover, arable land occupies 8% and water bodies occupies 10.23% of the total area of Selenge aimag. For further studies, there is a need to improve the methodology for interpreting satellite data and validate the remote sensing results using field surveys.

For small tables, please place it within a column and bigger table be placed in a text frame spanning to both columns. Use the Table facility available within the MSWord. The font in the row header should be bold and you can use the style available from the style palette.

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