

LAND COVER CLASSIFICATION IN UYANGA SUBPROVINCE

ENKHJARGAL.N^a, TSOLMON.R^b

^a – Graduate student “NUM-ITC-UNESCO” Laboratory for Remote Sensing and Geographic information System, National University of Mongolia, NUM building №1, Room 401, Sukhbaatar district, Mongolia; Tel: 976-91900119; E-mail: enhjargaln@gmail.com

^b – Professor, “NUM-ITC-UNESCO” Laboratory for Remote Sensing and Geographic information System, National University of Mongolia, NUM building №1, Room 401, Sukhbaatar district, Mongolia; Tel: 976-99978960; E-mail: tsolmon@num.edu.mn

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ABSTRACT

This paper discusses, a land cover classification system for use with spatial resolution remotely sensed data such as Landsat TM (August 5, 2010). The study area is Uyanga soum, Uvurkhangai province, which is situated in the central part of Mongolia and located on E 101,325 - E 102,464 and N 46,135 - N 46,881. We collected in situ land cover data during ground truth surveys for remote sensing data analysis. The ground truth collection was held in August 2009. A total of 527 sample points were chosen for ground truth collection. Then, we assessed temporal changes in land use and land cover using multiple methodologies for spatial analysis. Land cover/use includes vegetation and man-made features, as well as bare rock, bare soil and inland water surfaces. The results show that the overall accuracy of land cover classification is 72,77% for the study area.

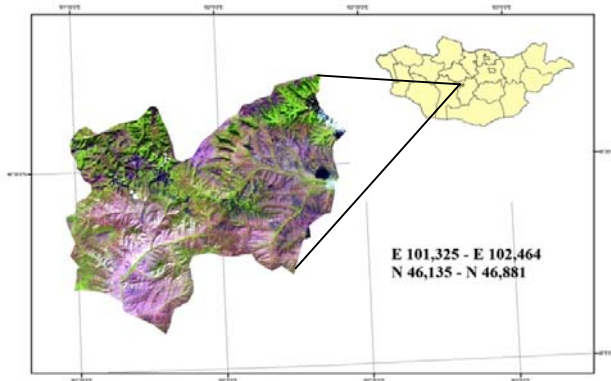
1. INTRODUCTION

Environmental scientists in Mongolia and abroad understand the importance of studying land cover and land use analysis, particularly in regions where human activity impacts the environment.

Land cover is the observed (bio) physical cover on the earth's surface. On the other hand, land use is characterized by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it (Lambin, E.F., Geist, H.J. and Lepers, E. (2003).

Mongolia's land surface is composed of six broad vegetation types: alpine (high mountain), taiga, forest steppe, steppe, desert steppe and desert. Lakes, rivers and ponds in Mongolia are dried up and have lost ecological balance caused by destructive human activities and mineral extraction and climate change. Furthermore, such activities have caused damage to the environment and nomadic people's lifestyle in Mongolia (A.Tungalag, R.Tsolmon; 2009). Our Research objective is to characterize land patterns and land cover classes remotely in the study area.

2. STUDY AREA



The study area is Uyanga soum Uvurkhangai province, which is situated in the central part of Mongolia, and located on E 101,325 - E 102,464 and N 46,135 - N 46,881 (Figure 1).

This area is in the southern Khangai Mountains between 2,700 to 2,800 m.

Figure 1. Study area (Uyanga soum)

3. USED DATA AND METHODOLOGY

- Satellite data:** The Landsat TM images present the primary source of data for land cover/use mapping of the study area. We used Landsat images from August 2010 in this study. Spectral sensitivity of Landsat bands are shown in Table 1. Table 2 shows the used Landsat imagery.

Table 1. Landsat satellite

Spectral sensitivity of Landsat Bands.		
Band Number	Wavelength Interval	Spectral Response
1	0.45-0.52 μm	Blue-Green
2	0.52-0.60 μm	Green
3	0.63-0.69 μm	Red
4	0.76-0.90 μm	Near IR
5	1.55-1.75 μm	Mid-IR
6	10.40-12.50 μm	Thermal IR
7	2.08-2.35 μm	Mid-IR

Table 2. Landsat imagery

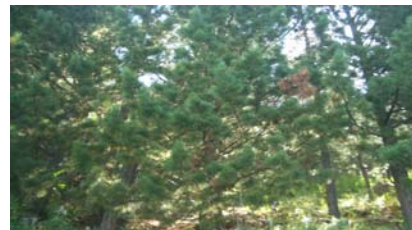
Instrument	Date	Path Row
TM	05/08/2010	P134 R28

- Ground truth data**

Collection of good ground truth data is a key issue for reliable land cover mapping. The ground truth collection was held in August 2009. A total of 527 sample points were chosen for ground truth collection. Ground truth photos are in Figure 2. Detailed descriptions and locations of the ground truth are shown in the Figure 3.



Buuruljuut river basin
N46⁰ 28.991' E102⁰ 16.376'



Needle leaf forest area
N46⁰ 43.148' E102⁰ 22.244'

Figure 2. Ground truth photo

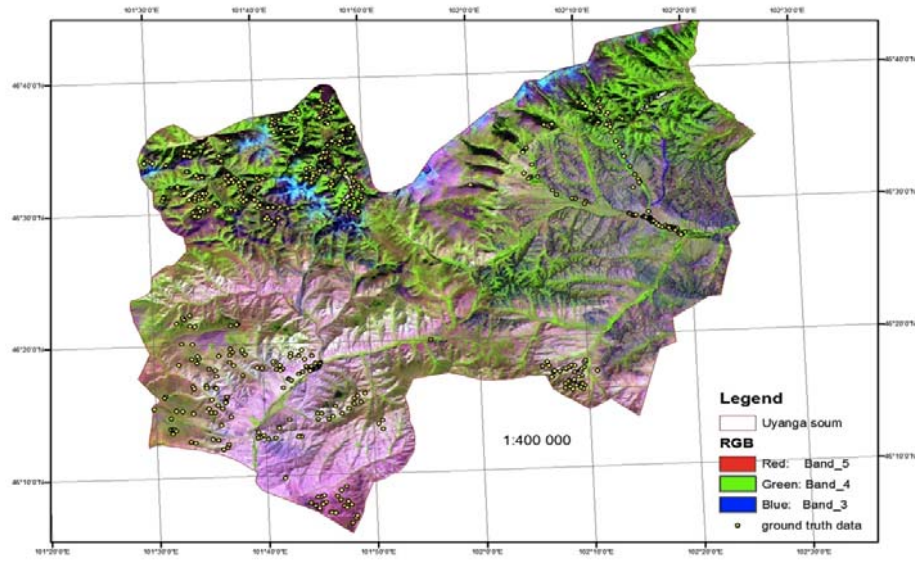


Figure 3. Location of ground truth points

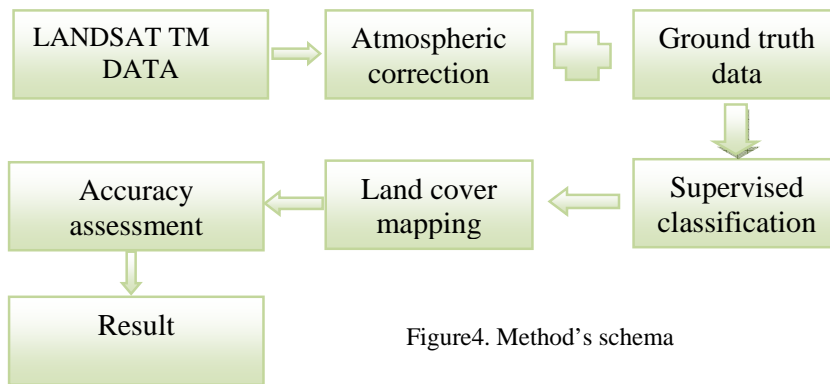


Figure4. Method's schema

Reflectance conversion without atmospheric correction:

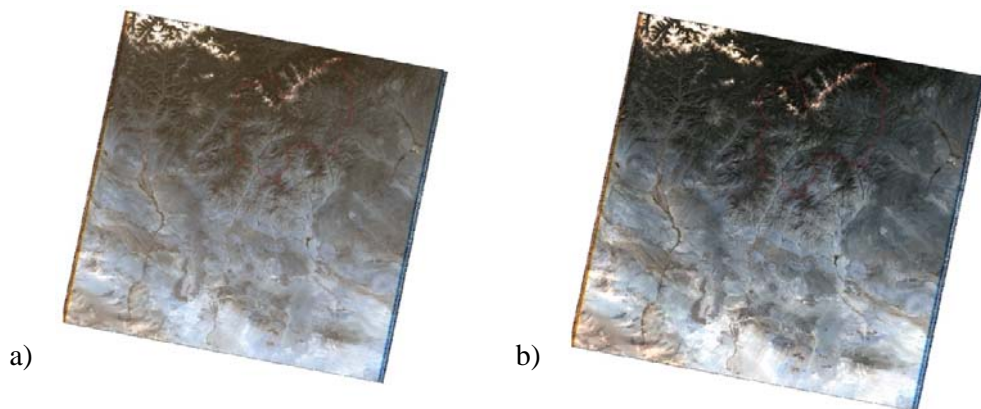


Figure 5. Atmospheric correction a) before; b) after

4. ANALYSIS

In order to make land cover legends, we used the baseline legends and took 13 classes from class definitions from NELDA Land cover legend. The assessment for 13 aggregated land cover classes included (APN report, 2010);

- B - Bare
- BS - Bare sparse
- HC - Herbaceous closed
- HO - Herbaceous open
- SC - Shrub closed
- SO - Shrub open
- TDBC - Tree Deciduous Broadleaf Closed
- TDBO - Tree Deciduous Broadleaf Open
- TDNC - Tree Deciduous Needleleaf Closed
- TDNO - Tree Deciduous Needleleaf Open
- TMC - Tree Mixed Closed
- TMO - Tree Mixed Open
- W – Water, were selected for the land cover mapping in this research work.

Tree dominated Shrub Dominated Herbaceous Dominated, Bare Land and Sparse Vegetation, Water were main classes for our imagery (APN report, 2010):

Tree Dominated:

- **Needleleaved Deciduous Closed** The main layer consists of needleleaved deciduous closed trees. The crown cover is more than (60-70)%. The height is in the range of >30 - 3m.
- **Needleleaved Deciduous Open** The main layer consists of needleleaved deciduous woodland. The crown cover is between (60-70) and (20-10)%. The openness of the vegetation may be further specified. The height is in the range of >30 - 3m.
- **Broadleaved Deciduous Closed** The main layer consists of broadleaved deciduous closed trees. The crown cover is more than (60-70)%. The height is in the range of >30 - 3m.
- **Broadleaved Deciduous Open** The main layer consists of broadleaved deciduous woodland. The crown cover is between (60-70) and (20-10)%. The openness of the vegetation may be further specified. The height is in the range of >30 - 3m.
- **Mix (not able to be defined according to LCCS)**
Areas dominated by trees where neither deciduous (broadleaved or needleleaved) nor evergreen (broadleaved or needleleaved) species represent > 75% of the cover present.

Shrub Dominated:

- **Mix** Areas dominated by shrubs where neither deciduous (broadleaved or needleleaved) nor evergreen (broadleaved or needleleaved) species represent > 75% of the cover present.

Herbaceous Dominated:

- **Herbaceous Vegetation Closed** The main layer consists of closed herbaceous vegetation. The crown cover is more than (70-60)%. The height is in the range of 3 - 0.03m but may be further defined into a smaller range.
- **Herbaceous Vegetation Open** The main layer consists of open herbaceous vegetation. The crown cover is between (70-60) and (20-10)%. The openness of the vegetation may be further specified.

Bare Land and Sparse Vegetation:

Primarily non-vegetated areas containing less than 15% vegetation cover during at least 10 months a year. A further distinction is possible in Bare, for areas with less than 5% of vegetation, and Sparse Vegetated for areas with vegetation cover more than 5% and less than 15%.

Water:

The land cover consists of perennial natural water bodies where water is present > 11 months.

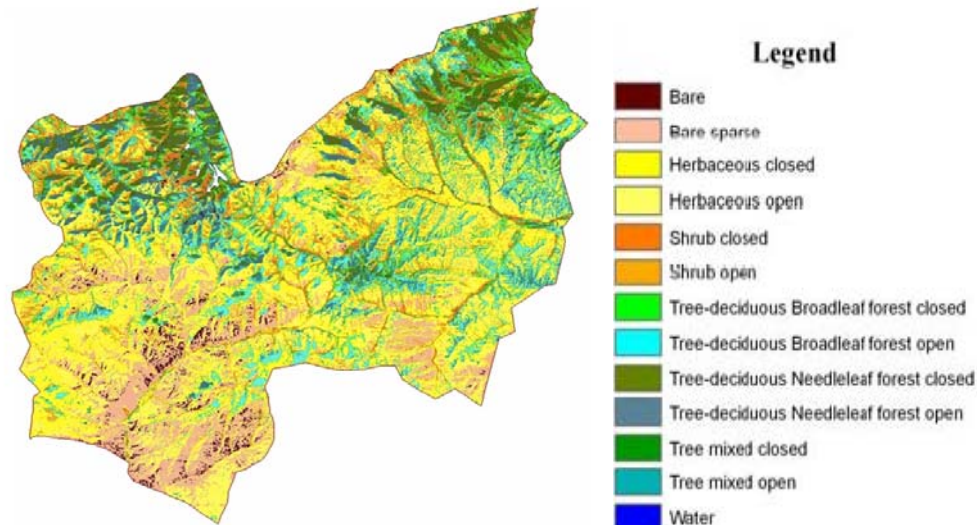


Figure 6. Land cover mapping (August 5, 2010)

5. RESULT

Accuracy assessment: We combined 13 classes into 5 classes; bare, herbaceous, shrubs, trees and water. The number of the accuracy assessment points for the study area is 527 Uyanga soum. The accuracy assessment is presented in Table 3. The results show that the overall accuracy of land cover classification is 72,77% for the study area.

Table 3. Accuracy assessment

		Classes derived from satellite													Commis sion %	
		B	BS	HC	HO	SC	SO	TDBC	TDBO	TDNC	TDNO	TMC	TMO	W		Sum
Grand Observed class	B	56	1	0	0	0	0	0	0	0	0	0	0	0	57	1,75
	BS	1	40	0	0	0	0	0	0	0	0	0	0	0	41	2,44
	HC	0	0	34	1	0	5	0	0	0	0	0	0	0	40	15,00
	HO	0	0	8	50	0	0	1	0	0	0	0	0	0	59	15,25
	SC	0	0	0	2	55	5	0	0	0	0	0	0	0	62	11,29
	SO	0	0	3	2	1	26	7	2	0	0	0	0	0	41	36,59
	TDBC	0	0	0	0	8	2	27	2	1	1	0	2	0	43	37,21
	TDBO	0	0	0	0	0	4	9	22	0	2	0	6	0	43	48,84
	TDNC	0	0	0	0	0	0	0	0	30	8	1	0	0	39	23,08
	TDNO	0	0	0	0	0	0	0	0	8	26	1	3	0	38	31,58
	TMC	0	0	0	0	0	0	4	0	0	0	30	5	0	39	23,08
	TMO	0	0	0	0	0	0	0	0	1	7	4	30	0	42	28,57
	W	0	0	0	0	0	0	0	0	0	0	0	0	60	60	0,00
	Sum	57	41	45	55	64	42	47	27	40	44	36	46	60	604	
	Omission %	1,75	2,44	24,44	9,09	14,06	38,10	42,55	18,52	25,00	40,91	16,67	34,78	0,00		
	Overall accuracy							72,77%								

6. DISCUSSION

The aim of this paper was to describe and analyze the accuracy assessment to the image. The results showed the overall accuracy of land cover classification is 72,77% for the study area. We concluded this method is useful for land cover classification. In the future, I would like to do study work in southern part of Mongolia, such as saxaul forest. Southern part of Mongolia is depended steppe, semi desert and desert zones of natural zone.

7. REFERENCES

- APN, NELDA project's report, October, 2010, pp16-23.
- Lambin, E.F., Geist, H.J. and Lepers, E. (2003) Dynamics of land-use and land- cover change in tropical regions. Annual Review Environment and Resources, 28, pp205-241.
- Second national Workshop on Application of Remote sensing/GIS for Mongolian Environment, 7 December, 2007, pp01-13.
- A.Tungalag, R.Tsolmon. (2009), Land use change analysis in Uvurkhangai province, The 3rd International and National workshop "Application of Geo-Informatics for Natural Resource and Environmental" 29-30 June, 2009.