DETECTION CHANGE OF SAND DISTRIBUTION IN MONGOLIA

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Abstract

Land deterioration and desertification increases broadening the sand distribution in semi-dry and dry regions due to the global warming and climate change. On this assumption, we have completed the sand distribution research study of Mongolia using the spatio-temporal analysis using the remote sense and GIS. The study comprises the sand distribution and movement mapping of Mongolia during 1984-2014 years and estimated distribution change as well. The study result indicates the sand in Mongolia increased by 0.46% for the past 30 years.

Key words: Sand, Change detection, Classification, Landsat image

Introduction

Mongolia situated in Central Asia bordering with 2 world power Republic of China and Russian Federation and it's dry region lacks with moisture becoming the transition zone of Siberian taiga in north part and Central Asian end point in south parts. Therefore, Mongolia has vulnarable ecological system in climate change. Some researchers found that desert region's area increased by 3.4%- and desertification level moved from moderate to severe type. In this regard, desertification exposure is one of the reason for sandy areas' increase. Total sandy area in Mongolia is 43702,8 square km and 3800 square km area newly formed since 1941. According to the D.Dash and T.Baasan's research study, for the past years sand areas' formed newly in Mongolian sand's south part great lakes depression, Altai inner gobi's Bulgan, Bodonch river basin, Khaich-Khuts mountain, near the Gurvan tes area, Tsookhondoi's gurvan, East gobi's Uush-Ulaan gobi, Unegt khargat. However, detailed research study of sandy areas' estimation in Mongolia is exceptional. The sand areas' estimation study is the base for analyzing the process happening in nature. We used and processed the database using the 1:100 000 scale map of 1984 and remote sense data of 2014 to assess the formation of the new sand area, sand distribution and changes.

Study area, material and method

The study area Mongolia is the landlocked country with continental climate, located in 1580m above the sea level comprising 1564100 square km area. It has four basic latitudinal region from the north to south direction including forest steppe, steppe, gobi and desert. Considering the natural zone, belts and surface of Mongolia it divides into four great natural zones such as Khangai, Khentii and Altai mountainous area, Eastern steppe and Gobi. Mongolia has total of seven region and 27 spatial distribution of sandy area starting from Darkhad depression of Khuvsgul, Great lakes depression, Selenge, Tuul valley, inner Altai, Onon, Kherlen, Khalkh river, Buir lake, Uush in Dornogobi, Galba gobi and till the Moltsog sand [2].

Data processing includes 1220 peices of map with 1: 100 000 scale, 70 pieces of Landsat 8 (OLI) images, 25 pieces of Landsat 7 (ETM+) images, 25 pieces of Landsat (TM) images and Spot-5 satellite images as well as used GIS programms Arcgis 10.2, Envi 5.0 and Erdas for the data development.

Data processing and method:
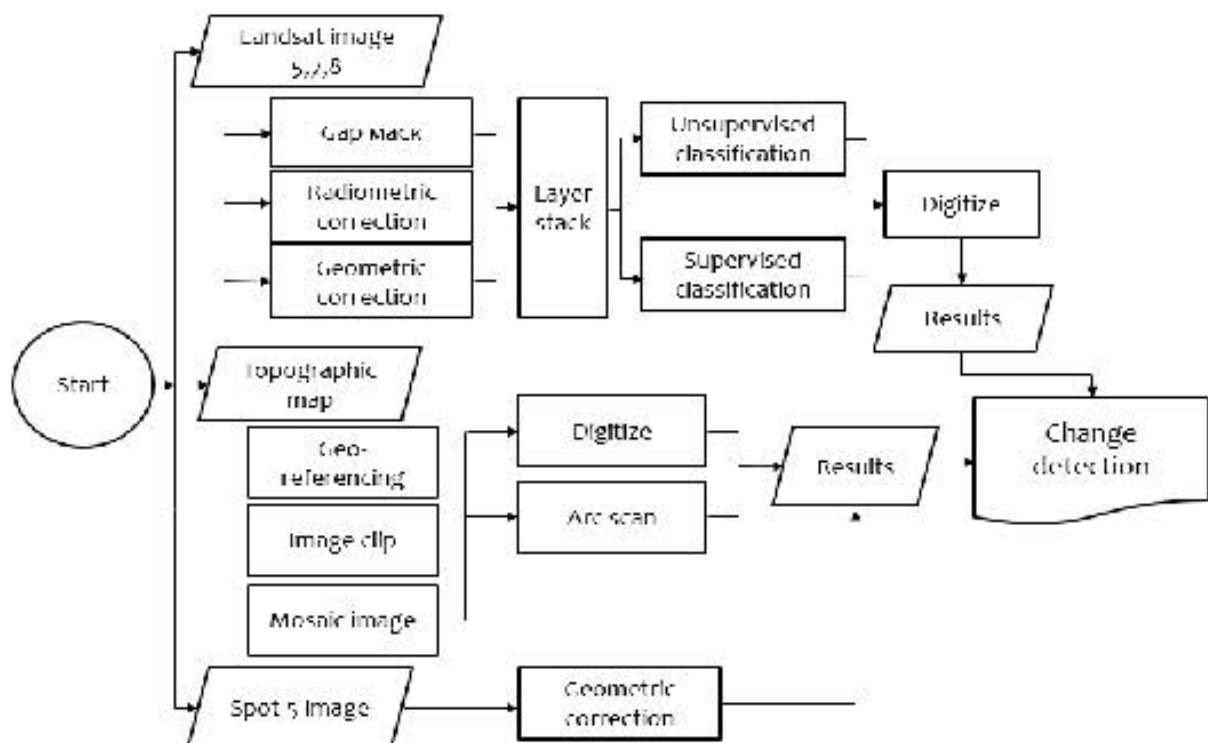
Satellite data use has the significance in covering the good size area, economic and time wise. Satellite data in land cover study uses documentary classification by providing the false and natural colors. Buurug del's classification is the example of processing and shown on following picture.
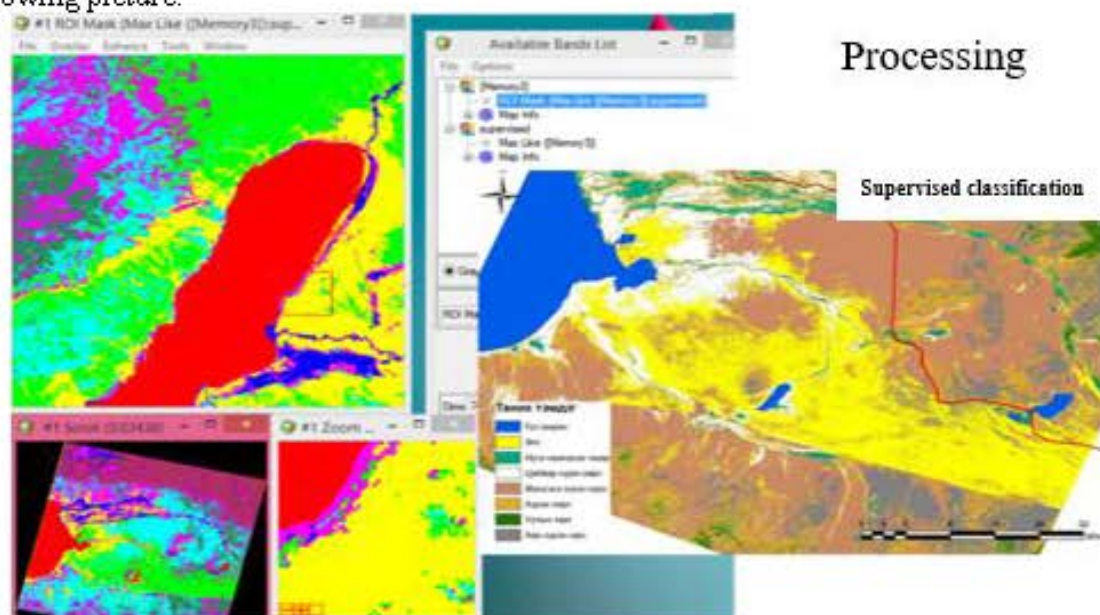
Picture 2. Supervised classification processing

Based on soil and vegetation mapping river, sand, meadow, swampy area, light brown soil, original brown soil, mountain soil and dark brown soil classification completed and shown on Picture 3. Yellow color defines the sand in below picture. Sand selected from this classification and its the border recorrection done using the Spot-5 satellite's 10m detailed data.
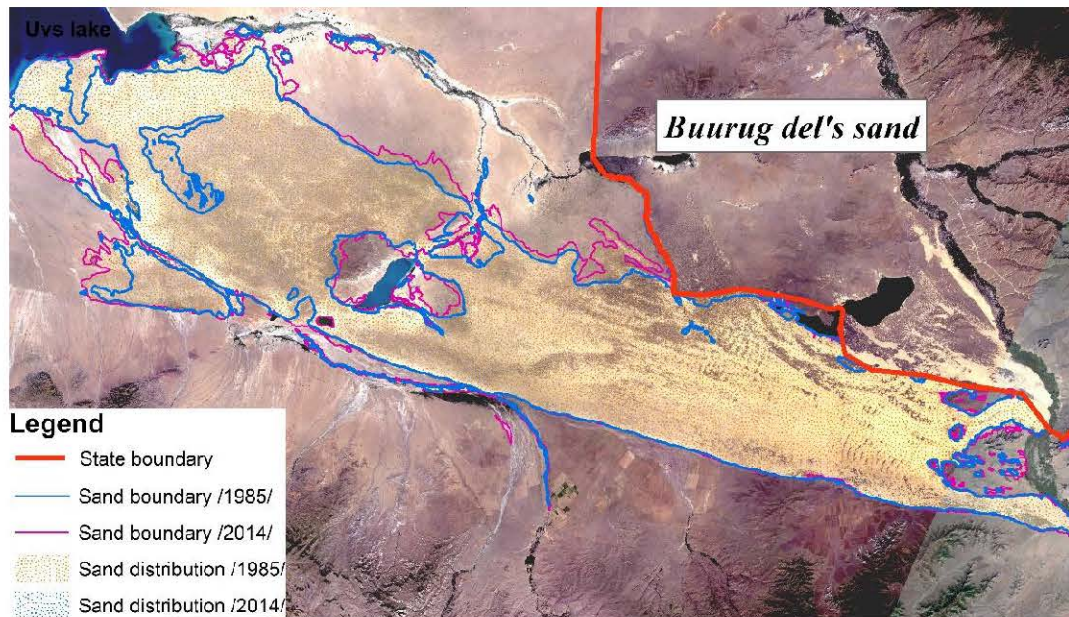
Picture 3. Sand distribution in 1984 and 2014. Exemplified in Buurug del's sand

As a result of classification the exemplified Buurug del's sand transformation between 1984-2014 shown on Picture 3. During the 30 years of research study vegetation cover significantly decreased and sand erosion, loose bare sandy area, hollow of wind blow and layered sand formation increased. In 1985, Buurug del's sand area comprised 386949.4ha and after over 30 years it became 452836.4 ha increased by 65887 ha area.

Study result
The result derived using topographic map: In 1984, sand distribution in Mongolia comprised 3954357ha area based on location map's result. (picture 4)
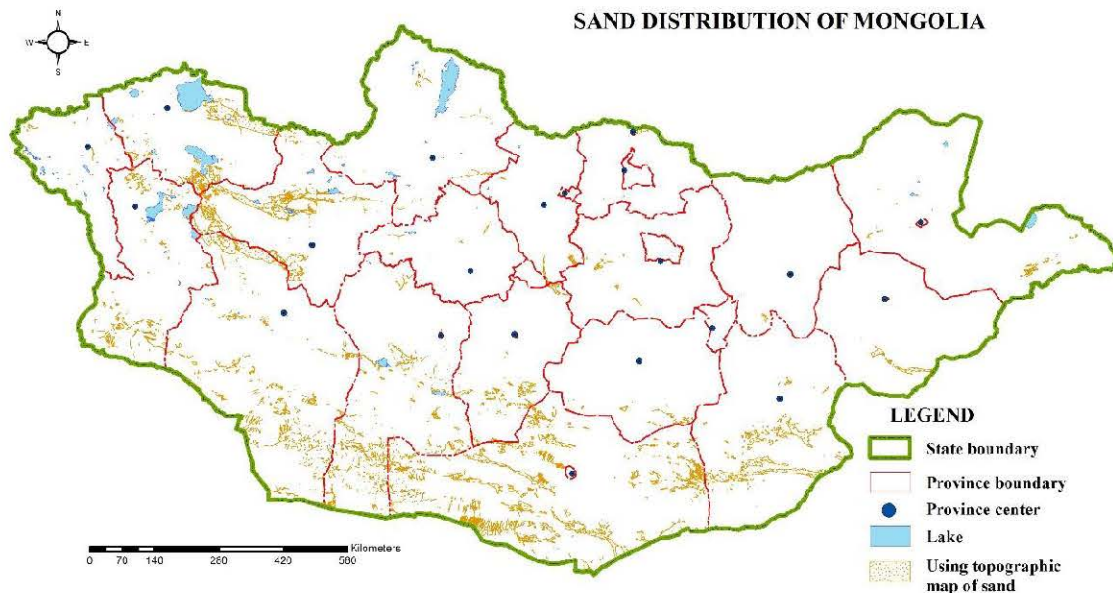
Picture 4. Sand distribution of Mongolia in 1984
Result using the Landsat satellite image process: In Mongolia, 4680960ha sand area distributed based on the result of Landsat satellite image data process. (picture 5)
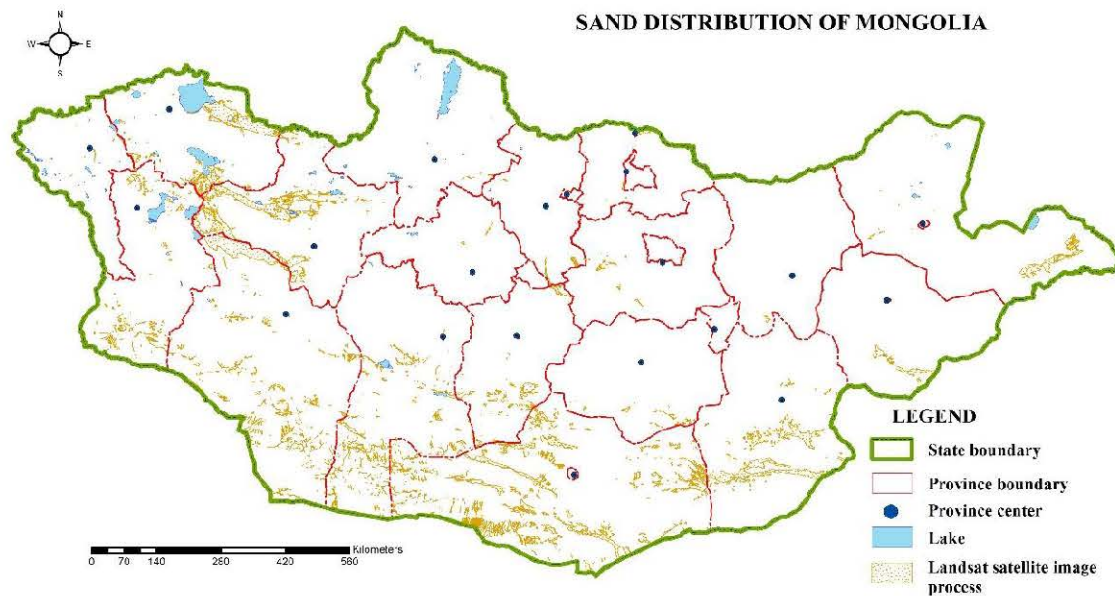
Picture 5. Sand distribution of Mongolia in 2014

Above two results show the sand area increased by 726603 ha (0.46 %) between 1984-2014. (table 1)

Table 1

Year	Sand the area, Ha	The percentage of the total area, %
1984	3954357	2.52
2014	4680960	2.98
Change	726603	0.46

Considering the natural zone forest steppe region, steppe region, gobi region and desert region's sand area increased where high mountainous region and mountain taiga region's decreased. (graph 1)
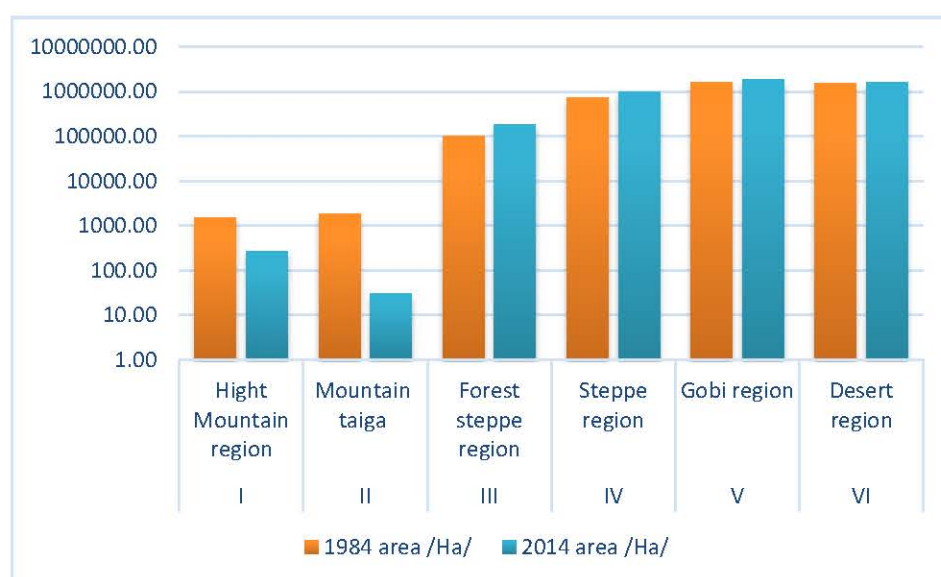
Graph 1.Classification of the Mongolian sand by the natural zones.

Conclusion

Based on the topographic map we used with 1:100 000 scale from 1984 shows the sandy area of 3954357ha which is 2.52% of the total area.

Landsat 8 (OLI) image of 2014 indicates the sandy area of 4680960 ha which is the 2.98% of the total area. The sand area increased by 726603 ha and increased by 0.46% comparing to the total area between 1984-2014 during the 30 years.

Forest steppe region, steppe region, gobi region and desert region's sand area increased considering the sand distribution of Mongolia by the natural zone. This demonstrates the climate change, pasture grazing and human influence impacts. Lack of pasture rotation and excess use of saxaul, sagebrush for the burning forms the soil erosion and activates the sand movement.

The number of days with dust storm in steppe and gobi region's increased 3-4 times comparing to 1960 year and in Great depression area recorded 61-127 days with dust storm. This phenomena viewed as the factor causing the increase in sand movement.

Aknowledgement

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