

Monitoring of land degradation in the mining impacted areas of Mongolia

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Introduction

Mongolia has a big territory, remote sensing offers a unique access to primary data about the research of land surfaces.

- Economically beneficial
- Accessible unreachable places
- Natural Disaster vulnerable



Introduction (cont)

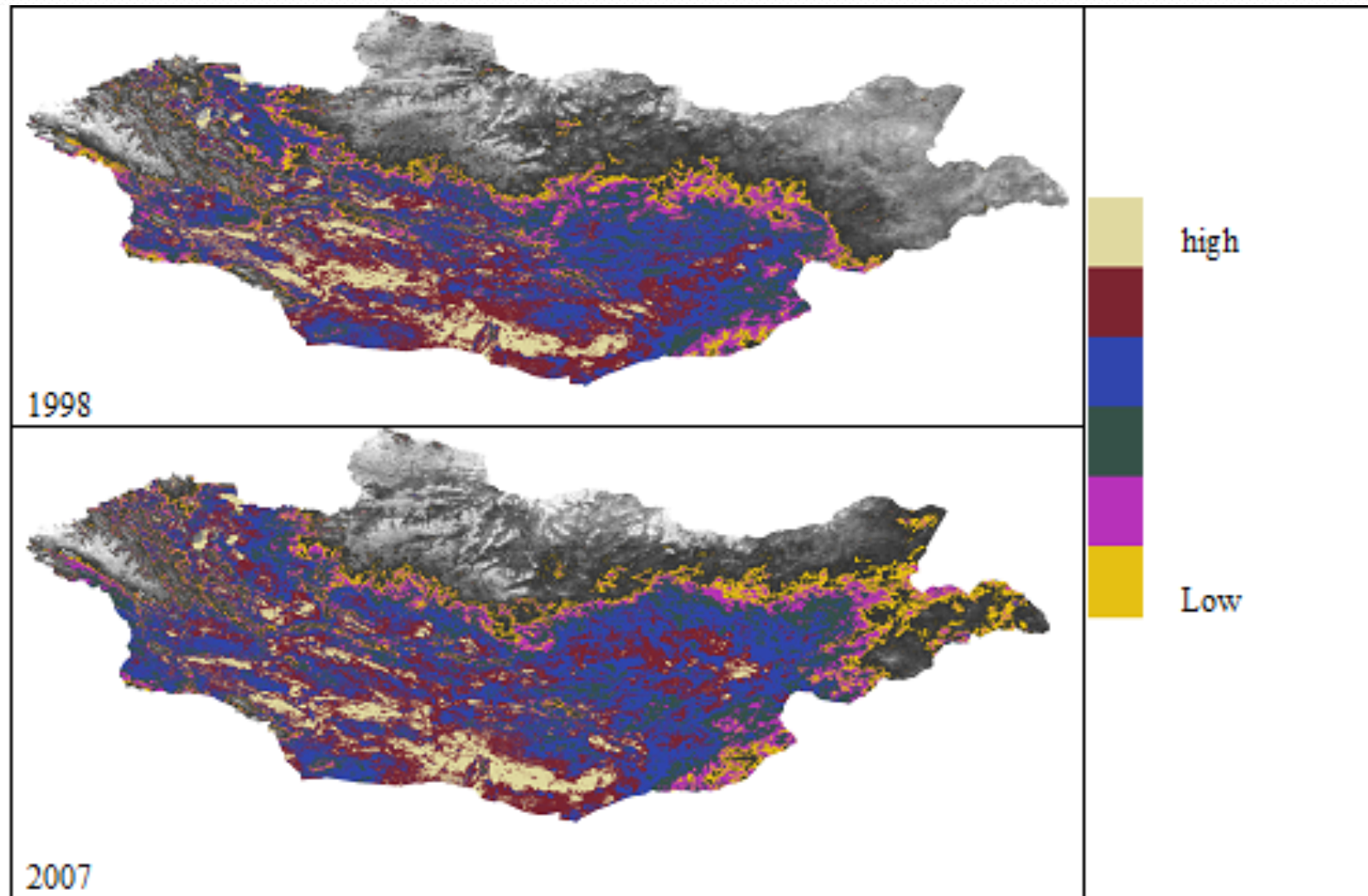


Figure 1. Desertification in Mongolia

Study area

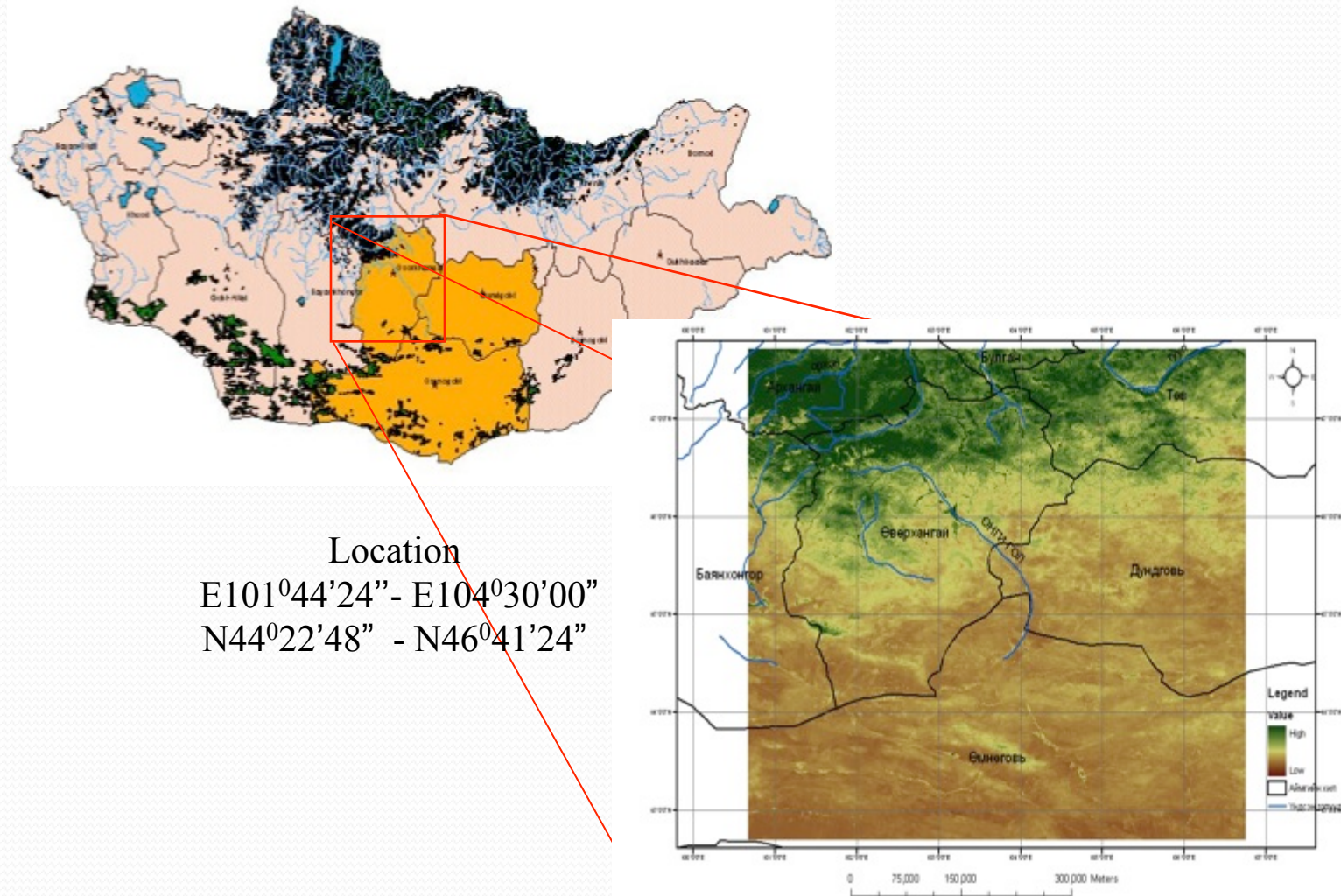


Figure 2. Study area, MODIS Data 250 m

Study area and motivation

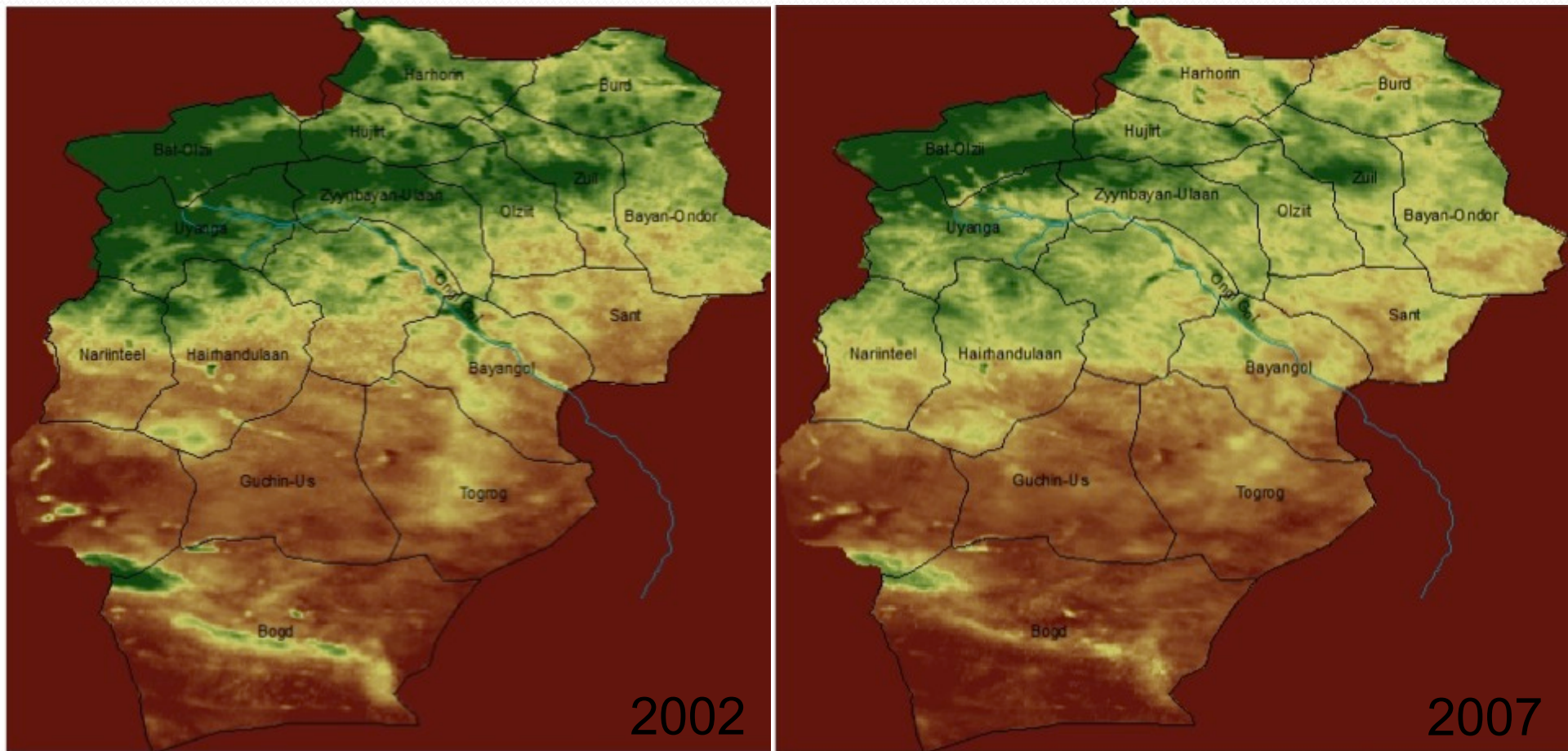


Figure 3. Uvurkhangai province (Spot Image, MSAVI)

Motivation

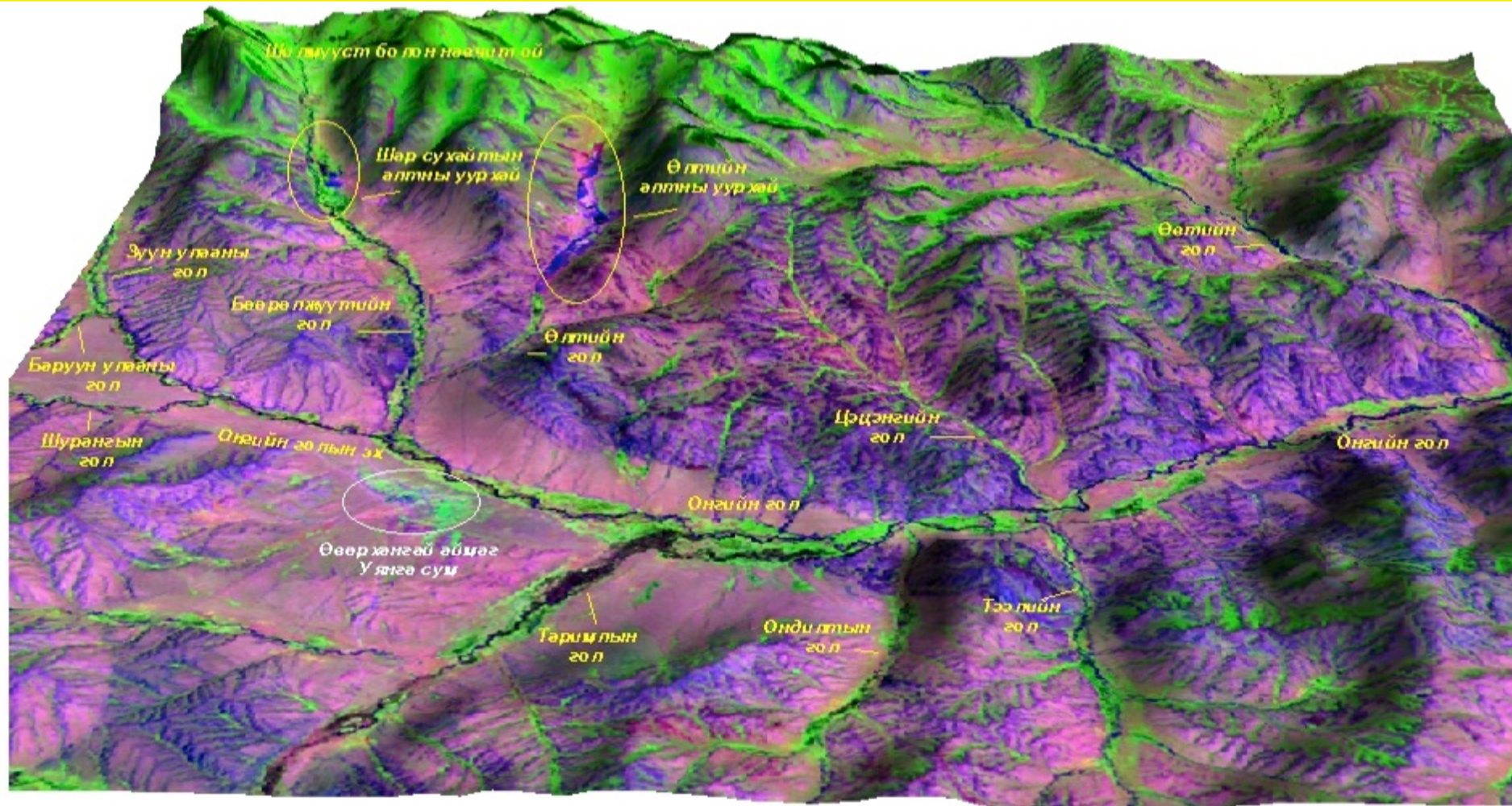


Figure 4. Mining activity in the Ongi River Basin,
(Landsat Image, 3D analysis results)

Objectives

- To apply change detection technique and supervised classification using radiometric and geometric corrected data for Landsat Image from years 2002 and 2007.
- To determine mining activity is dangerous impacted for land degradation.

Methodology

- COST atmospheric correction.
- The inputs to the model are the Earth-Sun Distance, sun elevation angle, and minimum DN values for each band. The model first converts each minimum DN value to an at-satellite minimum spectral radiance value:

$$L_{sat} = \text{bias} + \text{gain} * \text{DN} \quad (2)$$

(Landsat 7 Science Data Users Handbook)

- Supervised Classification (Maximum Likelihood)
- To apply Change vector analysis methodology

Methodology

- Change vector analysis first computes a multispectral difference image ($\mathbf{XD}$) subtracting the spectral feature vectors associated with each corresponding spatial position in the two considered images $\mathbf{X}_1$ and $\mathbf{X}_2$. Let $\mathbf{XD}$ be the multidimensional random variable representing the spectral change vectors in the difference image obtained as follows :

$$\mathbf{XD} = \mathbf{X}_2 - \mathbf{X}_1 \quad [1]$$

(Francesca Bovolo, and Lorenzo Bruzzone, University of Trento)

Analysis

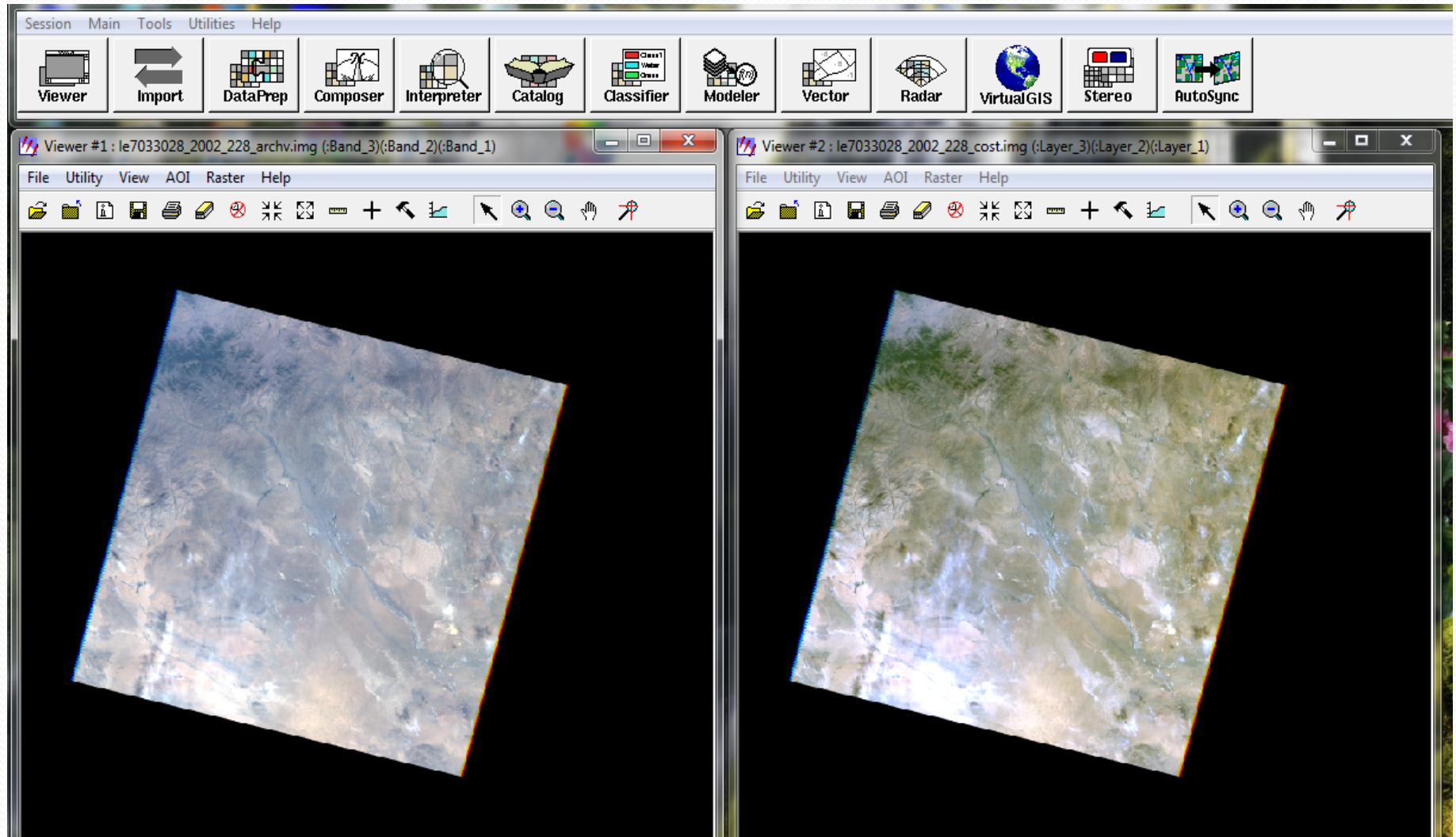
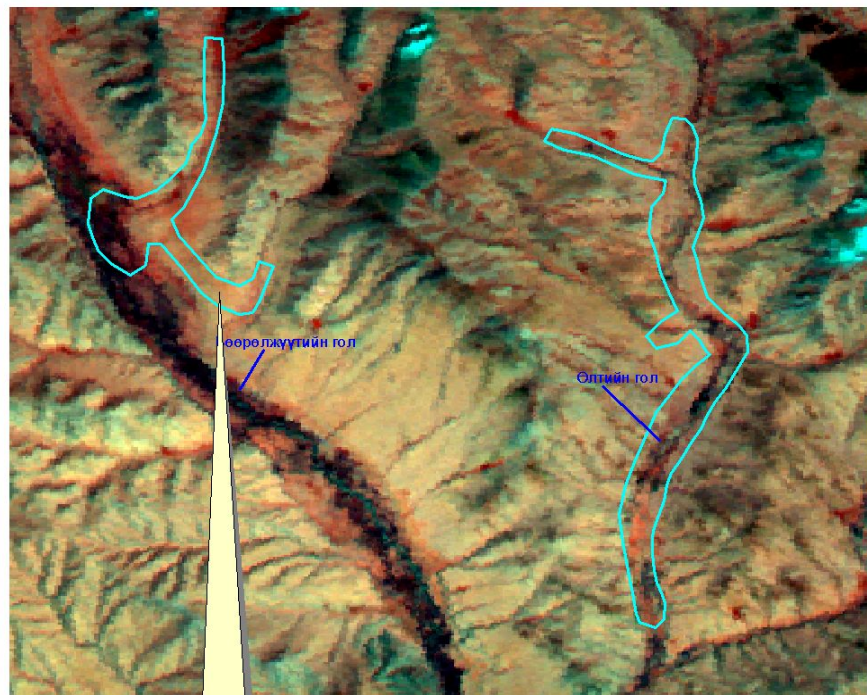
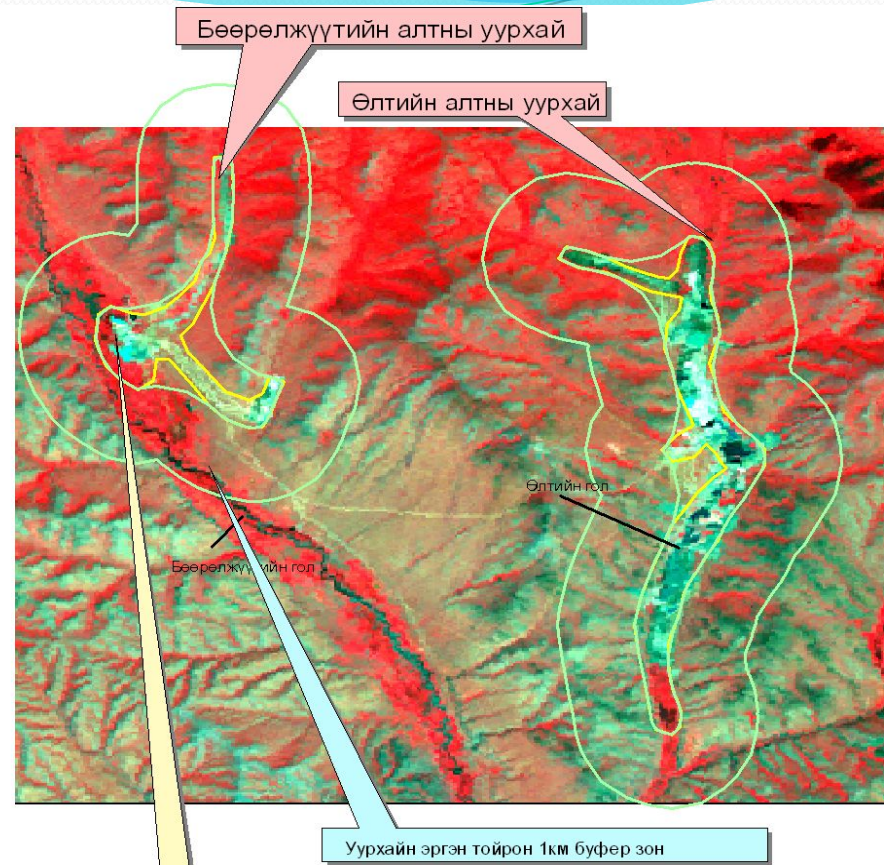


Figure 5. Landsat TM imagery, degraded area with mining site

Analysis



Before /mining site/
Landsat image, 1989



After /mining site/
Landsat image, 1999

Figure 6. RGB combination results
(Atmospheric Corrected Image)

Analysis

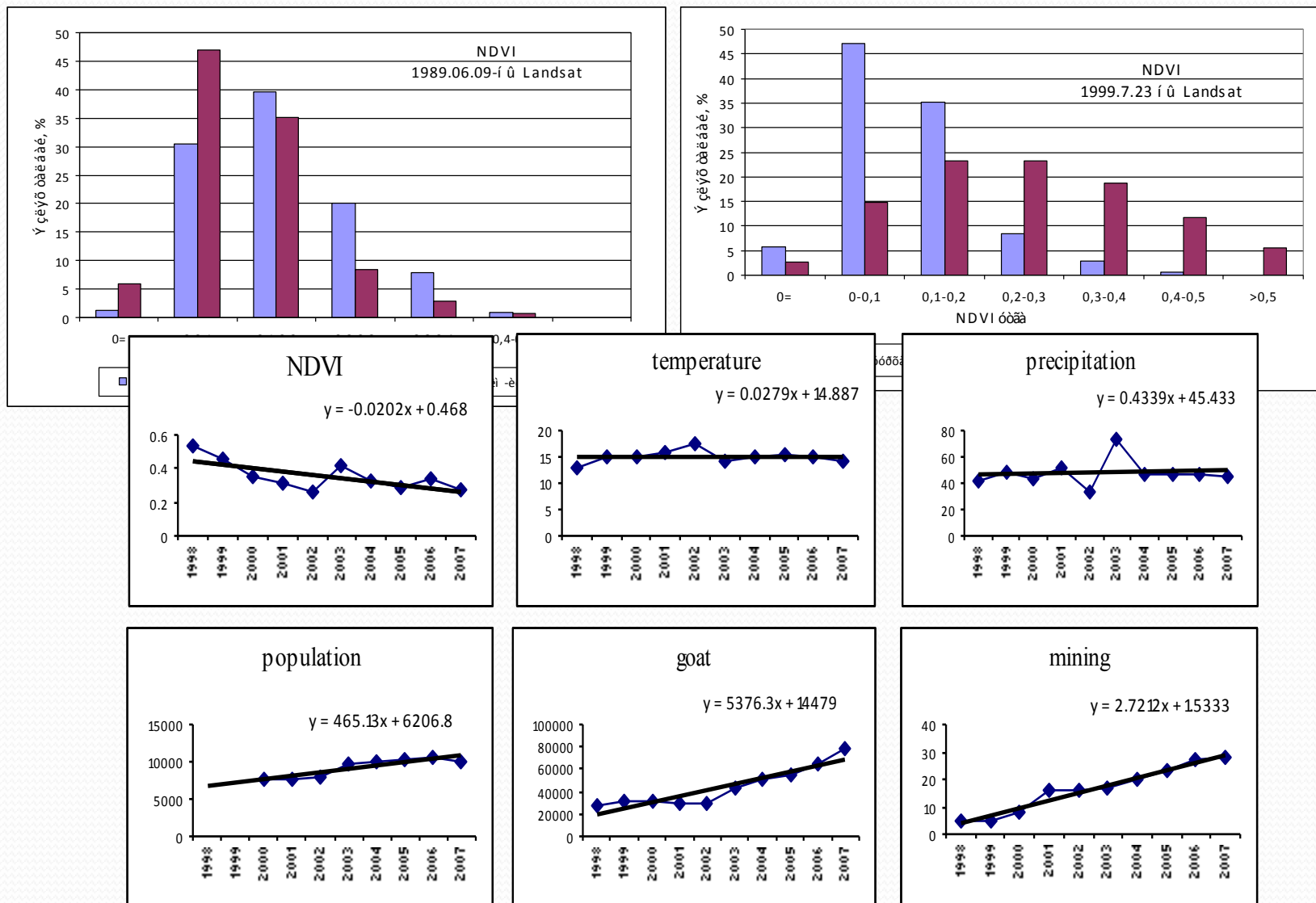
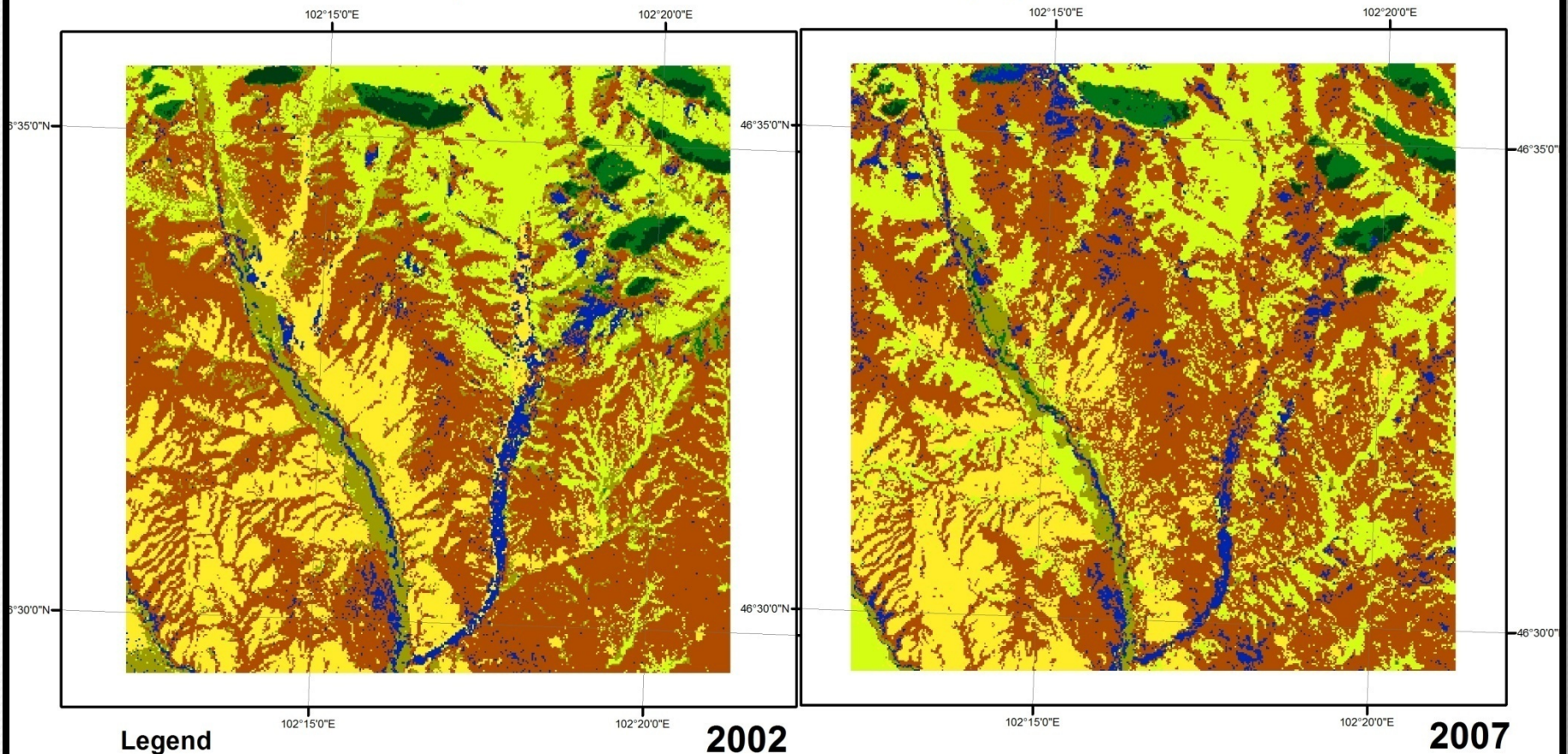


Figure 7. Factors in land degradation for Uynga soum

Supervised Classification in the Uynga Soum



Legend

- Needleleaf forest
- Shrub
- Broadleaf forest
- Water
- Bare sparse
- Herbaceous
- Bare

0 1,100 2,200 4,400 6,600 8,800 Meters

1:100,000

Classification method: Maximum Likelihood

Coordinate System: WGS 1984
UTM Zone, 48N



Test site-1



Figure 8. Change detection in the area of Illegal gold miners, 2002 and 2007 years, Landsat Image

Test site-2

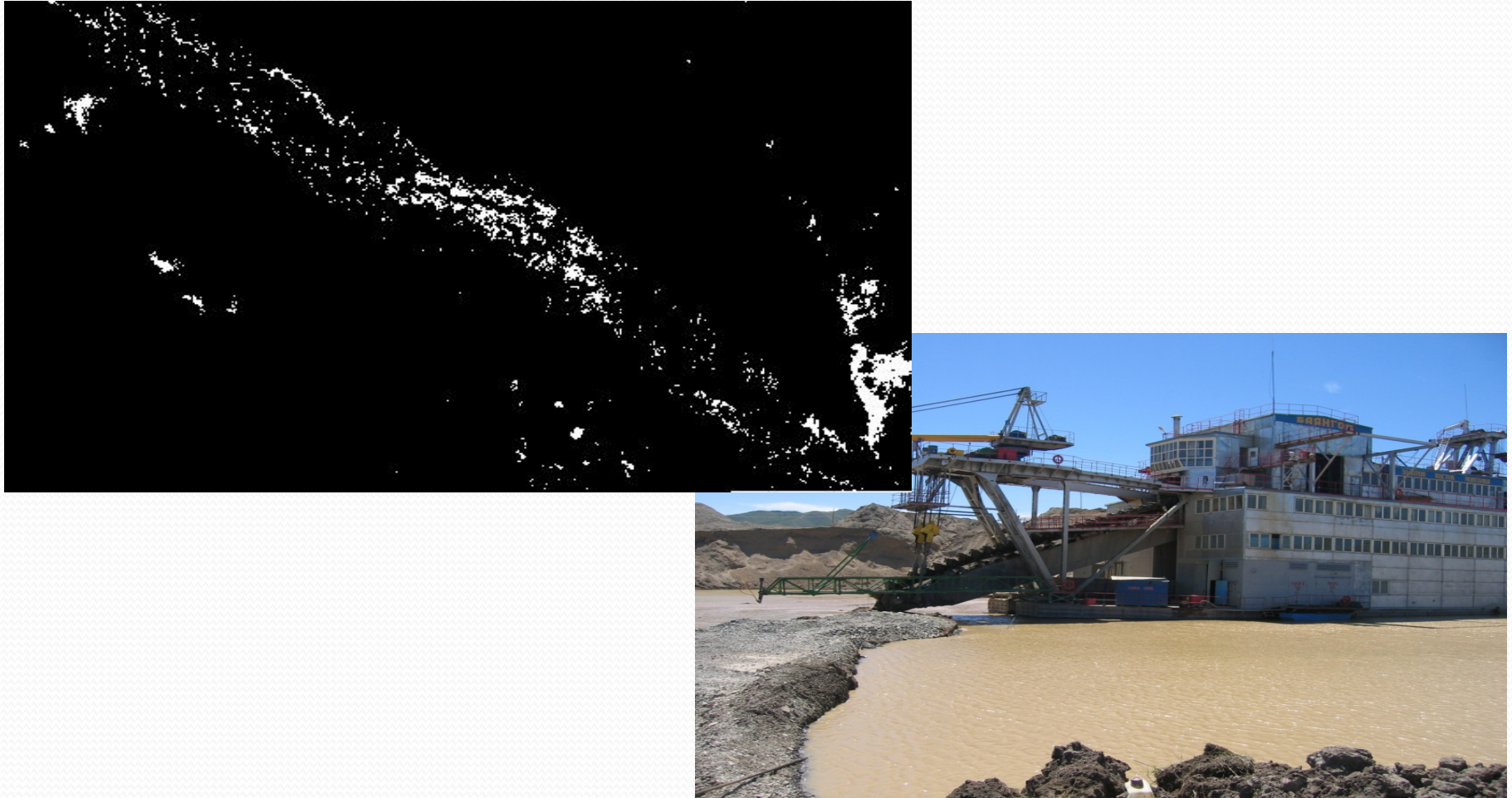


Figure 9. Change detection in the area of Domestic Investment company, 2002 and 2007 years, Landsat Image

Test site-3

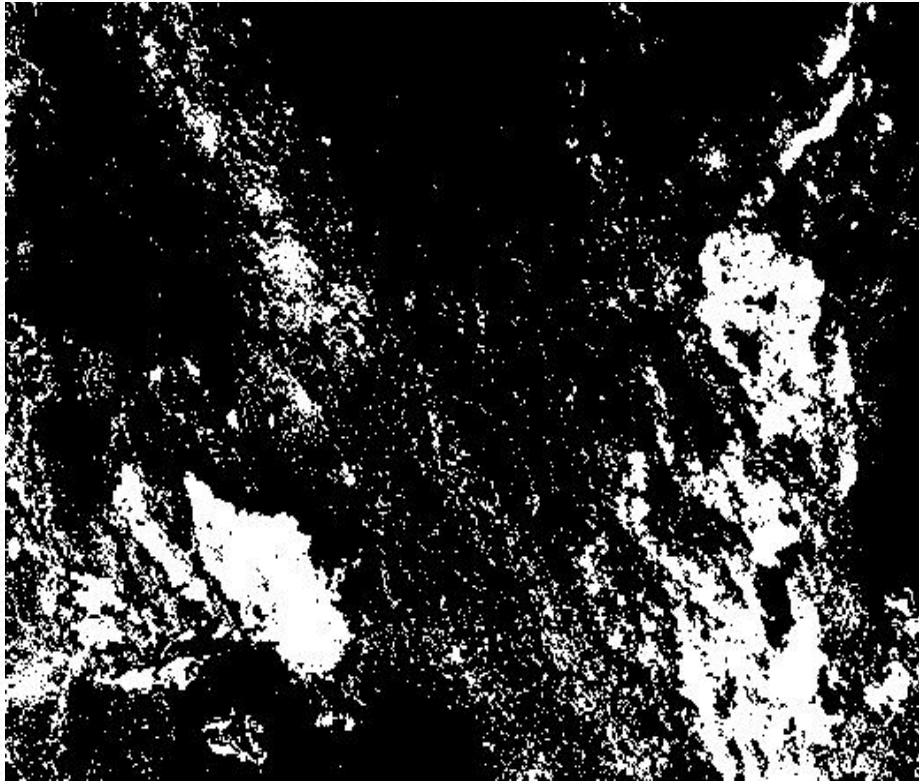


Figure 10. Change detection in the area of Foreign Investment company, 2002 and 2007 years, Landsat Image

Contribution to Land Degradation

Land degradation has been identified as one the priority concerns. Causes of land degradation can be divided into two categories natural and human induced .

Natural cause: - Climate changes
 - Dust and sand storms

...

Human induced: - Mining
 - Pasture Degradation
 /Overgrazing/

Discussion and Recommendation

- This study contributes to the research which involves policy makers and stakeholders to define and negotiate relevant scenarios in participatory approaches in the local area and to the studies about linking people to pixels.
- This case study will enable our researchers to plan for the future by making more educated decisions in issues stemming from mining, land degradation, water pollution and the potential health issues related to these environmental problems.
- We will do discussion among participatory mining land and local people on mining awareness and land degradation. During field work we will share our maps which produced from the field trip with local policy makers on livestock, wells, vegetation. Also handouts for local environmentalists will be distributed.

Acknowledgement

- We would like to thank APN support and organizers of the ENVIROMIS-2012.

