EVALUATE THE IMPACTS OF ECOLOGICAL BALANCE FROM GOLD MINING THROUGH THE SATELLITE DATA ON ONGI RIVER, MONGOLIA

Enkhjin Altanbulag [1] and Yi-Ching Chen [2*]

[1] MSc Student, Departmentof Environmental Engineering, Da-Yeh University
168 University Rd., Dacun, Changhua 51591, Taiwan
Email: r0692601@cloud.dyu.edu.tw
[2*] Assoc. Prof., Departmentof Environmental Engineering, Da-Yeh University
168 University Rd., Dacun, Changhua 51591, Taiwan
Email: yiching@mail.dyu.edu.tw

ABSTRACT

The purpose of the study is to investigate the disturbed area of the gold mining on the Ongi river, Mongolia by using satellite data. The reason for the study is that the Ongi River has a significant impact on the ecological balance of Gobi. In Mongolia, the mining sector is rapidly developing as one of key economic indicators of country, however, as known mining always induced a negative impact on environment, too. In particular, gold mining is underway and large area of land caused damage from mineral extraction. As consequence, the regional ecological balance is lost and difficult problems happened to animal husbandry and farming activites. Many small rivers have disappeared resulting a serious damage to environment. The major pollution for the rivers from mining is dirt wash with large quantities of water, especially for gold mining. Mining companies declared that washing method is on nature and "eco-friendly" only without using chemical methods. However, 1m³ dirt washing with 4-12 tons of water consumption will cause a long-term damage to the environment, finally cause destruction of the river in Mongolia. Evidences show that rivers from Khangai to Gobi dried up soon resulting Gobi desertification. Naturally Mongolia has low rainfall, few water yields and poor natural rehabilitation. However, 40% of the total land area has been granted exploration licenses will cause impacts on ecological balance for a long run. Serious of landsat satellite data were used to detect the developing of disturbed land. Comparing the period between 1986 and 2016 a rapid developing damage from 2.79 hectares to 703.9 hectares is shown.

1. INTRODUCTION

The basin of Ongi river covers three provinces and terriotory such as Khangai, steppe, and Gobi nature unique. As shown in Figure 1, the area along the Ong River is elevated from 1,000 to 3,000 meters above sea levels with different landscapes of flat, gobi steppe, mountain, etc. The distribution of precipitation also varies within this area (Pimentel *et al.*, 1999). The main reason for the water level of Ongi river decreased is during the period of gold extraction. The ecological system on river has been completely changed and biological rehabilitation has to proceed soon. Since 1990, gold mining operations are just being carried out on smaller rivers such as Ong River. Later on, a gold mining license was granted to over 30 entities in the riverbed of Buyant, Ult, Buurulchuut, Nariin River, Thabit, and Tsagaan Rivers across the Ongi River basin (Figure 2). Currently 8 enterprises are engaged in production which Ulht gold mine is the largest. In Ulht gold mine during this period a total extraction made soil 3,873m³ and sand 5,837.2m³ stripped and 3Mm³ water consumed. As result 5,272.9 kg of gold was produced with a total of 243.8 hectares of land damaged by mining operations and only 59.7 hectares area were rehabilitated. Another seriously damaged area is Nariin Gol (Tsagaan Gol) mine

where located 8km from the Ongi River. There are 35,000m³ soil stripped and and 700Mm³ water consumed. Rehabilitation has not been completed yet (Ongi River Movement, 2003).

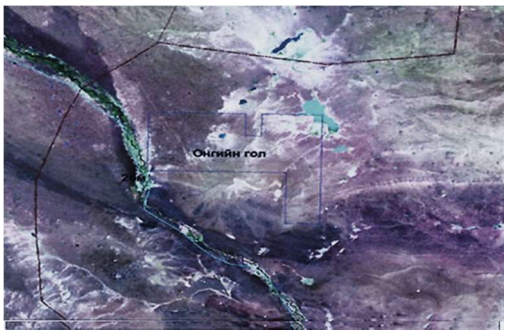

Figure 1. The Ongi river location

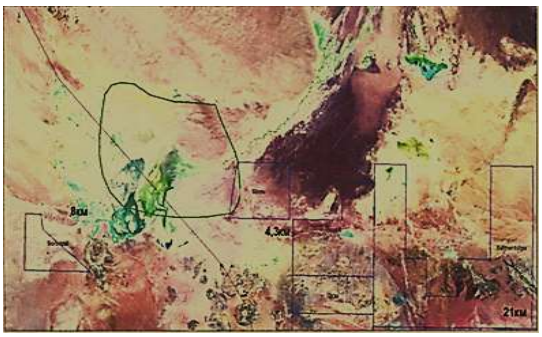

Figure2. Location of the mines along the Ongi river

Tungalag *et al.* (2008) found that Ongi River basin area is affected by mining activities and desertification processes. The vegetation indexes MSAVI2 and NDVI from SPOT data showed vegetation cover change in the time period of 1998 to 2006.The result from both vegetation indexes described that there is a vegetation decrease due to mining activities in the study area. Also, an assessment of the state of land degradation and desertification, and analysis of its drivers were done in Mongolia four times since 1990s (Nyamtseren, 2014). Desertification was defined as a process when the fertile land turned into a desert because of irrational use of natural resources in vulnerable lands, which are affected by successive droughts due to Global change and resulting climate fluctuations, and thus leading social activities be under the natural forces

2. RESEARCH METHODOLOGY

Remote sensing is the small or large-scale acquisition of information of an object or phenomenon, by the use of either recording or real-time sensing device(s) that are wireless, or not in physical or intimate contact with the object. The nature of objects created by natural or human activity and their electromagnetic waves understanding in different regions dispersed waves radiating and scattered waves will be studied on the basis of the measurements. In practice, determination of damaged land due to mining activities as well as step-by-step control over damaged land is widely applied and used by mapping, remote sensing and geographic information systems (GIS) (Pettorelli *et al.*, 2005). ERDAS 9.1 was applied with this method on a study at Ongi river. From the Landsat data of 27 years between 1986-2016 land degradation have been fully deteced. UlT gold mines were selected to investigate the area of their broken land. In order to determine the disturbed areas two Landsat Satellite data were identified by using the controlled classification for mapping methods of ERDAS as well as ENVI (Dong and Wang, 2011).

3. RESULTS AND ANALYSES

3.1 Runoff change of Ongi River

In some particularly wet years, Ongi River used to empty into Ulaan Lake, in most years it dries up earlier. In recent years it has been additionally threatened by 37 mining operations within the basin. In the picture of 1964 as shown in Figure 3(a) the length of Ongi River was 373 km and the area of Ulaan Lake was 27511.18 hectares. However, According to the picture of 2009 as shown in Figure 3(b) diversion has changed the Ongi river runoff decreased with

length dropped to 288.43 km and area of Ulaan Lake shrinked to 3247.45 hectares.

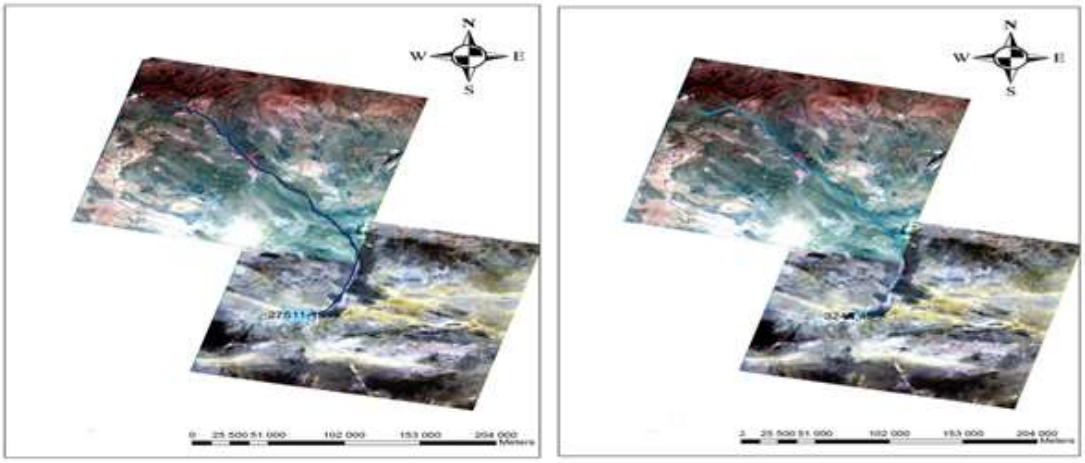

Figure 3. The map of Ongi river flow in 1964 (a); and 2009(b)

3.2 Broken land due to mining operations

Compareing a sequent of satellite imageries in Ongi River Basin from1986 to 2016 polpular gold mining operations made vegetation cover extinct along Buurulchuut river (13.9km) and Ult River (11.2km). Satellite imageries are shown as Figure 4.

Shank (2008) details a simple technique for estimating percent vegetation cover based on the widely-used Normalized Difference Vegetation Index (NDVI). High resolution images can be useful for monitoring vegetation change over time, including overall biomass increase, expansion of particular species, and die-off events. It could be applied in further study.

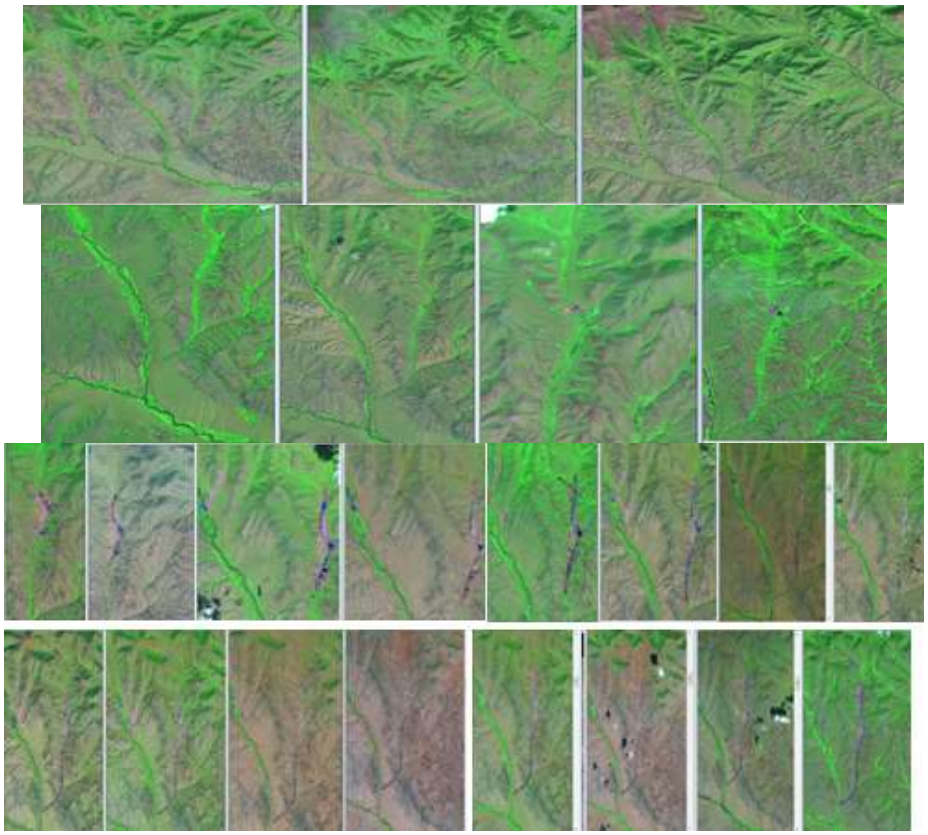

Figure 4. Comparison of mining damaged broken lands between 1986-2016

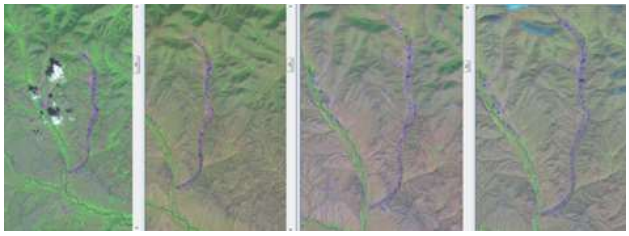

Figure 4. Comparison of mining damaged broken lands between 1986-2016 (conti.)

3.3 Defining mining disturbed land

Comparing a 27 year period satellite data between 1986 and 2016 the disturbed land caused by mining was detected**.** As a result of this analysis, mining has experienced dramatic increase in land degradation with 2.79 hectares in 1986 up to 703.9 hectares in 2016 of disturbed land (Figure 5). Also, a series of images to present the expanding of mining damaged broken land area are shown in Figure 6. Obviously the damaged area is more serious in recent years. The broken area is increasing sharply since 1995 and up to 600-700 hectares in 2008 (Figure 7).

4. CONCLUSIONS

According to the results of Landsat satellite data it can be shown that gold mining has experienced dramatic increase in land degradation and reducing vegetation in Ongi river basin. The areas along 13.9 km of Buuruljuut river and 11.2 km of Ult river are more affected by mining operations. There are 21 mining licenses with 12 exploitation and 9 exploration around Ongi river. licenses since 1980s. These licenses are mostly operating in the mouth of Uvur Ult, a large tributary of the Ongi River.

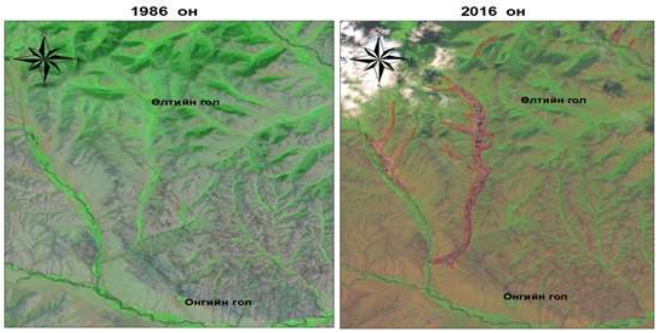

Figure 5. Satellite imagery of disturbed land compared with 1986 and 2016

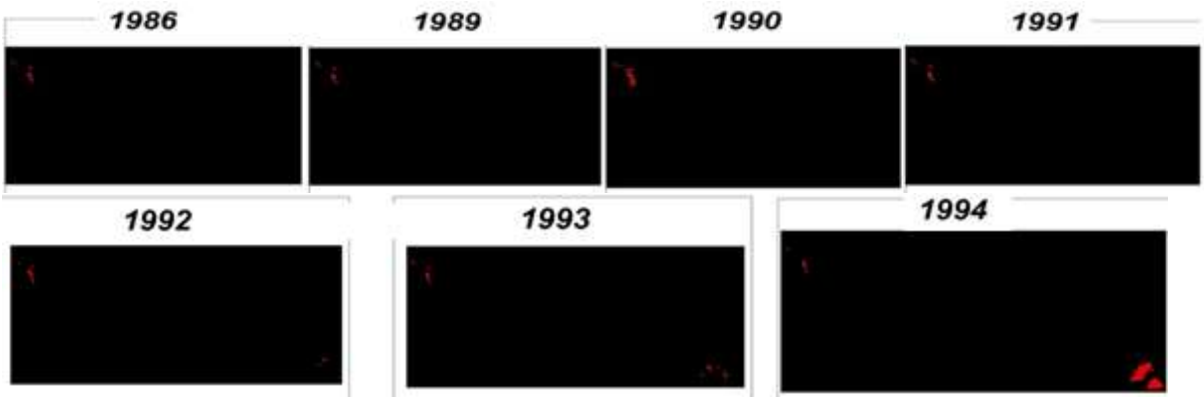

Figure 6. The expanding of mining damaged broken land area: 1986-2016

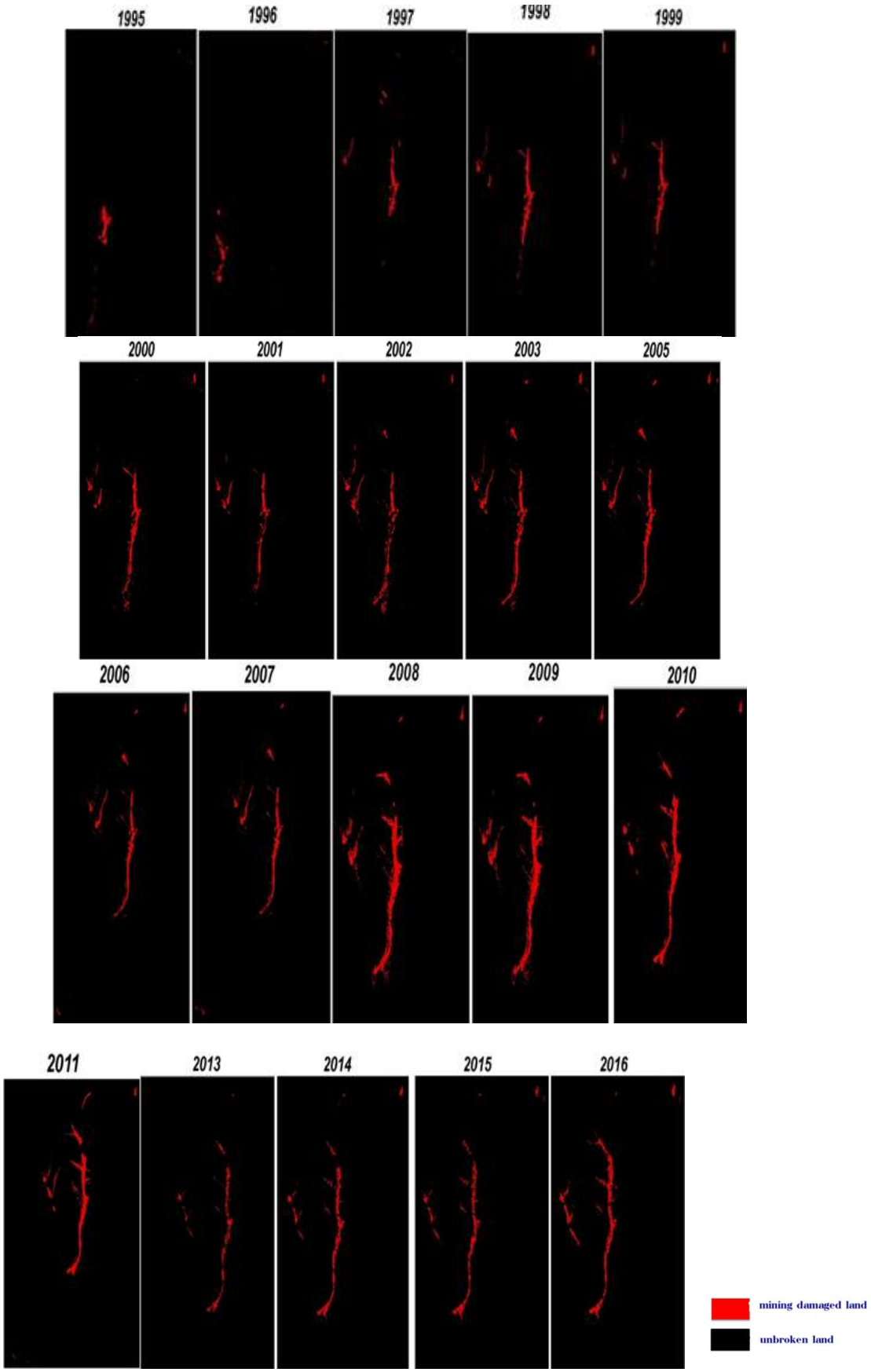

Figure 6. The expanding of mining damaged broken land area: 1986-2016 (conti.)

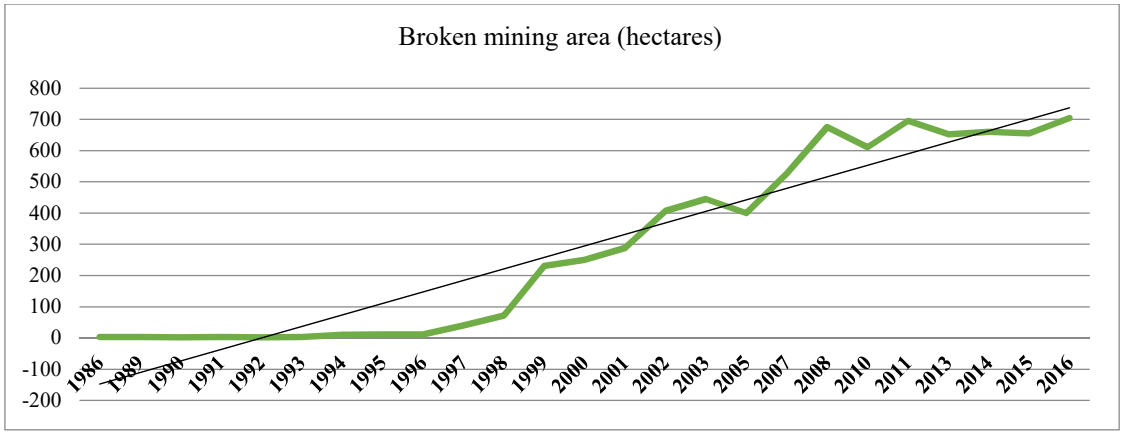

Figure 7. The increasing of broken area year by year

According to data in 1964 the length of Ongi river was 373 km and the area of Ulaan Lake was 27511.18 hectares, however, the Ongi River only has a length of 288.43 km and the lake area has decreased to 3247.45 hectares in 2009. In 1986 the damaged broken area is only 2.79 hectares and up to 703.9 hectares destroyed in 2016. It is necessary to conduct a high level of rehabilitation in Ongi river basin and stop the extraction of gold in this area.

5. REFERENCES

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