

RESEARCH ON LAND SANDY DESERTIFICATION WITH REMOTE SENSING

-Take Qinghai Lake Areas as an example

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ABSTRACT:

The Qinghai Lake is the biggest salt lake in China, which is also a famous marsh in world. However it is sharply become depravation because of the land sand desertification in the surrounding areas. In this paper, the basic natural, social and economic features were elected to be analyzed in the area to assess land desertification in Qinghai lake areas at first; then the environment background of land sandy desertification was specified; at last, the authors made an integrative assessment and discussion on land sandy desertification in Qinghai lake areas with MSS and ASTER satellite image.

1 INTRODUCTION

Land Sandy Desertification does many harm to human beings, it not only intimidates the environment, but also has grievous effects on survival of man as well as sustainable development of circumstance and society. For example, the granule's declining and thick grain's creasing in the substance on the earth, nutrient decreasing in soil and fertility declining and productivity decreasing of soil are all effected by it(Liu Yuping,1998).

China is a grave Land Sandy Desertification country, who has 334,000km² desert land,37,000 km² sand land and 1,162,000 km² Gobi sand land, with the proportion of 15.9% in this country. Land Sandy Desertification bring serious zoology and social effect in this country, the more and more sand storm in this country is a significant example(Wang Tao, Zhao Halin,1999, Wang Tao, et al,1998, Cha Yong, et al,1997, Dong Yuxiang, 1995).

The Qinghai Lake, located in the northeast of Qingzang tableland, is the largest inland salty lake and famous marsh in the world. By far, around the Qinghai Lake, sand area has increased to 403 hm² and the natural shrub area has decreased from 34 hm² to 14 hm². At the same time, in-flood water has decreased 60% since 1950s. There is 140 thousand km² degeneration grass around Qinghai Lake, with the area account to 34.9% of the total grass land. The area of sand has reached to 765 km², at the speed of more than 10 km² every year.

By the research on the Land Sandy Desertification around Qinghai Lake, the paper attempt to give a general evaluation on the mechanism of the Land Sandy Desertification, and bring forward some scientific suggestions.

2 METHODS

2.1 Study Area

The Qinghai Lake locates in the north of Qinghai province of China, with the scope of north latitude 36°50'—37°30' and east longitude 99°10'—99°50', it is the biggest slight salt tableland inland lake in the country with the area of 4304.5km². The average depth of the lake is 21m. Figure 1 is the sketch map of

Qinghai Lake. This paper do the research on the situation of vegetation distribution around the Qinghai Lake, the Buha Lake, the Jimen River, the Jun Rive, the Shaliu River and Qilian mountain chain.



Figure 1. Location of Study Area

The study area has the following Characters:

- Physiognomy: the hypsography is high in the northwest and low in the southeast, and the physiognomy type is mainly Lake shore ladder land, constructed tableland, denudation hilly-land and so on.
- Climate: The climate belongs to the tableland mainland climate, which is cool, dry, windy, Air temperature rather low, obvious difference in region, cool in

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summer, cold in winter, less rain but concentrate, long time Sunny day and more radiation.

- **Vegetation:** Grassplot is the leading vegetation, which mainly include hilly grassland field, high-cold grassland field and high-cold meadow field. hilly grassland field is chiefly distributed in the plain of the north bank of Qinghai Lake and in the edge of the south hill, and have less distribution in the slope to sun with 3200---3500m high-cold grassland field and with some plant such as precarious. High-cold grassland field principally spread in drought slope to sun of the north and middle part coteau and small proportion of the hill, with the altitude of 3300---3600m, and the vegetation in this region is mainly couch grass. Sub-high-cold grassland field chiefly distribute in the north of Gangcha and down-sun slope of the middle coteau, with 3400---3700 altitude, in the region of which vegetation is abundant, but the differentiation of the community is not obvious. The bottomland of north Molei River is the distribution of sub-high-mountain-swamp meadow field with 4400---4700m altitude, the arrangement of grassplot is unobscure with 1.95---12.1cm height of grass and the average bestow proportion is 71.5%. Frustex meadow field is mainly distributed in the downsun slope of Haixi Mountain and north hill with 3300---4500m height above sea level, but the arrangement of grassplot is conspicuous.
- **Social and economy:** There are four county--gangcha, gonghe, tianjun and haiyan. It has lager population consistency, and more developed economy, and which is an important pasture base of Qinghai province, and in 1986 the Qinghai Lake is authorized as the protective natural region of state by the State Department. But since 1950s, due to the change of the climate and the activity of the human being's, the quality of the grass is declined and the productivity of stockbreeding is descended in this area, and which have grave effect on the sustainable development in this area. The status will become worse if nothing has been done to the Land Sandy Desertification in this area.
- These characters have much impact of land sand desertification on

2.2 Data

Land sand desertification is a long-term action, so we elected Landsat MSS data collected in Oct,1973 and ASTER L1B data collected in Sep,2003 to do the research. The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) is an advanced multispectral imager that was launched on board NASA's Terra spacecraft in December, 1999. ASTER covers a wide spectral region with 14 bands from the visible to the thermal infrared with high spatial, spectral and radiometric resolution. An additional backward-looking near-infrared band provides stereo coverage. The spatial resolution varies with wavelength: 15 m in the visible and near-infrared (VNIR), 30 m in the short wave infrared (SWIR), and 90 m in the thermal infrared (TIR). Each ASTER scene covers an area of 60 x 60 km. The ASTER instrument produces two types of Level-1 data: Level-1A (L1A) and Level-1B (L1B). ASTER L1A data are formally defined as reconstructed, unprocessed instrument data at full resolution. They consist of the image data, the radiometric coefficients, the geometric coefficients and other auxiliary data without applying the coefficients to the image data, thus maintaining original data values. The L1B data are generated by applying these coefficients for radiometric calibration and geometric

resampling(Mei Anxin, Peng Wanglu, et al,2001, Shunlin Liang, 2004, Hu Peng,et al,2002).

Other than Remote Sensed data, we also elected some climate data, topography data, social and economy data, etc.

2.3 Land Sandy Desertification Classification system

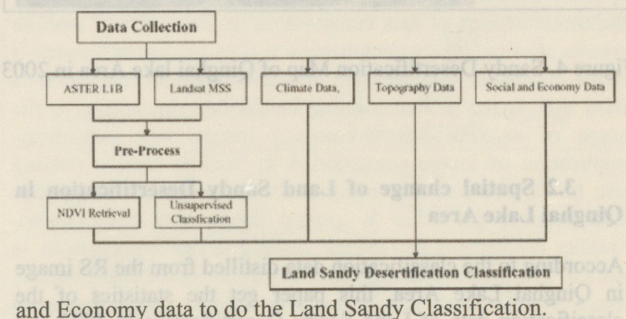
In order to simplify the classification, this paper classify the Land Sandy Desertification to six levels as light, low-grade, middle, high-grade, strong and Intensive. Table 1 is the classification index of the Land Sandy Desertification.

Table 1 Classification Index of Sandy Desertification

Grade	Surface form	Vegetation Overcast ratio
1 light	Fastness dene, sandlot and sand beach	>70%
2 low-grade	Fastness dene, half-fastness sandlot and sand beach	70~50%
3 middle	half-fastness dene and sandlot	50~30%
4 high-grade	half-fastness dene, flowing sandlot and sand beach	30~10%
5 strong	flowing sandlot and sand beach	<10%
6 intensive	Large-area flowing sandlot and sand beach	<5%

2.4 process flowchart

Figure 2 is the process flowchart used in the paper. We use false color image of ASTER 3N21 and false color image of MSS 754 for Unsupervised Classification, then with the aid of NDVI Retrieval result, Climate data, Topography data, Social



and Economy data to do the Land Sandy Classification.

Figure 2. Process flowchart

3 RESULTS

3.1 Land Sandy Desertification in 1973 and 2000 of Qinghai Lake Area.

Figure 3 and Figure 4 are the spatial change of Land Sandy Desertification in 1973 and 2000 in Qinghai Lake Area.

	1973	2000
Light	38.9	30.3
Low-grade	30.4	20.7
Middle	0	0
High-grade	0	0
Strong	0	0
Intensive	0	0
Water	9.0	9.0
Other	0.8	0.8

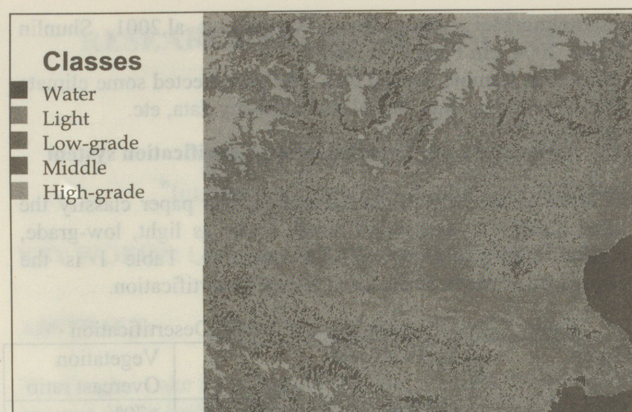


Figure 3. Sandy Desertification Map of Qinghai lake Area in 1973

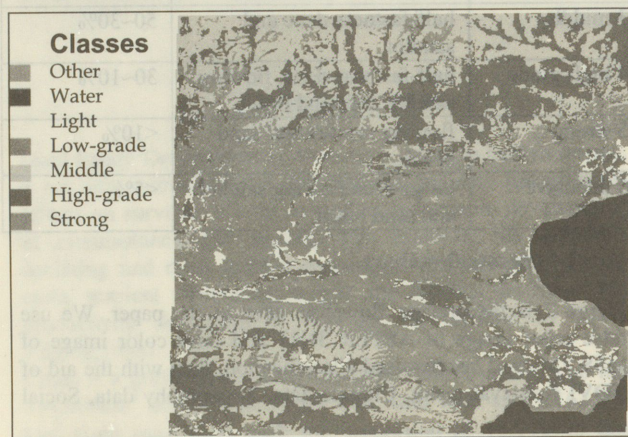


Figure 4. Sandy Desertification Map of Qinghai lake Area in 2003

3.2 Spatial change of Land Sandy Desertification in Qinghai Lake Area

According to the classification data distilled from the RS image in Qinghai Lake Area, this paper get the statistics of the classification data of Land Sandy Desertification in 1973 and 2003 in Qinghai Lake Area. Table 2 is the statistics.

Table 2 Classification of Sandy Desertification in Qinghai Lake Area (Unit: hm^2)

1973		2003	
Classification	Ratio(%)	Classification	Ratio(%)
Light	38.9	light	3.8
Low-grade	29.4	Low-grade	20.3
Middle	10.9	Middle	20.6
High-grade	10.5	High-grade	21.6
Strong and intensive	0	Strong and intensive	23.1
Water	9.6	Water	6.4
Other	0.8	other	4.3

4 DISCUSSION

NDVI vs Land Sandy Desertification: Figure 5 is the NDVI map retrieved from ASTER. From the map, we can indicate that the vegetation cover is low in this area for the number is

generally low. Also we can see that the NDVI has strong relationship with Sandy Desertification, so NDVI can be served as an index for estimating Sandy Desertification in the next research.

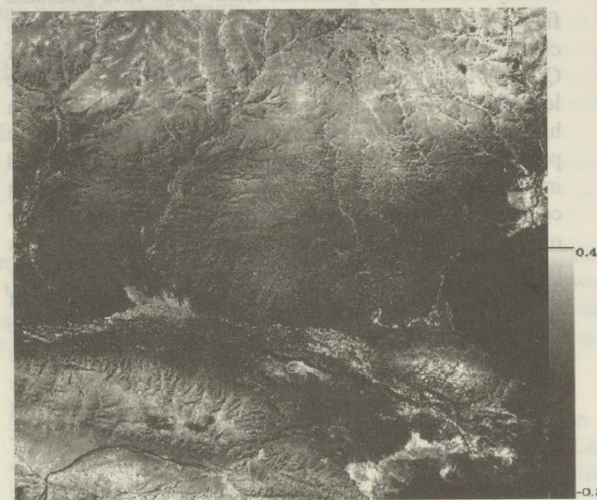


Figure 5. NDVI from ASTER of Qinghai lake Area in 2003

RS vs Land Sandy Desertification: With the help of climate data, social and economic data, Remotely Sensed data can do much work on Sandy Desertification. ASTER has a higher resolution in VNIR and some bands in SWIR and TIR, which can have much help in classification.

Water vs Land Sandy Desertification: From figure 3 and 4, we can see that water have strong relationship with land sandy desertification, with the water decreasing, high-grade has doubled and strong and intensive has changed from 0 to 23.1%.

Time Change vs Land Sandy Desertification: In the 20 years from 1973 to 2003, the Land Sandy Desertification in qinghai lake area is serious, this can be seen from table 2. From figure 6, we can see artificial factors become the main factor of the Land Sandy Desertification.

With the RS images, the authors have evaluated the Land Sandy Desertification in Qinhai Lake area. With the Economic development and population increase, artificial factors become the main factor of the Land Sandy Desertification. So reducing the artificial factor is the optimal way to prevent and cure the Land Sandy Desertification such as controlling population increasing, change the uncultured product fashion.

In the following works, we will collect the impact of vegetation distribution, soil type and other factors on land sandy desertification.

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