Research on Dynamic Change and Trend of Guyuan Soil Erosion Based on RS and GIS

Liu Jianming[1,2], Zhao Wenji[1,2], Nobukazu Nakagoshi[3]

(1.College of Resource Environment and Tourism, Capital Normal University, Beijing, 100048, China ; 2. Beijing Key Laboratory of Resources Environment and GIS, Beijing, 100048, China;3.Graduate school for International Development and Cooperation, Hiroshima University, Higashi-Hiroshima, 739-8529, Japan)

(Project fund: Research on the Dynamic Monitoring and Evaluation of Beijing Area Based on the Remote Sensing Technology, 2007BAH15B02)

1. INTRODUCTION

In this paper we use the remote sensing and GIS techniques to monitor and analyze the soil erosion of Guyuan. Soil Erosion Classification Grade Criteria (SL190-2007) which issued by the Ministry of Water Resources, Landsat TM images acquired in 1998、2008 and DEM data were employed in the study. We chose the multifactor comprehensive method as the analysis method and select three factors of land use class, vegetation coverage and slope as the indices to monitor the soil erosion of Guyuan. Then overlay the two-year's results to get the change of its area and space.

2. RESEARCH METHOD AND TECHNIQUE ROUTE

Under the guidance of the soil erosion mechanism of departure, we select the land use, surface slope and the vegetation cover as the degree of monitoring indicators. The multi-source information extraction of the selected factors which affecting soil erosion was based on the remote sensing and GIS technology. And then we reclassified the different results according to different grading standards and overlay it for further analysis. After this we can get the soil erosion intensity spatial distribution of different periods. Finally, we can obtain the changes and trends through the different periods of soil erosion intensity on the size and spatial distribution analysis. The technology route is as follows (Figure1):

2.1 The Land Use Information Extraction

On the basis of the field survey results of study area, seven kinds of land-use types of data were extracted through the acquisition of artificial interpretation. And then we reclassified the land-use data according to the Classification standard and get the results map as the follows (Figure2):

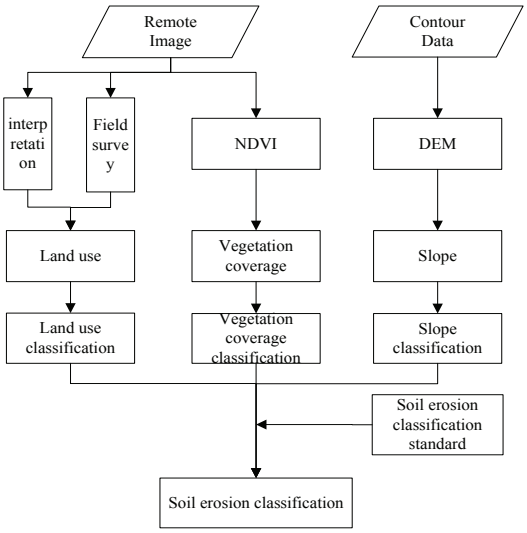

Figure 1.the Technology Route

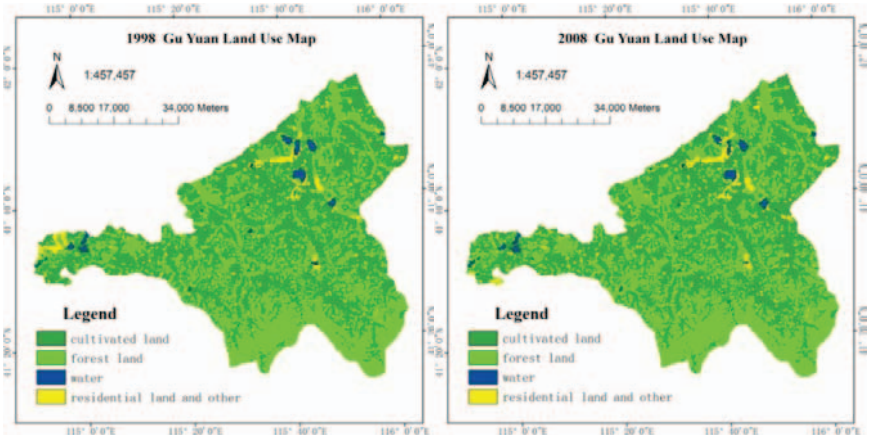

Figure 2. 1998/2008 land-use of Guyuan

2.2 The Vegetation Coverage Information Extraction

The normalized difference vegetation index (NDVI) was extracted based on the health vegetation's spectrum difference of the near-infrared and red bands in the TM image. And then we use the equation between the vegetation coverage and the NDVI to calculate the vegetation coverage (see below). Finally, we reclassified the vegetation coverage data using the 30%、45%、60% and 75% as the limits (Figure3).

2.3 Topographic Slope Factor Extraction

Firstly, the contour line of Guyuan was processed to generate TIN elevation model and the grid data (GRID) with the help of the geographic information system software ARCGIS. And then we use spatial analysis tool to extract the slope form the grid data. Finally, the slope classification map was obtained by reclassifying the gradient data with the limits of 3 °, 5 °, 8 °, 15 °, 25 ° and 35 ° (as Figure 4).

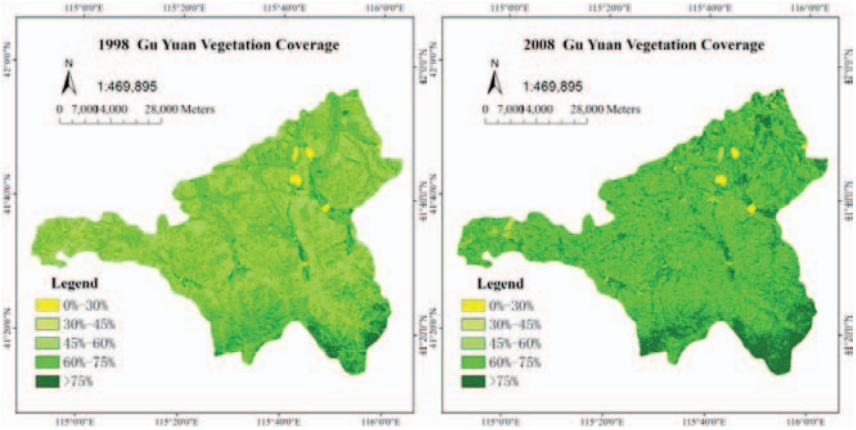

Figure3. 1998/2008 Vegetation Coverage of Guyuan

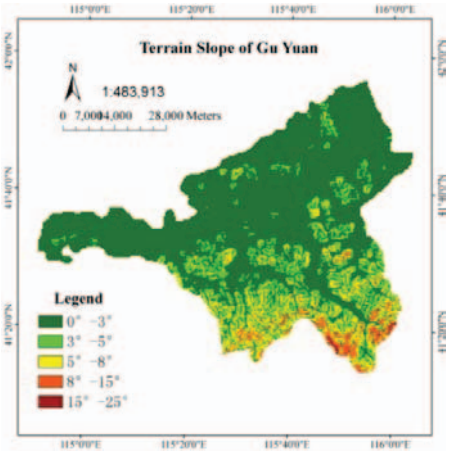

Figure4. the Terrain Slope of Guyuan

2.4 Soil Erosion Intensity Information Extraction

In order to get the soil erosion intensity distribution map, the slope classification data, land use classification data, and vegetation coverage data were weighted stacked according to the surface erosion (sheet loss) classification index of the "Soil erosion classification and grading standards" (SL190-2007)(Figure5).

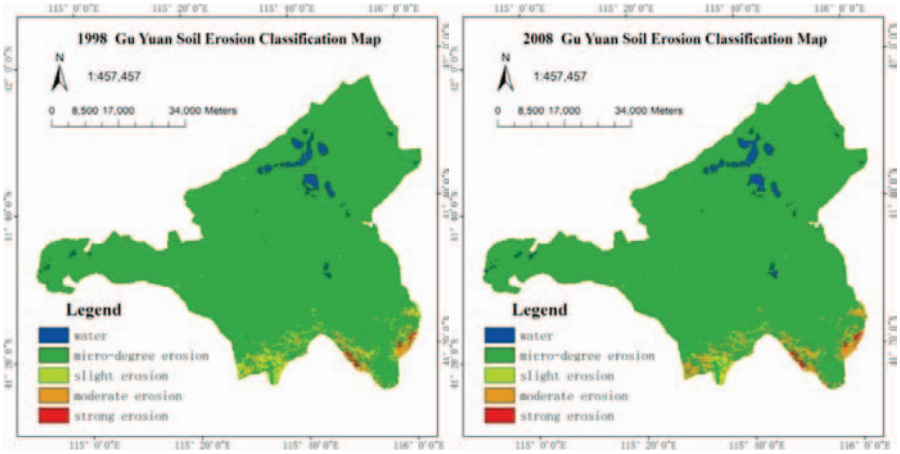

Figure5. 1998/2008 Soil Erosion Classification of Guyuan

Finally, we use the analysis tool to get the transformation matrix of the two years' soil erosion intensity classification maps (see table 1).In this table we can see the number of all types of soil erosion intensity changes.

Table1. the Soil Erosion Transformation Matrix of Guyuan

Intensity grade	Micro-degree	Slight	Moderate	Strong	Very strong	Violent	1998 Sum
Micro-degree	3339.11	4.86	0.86	0	0	0	3344.83
Slight	3.10	29.66	22.10	0	0	0	54.86
Moderate	2.53	51.20	3.14	0.74	0	0	57.61
Strong	0.02	0.13	0	6.53	0	0	6.68
Very strong	0	0	0	0	0	0	0
Violent	0	0	0	0	0	0	0
2008 Sum	3344.77	85.85	26.10	7.27	0	0	3463.98

3. CONCLUSION

(1) The study on the dynamic monitoring of soil erosion changes of Guyuan County has shown that the multi-factor synthesis method is an effective way for rapid monitoring of soil erosion in the using of RS and GIS technology.

(2) From the two analysis results of soil erosion intensity we can see that the erosion degree of Guyuan County is mainly micro-level and slight-level degree and mainly distributes in the Northern Plains region; the erosion degree is more serious in the southern mountain area but the total area is small.

(3) The absolute area of Guyuan County soil erosion was 3475.18 square kilometers in 1998 and then down to 2008 year's 3469.98 square kilometers. The proportion from 95.11% in 1998 down to 2008,94.96%. These results show that the general trend of soil erosion in Guyuan County had turned good. However, there are still signs of deterioration in some areas which need people to continue to increase building water conservancy projects, transforming the low-yielding fields and such soil conservation projects and biological measures to promote their development to the benign direction.

4. References

[1] Tang Keli, Shi Liren, Shi Deming and so on. Chinese Soil and Water Conservation [M]. Beijing: Science Press, 2004.

[2] Song-Lin Chen. Soil Erosion and Land Use Research based on GIS [J]. Fujian Normal University, 2000, (1): 34 - 37.