Soil Erosion Dynamic Monitoring in Ratgp by Using "3S" Technology

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Abstract: The reservoir area of the three gorges project (RATGP) of Yangtze River is serious in soil erosion, and always is a key area of soil and water conservation. As the Three Gorges Project (TGP) is under construction, the resettlement project brings about new artificial erosion. Carrying out dynamic monitoring in the area by using RS、GIS and GPS technology to analyze and evaluate its soil erosion dynamic change，will provide scientific basis for policy decision. We compare the SPOT images of 1980s and 1999，mainly by topographic maps digitizing and DEM , images processing and interpretation, as well as GIS system. The result indicates that this method is rapid, objective, accurate and economical, and able to provide scientific basis for policy decision.
Keywords: RATGP, "3S" technology, dynamic monitoring

1 Backgrounds

The reservoir area of the three gorges project (RATGP) lies in the upper reaches of Yangtze river. With tender ecological environment and serious soil erosion, the area is always selected as a nationwide key area of soil erosion control. As the Three Gorges Project is under construction, many people pay close attention to its environment. Since 1980s, the soil erosion condition has changed much: on the one hand, after more than ten years of large-scale soil conservation in a comprehensive way, ecological, social and economical benefits have been obtained remarkably; on the other hand, the resettlement project has brought about new artificial erosion. Therefore, it's necessary to carry out the soil erosion dynamic monitoring project in RATGP.

2 General situation in RATGP

The project involves 21 counties (cities, districts) witch are partly under 175m water level of the three gorges project (TGP). They are: Yichang, Zigui, Xingshan and Badong in Hubei Province, Wushan, Wuxi, Fengjie, Yunyang, Wanzhou, Zhongxian, Kaixian, Fuling, Fengdu, Wulong, Shizhu, Changshou, Yubei, Banan, Beibei, Chongqing and Jiangjin in Chongqing City .The total area is 58,014.85km^2.

The project area lies in the subtropics monsoon climate area, and the rainfall in summer makes up 78% of the yearly rainfall. This is a mountainous and hilly area with some rock stratum and soil easy to be eroded. Moreover, the population is kept increasing, the natural vegetation is being destroyed, and some development and construction events neglect soil conservation, all these factors aggravate the soil erosion. The type of soil erosion is mainly water erosion, including surface erosion and gully erosion. Besides, there are gravitational erosion and debris-mud flow erosion. Soil erosion destroys valuable soil resources, causes sediment deposition, aggravates disasters, worsens the ecological environment and pauperizes the living standard. Thus it can seriously restrict the sustainable development of society and economy in the RATGP.

3 Main contents

This project adopts the "3S" technology. Remote sensing image is our most important data source. In field investigation, we use GPS receiver to fix position, matching with the images, thus building up the interpretation symbols. Next, GIS accomplishes all the data layers composing, analysis and inquiry.

We choose 1980s and 1999 as the two periods of dynamic monitoring, and the image sources are SPOT (panchromatic image) and TM (multi-spectrum image). In order to take advantage of SPOT's high resolution and TM's multi-spectrum, we make a merged image to interpret the landuse, vegetation coverage, construction and gravitational erosion of two periods. Then, by use of landuse, vegetation coverage and slope maps (derived from DEM, scale is 1:50,000), we can get a soil erosion layer. The soil erosion classification is based on the professional standard of the P.R.C (SL190—96), as shown in Table 1.

Table 1 Water erosion intensity classification

<table>
<tr><th colspan="2">Slope / Landuse type</th><th><5°</th><th>5°—8°</th><th>8°—15°</th><th>15°—25°</th><th>25°—35°</th><th>>35°</th></tr>
<tr><td rowspan="4">Vegetation of non-farmland (%)</td><td>>75</td><td colspan="6" rowspan="4">Slight erosion</td></tr>
<tr><td>60—75</td><td colspan="3" rowspan="3">Light erosion</td><td colspan="2" rowspan="2">Medium erosion</td></tr>
<tr><td>45—60</td><td>Strong</td></tr>
<tr><td>30—45</td><td colspan="2">Strong</td><td>Very strong</td></tr>
<tr><td><30</td><td colspan="3"></td><td rowspan="2">Strong</td><td rowspan="2">Very strong</td><td rowspan="2">Violent</td></tr>
<tr><td colspan="2">Sloping farmland</td><td></td><td>Light</td><td>Medium</td></tr>
</table>

On the basis of the soil erosion of two periods, we can also get the dynamic change layer. Then, all the data and layers are integrated into GIS, and we have made a user interface, which can display, analyze, inquire and count the state of any region or any layer in the project area. The technique process is shown in Fig. 1.

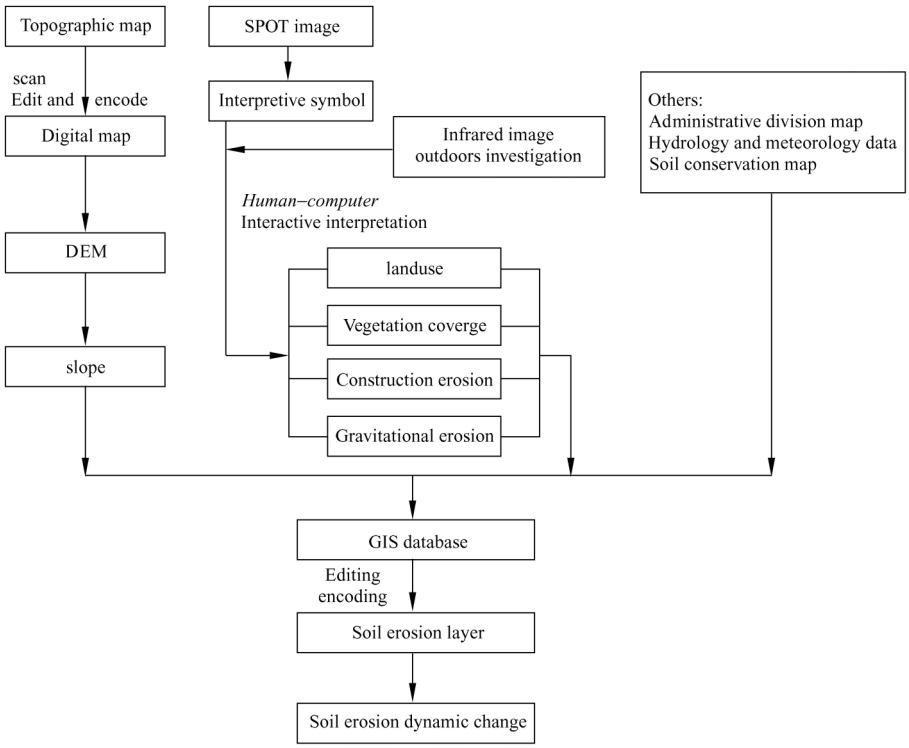

Fig. 1 The operation process flow Chart

4 Achievements and conclusions

4.1 Achievements

- DEM and slope map
- 1980s landuse and vegetation coverage maps
- 1999 landuse and vegetation coverage maps
- soil conservation measures map
- construction and gravitational erosion maps of two periods
- 1980s soil erosion map
- 1999 soil erosion map
- soil erosion dynamic change map of two periods

4.2 Conclusions

The monitoring data proves that, after more than ten years soil conservation in a comprehensive way, the landuse structure of RATGP is tending to rationalize, and the sloping farmland has decreased, the terraced farmland increased, garden plot improved, barren mountains and hills reduced, the vegetation coverage is raised. Thus the soil erosion in the area has reduced effectively. As shown in the soil erosion layers of two periods, the erosion grade has lowered, and the eroded area has reduced 4.01%—13.05%. But it should not be neglected that construction erosion has increased remarkably. Its area is very small, while the erosion intensity is great, and can cause serious harm.

The fact indicates that, carrying out the dynamic monitoring by using “3s” technology is rapid, accurate, objective and economical, and able to provide scientific basis for policy decision of soil conservation.