

## **Texture Interpretation Keys Using in Remote Sensing Investigation of Soil Erosion**

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**Abstract:** When investigating the soil erosion, we apply the satellite remote image of scale 1:100,000, Set up the texture interpretation keys. Study shadow character of water erosion (include squama surface erosion, plowland surface erosion, little ditch erosion, channel erosion and ravine erosion, the intensity of soil erosion is increased), and shadow character of wind erosion. Combine RS with GIS, using the sloping analyze system and numeric information of ground, assistant by the computer, exchange each other. Deal with numeric image data. Set up the database of soil erosion intensity and Fig. database, formed the map of soil erosion.

**Keywords:** texture interpretation keys, erosion investigation, shadow character, Fig. database

In 1999—2000, We we apply the satellite remote image tape data of scale 1 : 100,000, investigate the soil erosion in our Hebei Province. The data was provided by the Survey Center of Soil and Water Conservancy of Water Conservancy Ministry in P.R.China. We set up the texture interpretation keys, combine RS with GIS technology, using the sloping analyze system and numeric information of ground, assistant by the computer, exchange each other. Deal with numeric image data. Set up the database of soil erosion intensity and Fig. database, formed the map of soil erosion.

Now there are many advanced image divide methods, for example, texture analyse, near scape analyse, assistant information analyse, and nerve network analyse. We applied the Texture analyse method, set up the texture interpretation keys, finished the room's investigating work only a month. Due to combining with open surveys, our work has a better result.

### **1 The basis of set up the texture interpretation keys**

The texture is simple repeat of the hue in image in little district (i.e. respond of the spectral). The texture divided into two analyse method: statistical texture analyse and structure's texture analyse. Statistical texture analyse is include statistical character of all image element in a certainly area(a little plot). The little plot can carved up image element fully, can described all texture's character , The little plot can not very big, only include a texture's character. There are many expression of texture's character, for example averaging, standard deviation, average deviation contrast center image element with neighborhood image element, and the rectangle pictures of a pair of shadow's utterly difference in the plot, etc. The structure texture analyse is study space's distributing of the image structure cell(original).First, should confirmed the structure cell of color, size, and shape, then confirmed the relation of space's position in these cells, for example its model distance, we used this method.

### **2 The texture interpretation keys of water erosion and wind erosion in Hebei Province**

The main soil erosion type is water erosion and wind erosion in Hebei Province, the wind erosion main take placed in Bashang Plateau, and freeze-melt erosion was not reported, the area of gravity erosion and engineering erosion is a little. Then we main study the texture interpretation keys of water erosion(include squama surface erosion, plowland surface erosion, little ditch erosion, channel erosion and ravine erosion, the intensity of soil erosion is increased gradually),and texture interpretation keys of wind erosion.

(1) squama surface erosion, distributing in lower and middle mountain and hill range, its surface is barren. Due to the difference in height above sea level, position of landform, stones, vegetation status, the erosion degree and intensity's image difference is vary big. We can confirm the intensity of soil erosion based on the third dimension obvious or not, color different, the thickness white thread (texture)in shadow. Take placed the squama surface erosion plot, its intensity of soil erosion is more than lighter. Then based on the change of hue, main see the percent of red speckle's area, confirmed intensity of soil erosion gradually.

(2) Plowland surface erosion, distributing in farmland of mountain-foot, valley, slope hill and plateau. Due to the difference in control degree, cultivate technology, and plant ways, the intensity of soil erosion reflected in satellite image is vary different. The lighter erosion can see white threat (texture) orderly among the plot in image. The heavier erosion can see blue plot and threat, its land's intensity of soil erosion is more than lighter.

(3) Little ditch erosion, distributing in mesa of the mountain-foot, slope-plain, foreside of the flooding-pile fan, most of them maked control engineering already, the hue from lighter blueness to hoariness, chenged a little, not the third dimension. the shadow is not obvious, have white threat (texture).The land is take placed little ditch erosion in mountain, it's the intensity of soil erosion is more than lighter. In plain, the intensity of soil erosion is tiny erosion.

(4) The channel erosion, distributing in mesa-side of the mountain, foreside of the flooding-pile fan, the hue from ash-blueness to ash-white, the heavy erosion's land can see texture as a filament, the third dimension is not obvious, chromatism chenged from equality to unequality. The land that take placed channel erosion in mountain, it's the intensity of soil erosion is more than middle erosion. In plain, the intensity of soil erosion is tiny erosion, make sure the intensity of soil erosion based on channel length, width, and depth.

(5) The ravine erosion, distributing in loess channel area, and the flooding-pile fan before the mountain, the hue chenged from ash-blueness to hoariness, the third dimension is obvious, the hue deference chenged is greatly, most of plots as a fan, can see arborization shadow or emitting texture. the land's intensity of soil erosion is more than middle erosion. In plain, the intensity of soil erosion is tiny erosion, make sure the intensity of soil erosion based on channel length, width, and depth.

(6) The windy erosion, distributing in undulance place in Bashang Plateau, the hue from red-yellow to white-red, its deference chenged based on intensity of soil erosion from lighter to heavy, most of plots as belt, can see diffused white and blue texture, make sure the intensity of soil erosion.

### 3 The result

Based on the result of the second Remote Sensing Investigation of Soil Erosion, the area of soil erosion in Hebei Province have 63,299.82 km<sup>2</sup>, occupied 33.7% in the total area(187,693 km<sup>2</sup>).Water erosion area is 52,145.48 km<sup>2</sup>, occupied 82.4%.The lighter erosion area is 34,097.31 km<sup>2</sup>, the middle erosion area is 26,352.86 km<sup>2</sup>,the heady erosion area is 2,673.03 km<sup>2</sup>, the very heavy erosion area is 76.62 km<sup>2</sup>. All erosion area reduced 8,008.42 km<sup>2</sup> compare with in1982. Wind erosion area is 11,154.34 km<sup>2</sup>, occupied 17.6%.

From subarea to see, due to excess browse in the Bashang Plateau, and did not protect the grassland, wind erosion area is increased from 9,503.0km<sup>2</sup> to 11,154.34 km<sup>2</sup>, net increased 1,651.34 km<sup>2</sup>; anther area erosion area reduced. Analyze from the intensity of soil erosion, the vary heavy erosion area reduced from 1,009.65 km<sup>2</sup> to 176.62 km<sup>2</sup>, net reduced 833.03 km<sup>2</sup>, the heavy erosion area reduced from 8,465.64 km<sup>2</sup> to 2,673.03 km<sup>2</sup>, net reduced 5,792.61 km<sup>2</sup>, This reduced area main distributing inYongdinghe valley, after control it get a better effect 17years latterly. The all erosion area and its chenging, please watch the Table 1.

**Table 1 The all erosion area and its changed in Hebei Province**

Date (A.D.)	All soil erosion area (km <sup>2</sup> )	Tiny soil erosion area(<200 t/(km <sup>2</sup> · a))	Lighter soil erosion area (2,000—2,500 t/(km <sup>2</sup> · a))	Middle soil erosion area(2,500—5,000t/(km <sup>2</sup> · a))	Heavy soil erosion area (5,000—8,000 t/(km <sup>2</sup> · a))	Very heavy soil erosion area(8,000—15,000t/(km <sup>2</sup> · a))	Total erosion sands weight (10 <sup>4</sup> t)
1982	70,190.84	117,502.16	32,101.0	29,710.13	7,389.68	990.03	22,245.3
1995	63,299.82	124,293.18	34,097.31	26,352.86	2,673.03	176.62	17,607.2
2000	60,916.11	126,977.22	37,797.71	22,133.95	984.45	0	15,312.6

#### 4 The survey of soil erosion

##### 4.1 Experimental unit of the survey of soil erosion

Our province total area is 187,693 km<sup>2</sup>. The plain is the tiny soil erosion area, not count in soil erosion area, the mountain area is 113,544.27km<sup>2</sup>, its soil erosion area 63,299.82 km<sup>2</sup>, make the survey of soil erosion in such great area, need investigating the soil erosion on behalf of several countries. We selected Chaobaihe valley to investigate the soil erosion as an experimental unit, its area is 11,871 km<sup>2</sup>, occupied 10.4% total province area, its soil erosion area is 6,096 km<sup>2</sup>, occupied 9.6% in all soil erosion area. The valley is main involved Chicheng, Fengning, and Ruanping countries, these countries developed controlling after 1989, have a better organize leading and technicians, have many experience for a long time. These countries there are many reservoirs and pools, water observation station, collect the data easy, have measure fill-earth conditions. General, the more survey area of soil erosion big, the more need many time and expend money. Sometimes limited by time and survey conditions, not allowed surveying area too many.

We let the comrades in these countries selected 6 reservoirs and 2 pools to survey, asked more detailed design data, surveying easy. The Chicheng county's comrades selected 1 great and 1 little reservoirs to survey. The Fengning county's comrades selected 3 little reservoirs to survey, and the Ruanping county's comrades selected 1 little reservoirs and 2 pools to survey. The countries' locale measure, account the result, then give it to our general office.

##### 4.2 The situation of survey of soil erosion

We survey of soil erosion in reservoirs and pools in Chaobaihe valley, the result please watch the Table 2.

**Table 2 The room read result compared with the locale measure result**

No.	County	Town	The reservoir or pool's name	Room read the intensity of erosion	Per unit soil erosion (t/(km <sup>2</sup> · a))	Measure Per unit soil erosion (t/(km <sup>2</sup> · a))	The intensity is alike
1	Fengning	Huangqi	Mujianggoumen little reservoir	Lighter	200—2,500	266.39	Yes
2	Fengning	Tianqiao	Hongqiying little reservoir	Lighter	200—2,500	303.52	Yes
3	Fengning	Shirengou	Lingying little reservoir	Lighter	200—2,500	820.37	Yes
4	Chiching	Yunzhou	Yunzhou great reservoir	Lighter	200—2,500	427.76	Yes

Continued

No.	County	Town	The reservoir or pool's name	Room read the intensity of erosion	Per unit soil erosion (t/(km <sup>2</sup> · a))	Measure Per unit soil erosion (t/(km <sup>2</sup> · a))	The intensity is alike
5	Chiching	Chiching	Tangquan little reservoir	Lighter	200—2,500	1,137.65	Yes
6	Ruanping	Dengchang	Wangying little reservoir	Lighter	200—2,500	794.78	Yes
7	Ruanping	Dengchang	Bamudi pool	Tiny	<200	18.34	Yes
8	Ruanping	Dengchang	Xiaowudui pool	Lihgter	200—2,500	1,830.78	Yes

The result is proved is alike in room read and the locale measure, not system's error.

## 5 Precision of remote sensing investigation

We checked open 154 image plots in 10 counties, have 23 sideline errors, the read precision is 85%, One reason is several land-using sideline not reading correctly, the other is painting error. There are 7 errors in reading land-using type, the read precision is 95%, the main reason is the several physiognomy image characters different to present erosion. For example, the Cretaceous physiognomy of our province, the hill slope is little, but the soil erosion is heavy. General said, using the remote sensing image to investigation, may save work time, raised precision of the painting maps, can survey of soil erosion at present.

Main way that raise precision of the remote sensing investigation is selected the high quality of remote sensing image, get up all period and different varietal images, using and adapt many information, using the experiment data of little plot, it is important to raise precision.

This time we apply the satellite remote image of scale 1 : 100,000, all land-using type plots can expressed in the map, for example, expressed the longer canyon, bottomland, etc. It is possibility for synthetize mapping of the little plots, divided the soil erosion. We with the computer exchange each other, can raise the working efficiency and the reading precision.

## 6 Sum-up

(1) It is advanced and feasible that using remote sensing survey soil erosion in our province at present.

(2) Remote sensing investigation and surveying save time and expending, two persons can finished the investigation working task in a month, account economy period is better.

(3) Remote sensing investigation combine with the fill up data of reservoirs, with the data of soil erosion model, can get better result.

(4) It is important to use the remote sensing investigation result control soil erosion and lay the control measures properly, therefore these technology is practicability, and have high value of popularize.

## References

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