RESEARCH ON MONITORING THE CHANGES
OF DESERTIFICATION BASED ON REMOTE SENSING

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ABSTRACT:

Desertification is caused by the influence of the climatic, environmental changes and human activities. Its enlargement and reverse leads to not only the changes of spatial structure, scope and environment but also the development of society and economy. Chose TM remote sensing images which had two different temporal phases as data sources. Through data preprocessing and the choice of suitable vegetation index,information of desertification in typical area was acquired. Then, in the support of ARCGIS,monitored the changes of desertification in the typical area. The result shows: From 1995 to 2001, the study area was the development of land desertification state, development area covered 478.10 km^2, reversed area covered 426.90 km^2. The development area was 51.20 larger than reversed area.

1. INTRODUCTIONS

Desertification is one of the most serious environment social-economy problems nowadays. It involves the world about 900,000,000 populations, more than 100 nations and regions, area of 36×108 square kilometers. The total area of Chinese desertification has reached 86.16×104 square kilometers, especially in the northern agriculture herding interleave region, the percentage of desertification has already risen from 30% of the 70's in 20 centuries till 40% of 80's.

China is one of the countries which have the most serious desertification in the world, the desertification area is about 2.6232 million hm^2, accounting for 27.3% of land area, the expansion speed 3436 hm^2 annual, and the rate of development is increasing every year, the quality of the land is also declining, ecological environment is deteriorating constantly, dust storms and other natural disasters have occurred frequently which have seriously affected the security of people's life. Desertification problem has already seriously obstructed continuous development of the society and economy.

Remote sensing technology can acquire the information of changes and reflect changes timely in the Earth. Remote sensing in desertification monitoring played a growing role because of the limitations of traditional ground surveys[1].

As a new interdiscipline, Geographic Information Systems played a growing role with the process of information society. Geographic Information Systems has been widely used in urban planning, surveying, land, municipal facilities, pipelines, telecommunications, transportation and other industries. The integration of the Remote Sensing and Geographic Information Systems has made certain achievements in land use / cover change and desertification mechanism of evolution.

2. OVERVIEW OF RESEARCH AREA

Faku county locates in the north of Liaoning Province, belongs to shenyang city. area of the county is 2,320 square kilometers. It has jurisdiction over 19 rural towns, two development zones. Its population is 450,000. The ground gets higher from south to north. land feature is alluvial plain. The average annual temperature is 6.7 ℃, about 600 mm of precipitation around, frost-free period of about 155 days, the North temperate continental monsoon climate.

3. REMOTE SENSING INFORMATION EXTRACTION OF DESERTIFICATION

3.1 Selection of information

Research on desertification requesting the information is relatively high. Selecting a reliable and comprehensive data is the base and guarantee of the research. According to study the spatial scales and indicators chose different remote sensing data source. As to the national scale or greater scale of the ecological environment research, NOAA polar orbit meteorological satellite remote sensing data can meet the requirements. As to the province scale or county level scale of the research, remote sensing data of Landsat series is very effective. Remote sensing data of Landsat TM contains moderate multi-spectral characteristics, spatial resolution, accessibility, cost performance and so on, are still other remote sensing data is second to none. The research Range is larger, belongs to the middle scale, so chose the Landsat5 TM data.

Through the sufficient district investigate and choice of remote sensing images, chose TM remote sensing images which had two different temporal phases as data sources[5]. As shown in the table 1.

Year	Scene ID	Phase	Band

| 1995 | 119/31 | 05.15 | 7 |
| 2001 | 119/31 | 08.11 | 7 |

Table 1. Faku TM data

In addition, Faku county's relief map of 1:50000 in 1975, investigation report of land use in 1992, population statistic data from 1995 to 2001 and other text data were collected.

3.2 Remote sensing data preprocessing

Data preprocessing mainly refers to do data correction, noise removed, cut, and so on before the official use[2]. The chosen data has no spots or various types of noise, So do data preprocessing including putting the text data in database, geometric correcting and radiometric correction for the remote sensing images.

3.3 Determination of NDVI threshold

Vegetation index reflects the approximation relation between the spectral response and vegetation cover. The essential characteristic of desertification is the lower the productivity of land. Changes in vegetation index can reflect the changing process of land productivity. Therefore vegetation index can be used as desertification monitoring indicators to monitor land desertification and dynamic changes. NDVI is the abbreviation for Normalized Difference Vegetation Index. It was confirmed according to strong absorptions of chlorophyll in 0.69μm. Use ratio between infrared and near infrared and linear combination to express vegetation information. The Vegetation index can reflect a series of physics quantity of the plants, such as index of leaf's area, plant overlays degree, amount of living creature and plant category etc[3-4]. The index of vegetation contain many different expression methods, among them NDVI is applied in the fixed amount research of plant overlays. Calculation formula of NDVI is:
For the image of TM:

$$NDVI = (\rho4 - \rho3)/(\rho4 + \rho3)$$

Where
ρ4 = TM images the four-band near-infrared

ρ3 = TM images the three-band visible light
Determining the threshold of NDVI is the first step in extraction of land desertification. Then we can use the threshold to separate vegetation information and non-vegetation information from land cover.

Through comparative analysis of the NDVI images and the research area, select NDVI = 0.05 as the threshold, which can separate vegetation information and non-vegetation information from the research land cover. that is: if NDVI> 0.05, the area was considered as vegetation; Instead, considered as non-vegetation information. The NDVI image of research area in 2001 is below (Figure 1).
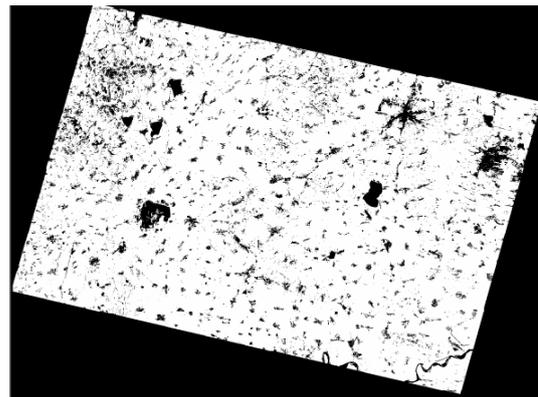

Figure 1. NDVI image of research area in 2001

3.4 Desertification index system of research area

Through the sufficient district investigate and practice research, divided the extent of desertification in the research area into three degrees: slight desertification, middle desertification, severe desertification. Specific quantitative indicators are shown below (Table 2).

3.5 Result of the research area's classification

Do remote sensing classification based on the index system in the research area. The result is below(Figure 2.).
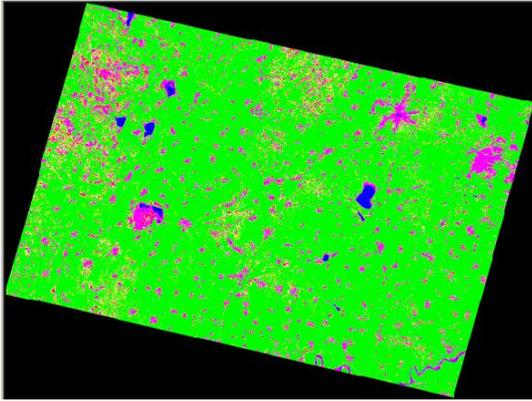
	vegetation coverage	NDVI（Normolozed Difference Vegetation Index）	PCA (3,2,1) synthesis features of color images
slight desertification	<15%	<0. 14	shallow green, distributed in the stope edge, the bands on both sides of the river
middle desertification	<10%	<0. 10	shallow pink, distributed around severe desertification
severe desertification	<5%	<0. 07	red or blue, distributed in the waste dump, mining pits and the surrounding settlements

Table 2. Extent of desertification hierarchical list in Faku county

Figure 2. Result of the research's classification in 2001

4 MONITORING THE CHANGES OF DESERTIFICATION BASED ON GIS

In support of GIS, achieved the overlay of type distribution, which was from two different temporal phases of desertification. Then we discovered the changes of desertification.

Desertification types of changes could be divided into development, and stability, reversal three basic types. In order to reflect a certain period land desertification types of mutual conversion pattern more accurately. The development was divided into two basic types: significant development and general development. The reversal was divided into two basic types: significant reversal and general reversal.

Firstly, in the support of ARCGIS，Do Data coding to the types of desertification. Respectively, used 1,2,3,4 to representative severe desertification, middle land desertification, mild land desertification, no land desertification.

Secondly, in the support of overlay function of ARCGIS software, overlayed two different types of desertification distribution map. Then did subtraction operation. First, it is

dentified as significant development areas, that no desertification translated into land desertification. It is identified as significant reversal areas, that desertification translated into no desertification. Then, according the code margin, determined

the change types of desertification, which were generated after the overlay (Table 3) .

At last, automatically generated map of changes types of land desertification in the study area.

Then, do area statistics of land desertification in different periods types of changes(Table 4).

From 1995 to 2001, the study area was the development of land desertification state, development area covered 478.10 km2, reversed area covered 426.90 km2. The development area was 51.20 larger than reversed area.

5 CONCLUSION

The Article chose two different temporal phases remote sensing images in typical area as data sources to do the research. By choosing the appropriate NDVI and index system of land desertification in the study area, acquired the land desertification information. Then, in the support of the ARCGIS discussed convert pattern of land desertification in research area from 1995 to 2001.Use RS and GIS to do the research on Monitoring the Changes of Desertification in Typical Area is advanced, but not yet a very mature, we also need in-depth research, their applications will become more and more widely.

REFERENCES

[1]Mingyi Du. Research on acquirement and analysis of the desertification of remote sensing information. doctoral thesis, pp. 5-25.
[2]Qinghe Li and Baoping Sun, et al. 1999. Desertification dynamic monitor and appraisal research progress, Beijing forestry university journal, 20(3): 67～73.
[3]Desertification disaster evaluation of remote sensing information extraction. Collection of remote sensing knowledge innovation.Beijing:Chinese Science Press, pp. 306-312.
[4]Qingjiu Tian and Xiangjun Min. 1998. the progress of the vegetation index research, the progress of earth science, 13(4):327-333.
[5]Li Cui , Wenbo WU Research on Monitoring the Changes of Desertification Based on Remote Sensing. The 9th International Symposium on Physical Measurements and Signatures in Remote Sensing.2005(779-781)

code margin	$\leqslant -2$	-1	0	1	$\geqslant 2$
changes type of desertification	significant development	general development	stability	general reversal	significant reversal

Table 3. relationship between code margin and changes type of desertification

changes type	desertification area from 1995 to 2001 $/km^2$	proportion of the total area
significant development	114. 81	3. 69%
general development	363. 29	11. 69%
stability	2202. 35	70. 88%
general reversal	334. 27	10. 76%
significant reversal	92. 63	2. 98%

Table 4. Analyse the Results of changes pattern of desertification