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Research on Dynamic Monitoring and Evaluation of Ecological Environment Based on Image Processing Technology

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Abstract: The paper combines the practice and uses satellite remote sensing image processing technology combined with GIS technology to investigate the regional land use and vegetation coverage. Through the extraction of image information, the dynamic changes of the ecological environment in a certain area from 2016 to 2018 are discussed, the ecological environment database of the area is established, and the reasons for the changes in the ecological environment of the area are discussed. Through research, it is found that micro-remote sensing images combined with GIS technology can provide real-time monitoring and pre-evaluation of ecological environment, provide scientific basis for regional ecological environment construction, and also verify the important role of image processing technology in ecological environment assessment.
Keywords: Satellite image processing technology; Ecological environment; Monitoring; GIS technology; Environmental assessment.

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1. INTRODUCTION

With the rapid development of economic diversification, the ecological environment problems presented are complicated, which has caused people's cognition and judgment on environmental issues to be very troubled, especially when such problems are disorderly, massive, and intertwined. Sexuality and infinite time domain are beyond the cognitive ability of human beings. To deal with this kind of correlation and gradual change, the problem of great time and space span requires new ideas, new methods, new technologies and new systems.

With the development of remote sensing technology, remote sensing image data has been greatly improved in different aspects. Remote sensing data of different satellite sensors, different scales and different phases are diverse, and the amount of remote sensing data received is increasing. The amount of image data is showing a rapid growth trend. This puts high demands on the storage management of massive remote sensing image data. The emergence of cloud computing technology is to solve this problem, making it convenient and convenient for storage management of remote sensing data [1].

In this study, satellite image data was used to conduct comprehensive remote sensing survey and evaluation of the ecological environment background of a certain area. Through image processing

and interpretation of remote sensing data, an ecological environment background database was established, focusing on the dynamic monitoring and analysis of land resource utilization, ecological environment status and ecological environment change trend in the study area, in order to develop the ecological environment of the area. Environmental protection and recovery strategies provide a good basis.

2. CONTENT AND CHARACTERISTICS OF DYNAMIC MONITORING OF ECOLOGICAL ENVIRONMENT

2.1 Contents of dynamic monitoring of ecological environment

Ecological monitoring is the use of comparable methods to periodically and systematically measure and observe one or more elements of the type, quantity, structure and function of ecosystems or ecosystem aggregates in a given geographical area. Process [2]. The task of ecological monitoring is to establish the relationship between the various influencing factors in the environment and the response of the ecosystem, and finally to evaluate and predict the status and development trend of the ecosystem [3]. The content includes ecological environment status survey, trend analysis and environmental pollution, soil acidification, land use status, deforestation, urbanization and other impacts on ecosystems [4].

Fig.1 Ecological environment monitoring content

2.2 Main features of dynamic monitoring of ecological environment

Firstly, it has long-term nature. The demand for environmental information by national decision-making departments and the environmental science community is long-term, continuous, and dynamic [5]. Any one-off (or short-term, static data and survey results cannot make accurate forecasts

of the ecological environment). Judgment must be carried out in a long-term dynamic monitoring to reveal its changing patterns from a large amount of data and predict its changing trend. Second, comprehensive. A complete and efficient ecological environment dynamic monitoring program will involve the natural and social aspects of the region. In all aspects, the monitoring targets include air, water, soil, solid waste, vegetation and other objects. Environmental information needs to be stored and processed with massive data. Monitoring means include biology, geography, environment, ecology, physics and chemistry, mathematics, information and technology science. The method that can characterize the quality of the environment. The third is periodicity. The process of ecological change is slow (such as forest succession, wood decomposition, etc.), and the ecosystem itself has self-regulating functions, and the response to human activities is extremely slow. Therefore, the time scale of dynamic monitoring of ecological environment is generally very long, usually Periodically monitoring using intermittent, non-continuous monitoring without interruption.

3. DATA SOURCES

The selected cases distinguish three scales. The large-scale scale is 1:25, covering the province-wide, mesoscale scale, 1:50,000, ranging from 20km inside and outside the border line, and small-scale is a number of ports along the border. In addition, there are time scale requirements - the regular period of "year-season-month" obtained from large-scale monitoring on the whole area and the special period ecology before "before construction - after construction - after construction" Environmental monitoring results were added to the ecological environment database. The content structure of the background database is "basic geodatabase + remote sensing image library + ecological environment database + social economic database + historical database". In addition to the basic database, the background database also stores and manages eco-environmental factor data, land cover and land resource data, land use data, soil erosion data, and eco-environmental assessment data. The database model used is a model in which the graphics library and the attribute library are stored separately and managed in a unified manner. The data model is divided into a hierarchical structure of "index layer - layer - geocoding - pixel encoding - attribute encoding", data splicing, segmentation and Derived mode: seamless splicing (including vector data and remote sensing data) in the whole region, and has arbitrary cutting and derivation methods according to watershed, administrative area, ecological area, key area and belt. The GIS database management system used is Oracle, and can be managed, analyzed, manipulated and expressed in both MGE and Arc GOS systems [6].

4. IMAGE PROCESSING TECHNOLOGY PROCESSING

4.1 Technical Process

Image acquisition by satellite to eliminate strip noise, geometric fine correction and registration, enhancement processing, multi-band image synthesis, image mosaic and cropping. The construction of the ecological remote sensing monitoring database requires the use of remote sensing satellite imagery for land use/cover analysis in 2016. Based on the 2010 interpretation results, the interpretation of blind spots in 2010 and the interpretation of dynamic changes between 2016 and 2018 will be completed, and the province will be completed. Land use/cover status and dynamic database of cities and counties.

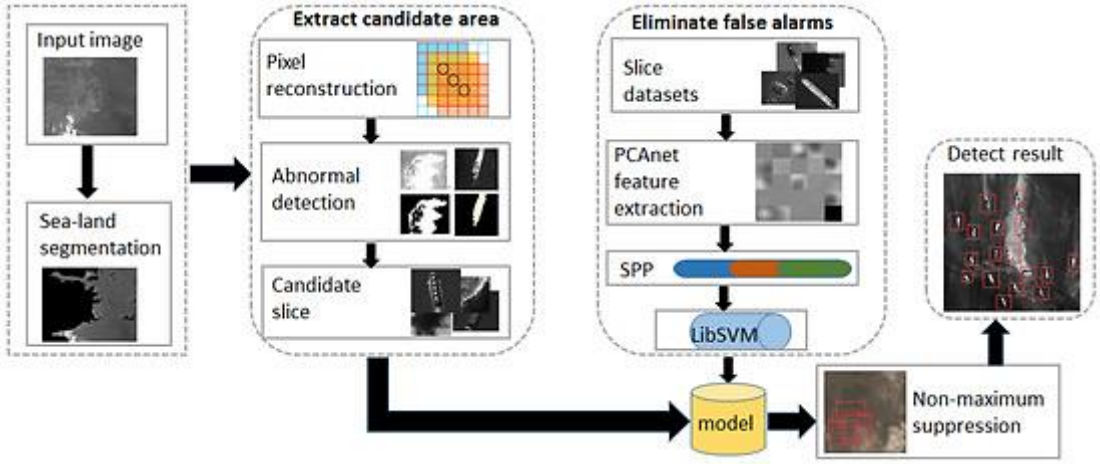

Fig. 2 satellite image processing technology flow

4.2 The best combination of remote sensing data bands

By analyzing the spectral information structure of remote sensing data, comparing the information volume of each band, and calculating the correlation of each band information, using Sheffield's proposed Snow's entropy method to select the best band is a comprehensive, simple and effective method. The basis of the PPG principle is Lambert-Beer's law. Lambert-Beer's Law is the basic law of light absorption, describing the relationship between the intensity of a single wavelength of light absorption and the concentration of a light absorbing material and its liquid layer thickness. When a bundle of monochromatic light I_0 passes through a uniform medium, the optical path is divided into three parts, one light is absorbed, one light is reflected by the surface of the medium, and one light penetrates the medium, and the transmitted light intensity I is expressed as follows [2].

$$I = I_0 e^{-\varepsilon(\lambda)cd} \tag{1}$$

Where: $\varepsilon(\lambda)$ represents the absorption rate of the medium for a fixed wavelength of light, called the extinction coefficient, c is the concentration of the substance, and d is the distance traveled by the light in the medium. The ratio of transmitted light I to incident light I_0 is defined as the transmittance T of light in the medium.

$$T = \frac{I}{I_0} e^{-\varepsilon(\lambda)cd} \tag{2}$$

Definition: Non-scattering absorbance A is the logarithm of the natural number as the negative transmittance T.

$$A = -\ln(T) = \varepsilon(\lambda)cd \tag{3}$$

According to the statistical analysis of the Snow's entropy method and the characteristics of the ground spectrum, it is decided to select the 4, 3, and 2 bands of the satellite sensor for the remote sensing data as the best RGB color composite image combination for vegetation interpretation. False color synthesis was performed on the 4, 3, and 2 bands under ERDAS software.

5. REMOTE SENSING DYNAMIC MONITORING AND ANALYSIS OF ECOLOGICAL ENVIRONMENT SUPPORTED BY GIS

Based on the seasonal multi-temporal remote sensing images of 2016 and 2018, a dynamic monitoring database of ecological environment in a certain area was established under the support of GIS. The database consists of a spatial database and an attribute database, including counties (157), local cities and states (21), and provincial databases. The following satellite distribution map is obtained:

Tab.1 database file attribute structure table

Field Name	Types of	length	Description
FID	Object-ID	4	System default generation
SHAPE	Polygon	\	System default generation
AREA	Float	4	Polygon area
PERIMETER	Float	4	Polygon perimeter
DT510421#	Long	4	Polygon number
DT510421-ID	Long	4	Record land use coverage type values

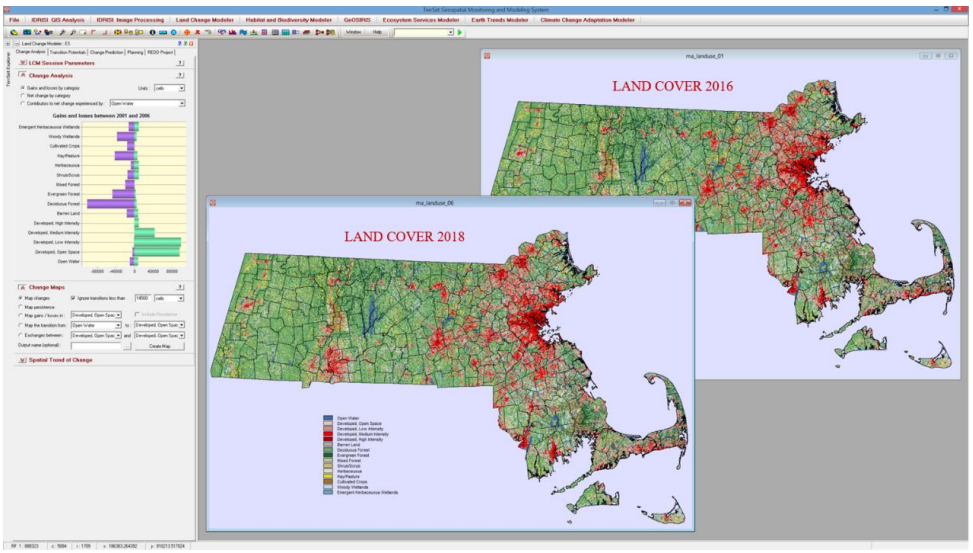

Fig.3 Change of land cover change in 2016 and 2018

The changes in the ecological environment are mainly influenced by the interaction between human activities and fragile ecological environments. Using the spatial analysis function of GIS, the land use area is statistically analyzed for the land use/coverage of forest land, cultivated land, grassland, construction land (residential industrial and mining land), and unused land and water bodies. By comparing the land use/cover dynamic change map from 2016 to 2018 (Fig. 3) and the land use/cover maps of the two phases in 2016 and 2018, the land types such as forest land, cultivated land, grassland and construction land are mainly used. Use changes to analyze. According to the GIS analysis and calculation function, and referring to the technical data of the relevant departments, the results of remote sensing dynamic changes of the ecological environment in the region are obtained: the forest land accounts for the largest proportion of various land use types, reaching 35.632% in 2018, and it is increasing year by year. In the period from 2016 to 2018, the total increase was 43223.38km^2, but the annual change rate was very small, only 0.29%. The grassland area accounts for 34.345%, the grassland area decreases year by year, and the grassland area decreases by 16028.37km^2 in three years.

The cultivated land area accounted for 24.998% of various land use types. Due to the returning farmland to forests and grassland projects, the acceleration of regional urbanization, and the conversion of some slope farmland to fruit trees and peppers, the area of cultivated land decreased by 62,707.82km^2 in three years. Among them, the reduction of dry land accounted for 69.42% of the total area of cultivated land reduction. The construction land area accounts for 0.67% of various land use types, showing an increasing trend year by year, with an increase of 35,748.10km^2 in three years, and the annual change rate of construction land is as high as 10.99%. The water area has increased slightly, and the unused land has decreased relatively, but the rate of change is small. In the land use change, the cultivated land is mainly converted into construction land (residential industrial and mining land and transportation land) and forest land, and the grassland is converted into forest land, construction land and cultivated land, and the unused land is converted into grassland and forest land.

6. CONCLUSION

From the above data, it can be concluded that the overall trend of land use is the reduction of cultivated land, grassland and unused land, and the increase of construction land, water area and forest land; land use change is based on land development and reclamation, ecological conversion, agricultural structure adjustment and construction. Land use and other changes are the dominant process, accompanied by environmental degradation processes of land degradation and deforestation; the overall trend of land use is better, and the ecological environment is improving, but land use in some areas still exists, such as arbitrarily occupying arable land, etc. phenomenon. In addition to the effects of topographic conditions and natural disasters, changes in land use/covers are more driven by socio-economic factors such as population growth, urbanization, and government decision-making. If the natural forest protection project, the conversion of farmland to forests and grassland projects and the implementation of ecological environment construction and control projects are continued, and the rational exploitation and utilization of natural resources by human beings is effectively carried out, the restoration and reconstruction of the ecological environment in the region will be realized.

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