Analysis and Research on Information Processing of Regional Land Use Coverage Change

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Abstract. Based on TM remote sensing image, combined with image processing technology, under the GIS software, using manual visual aid and self-calculation automatic classification method, the land use cover change information is proposed, and the land use type is divided into forest land, dry land, glaciers and grassland, alongside the adjacent wall, bare ground, saline-alkali land, etc., combined with the landscape analysis index, quantitative analysis of land use green change information. The plaque shape index analysis of various land types in the region is divided into interference levels, and the correlation of activities to regional land use cover changes is analyzed.

1. Introduction

Since the publication of the Global Change Research Strategy Report in the United States in 1986, global change research has become a frontier topic in the field of earth science and related disciplines, and has been highly concerned by the academic community. Global change has therefore become one of the most active research areas in the world in recent years. With the in-depth development of global change research, scientists from all over the world are increasingly aware of the impact of human activities on the environment. They believe that humans have changed the surface of the earth, the ocean, the coast, the atmosphere, biodiversity, the water cycle, and the agrochemical cycle. Significantly more than the role of nature, the role of humans in a complex way to the Earth system has a multi-access impact, becoming the dominant factor in global change. These effects interact and change in multiple patterns on a regional scale, which is difficult for people to grasp. Therefore, how to distinguish the white factor variable and the human behavior variable of global change, and find the mechanism of action between the two becomes a difficult problem in global change research.

The two concepts of land use and land cover are closely related and have essential differences, and it is extremely easy to stick. When making land use cover changes, the meaning of the two and their relationship must be clarified. Many scholars have explained the meaning of land use coverage. In particular, the coverage of the ten places is quite controversial in concept. IGBP and IUDP believe that land cover is the natural state of the Earth's land surface and near-Earth, and is a natural result of natural processes and human activities [1]; the United States USSGCR defines it as vegetation and other traits covering the surface of the Earth [2]; Some scholars believe that land cover is the cover formed by all natural and human influences on the surface of the earth, including surface vegetation, soil, glaciers, lakes, swamps, wetlands and roads [3].
2. Surface coverage domain service model

The primary task of global surface coverage service computing research is to define basic information services (or atomic services), primary users, and interactions that are covered by the surface, and to establish a domain service model consisting of users, services, and interactions. Among them, users are the source of demand for domain service models, and services are the basic unit to meet user needs. Interaction is an important way for users to cooperate with services, services and services. Data production, quality inspection, accuracy inspection, application analysis to update and other aspects constitute the basic life cycle. Therefore, it is necessary to analyze the information service needs of different user groups and their commonalities in the surface coverage field around this life cycle, sum up the common atomic services, consolidate the dependence and configuration constraints between users and services, and build a balance between current needs and changes. Domain service model. Compared with the traditional universal geographic information service model, this domain service model puts higher demands on the interactivity, advisability and dynamics of atomic services.

![Fig 1. Correspondence between the life cycle of global surface coverage information and domain common services](image)

3. Research methods

The TM image is processed by remote sensing image processing software PC17.0, which mainly includes geometric correction of image, mosaic color matching, cropping and enhancement. The processed image is supported by the ARCVIEW software, and the image raster file is used as the interpretation background. The method of visual interpretation is mainly used, and the computer automatically classifies as a supplementary method. According to the image interpretation marks, such as hue, shape, size, shadow, etc., the land use coverage information is extracted separately, according to the use, management characteristics, utilization mode and Covering characteristics and other factors as the classification basis of land use, distinguishing differences, summing commonality, dividing from high to low level, dividing land use types into rivers, river beaches, bare grounds, bare rocks, fields, glaciers, woodlands, grasslands, Gobi, sand, wetland and saline-alkali land, and according to the database structure design, assign value to the property sheet, the work flow chart is as follows.
4. Land use coverage landscape analysis indicators

After using remote sensing technology to obtain information on regional land use cover change, the information is analyzed and processed to make the information clearer and clearer, so as to understand the pattern characteristics and evolution law of regional land use cover change. At present, the commonly used treatment methods mainly include parameter construction method and landscape analysis method. The author's research mainly uses landscape analysis method [5].

4.1. Land resource quantity change index

The dynamic degree of a single land use type indicates the change in the quantity of a certain land use type within a certain time horizon of the study area. Where $K$ is the dynamic degree of a land use type during the study period, and $U_a$, $U_b$ is the number of land use types at the beginning and end of the study period, respectively, and $T$ is the length of the study period.

$$K = \frac{U_a - U_b}{TU_a} \times 100\%$$

The comprehensive land use dynamics expresses the change in the quantity of land use types within a certain time frame of the study area. Where $LU_i$ is the area of the i-type land use type at the beginning of the measurement; $U_{ij}$ is the absolute value of the area of the i-type land use type converted to the non-i-type land use type during the measurement period, and $T$ is the length of the monitoring period.
The relative change rate of land use types reflects regional differences in land use change and change. If the relative change rate of a certain land use type in a certain area is \( R > 1 \), it means that the land use type in this area changes more than the whole area. In the formula, \( K_a \) and \( K_b \) respectively represent the area at the beginning and end of the study period of a specific land use type in a certain area; \( C_a \) and \( C_b \) represent the area at the beginning and end of the study period of a specific land use type in the whole study area.

\[
R = \left( \frac{K_a}{K_b} \right) \left( \frac{C_a}{C_b} \right)
\]  

(3)

4.2. Plaque scale

The fractal dimension of the plaque. The closer \( F_d \) is to 1, the stronger the self-similarity of the plaque, and the simpler the plaque geometry, indicating the greater the degree of interference. Where \( P \) is the perimeter of the plaque, \( A \) is the area of the plaque, \( F_d \) is the fractal dimension, and \( k \) is a constant [6].

\[
F_d = \frac{2 \ln \left( \frac{P}{k} \right)}{\ln \left( \frac{A}{k} \right)}
\]  

(4)

The average area of the plaque can reflect the basic characteristics of the area of various land use coverage types in the region. Where \( A \) is the total area of a certain type of plaque, and \( N \) is the total number of such plaques.

\[
P = \frac{A}{N}
\]  

(5)

The standard deviation of plaque area can reflect the basic characteristics of various land use coverage types in the region. Where \( a_{ij} \) is the area of the plaque numbered \( ij \), \( A \) is the total area of a certain type of plaque, and \( N \) is the total number of plaques.

\[
D = \sqrt{\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} \left( a_{ij} - \frac{A}{N} \right)^2}{N}}
\]  

(6)

4.3. Landscape System

The diversity index, which can reflect the extent of land use coverage types and the proportion of each type in the region. When there are two or more types of landscapes, and the proportions of the landscape types are equal, the landscape diversity index is the highest. Select the Shannon-Weaver formula to calculate. Where \( H \) is the landscape diversity index, \( n \) is the total number of landscape plaque types, and \( P_k \) is the proportion of the \( k \) type plaque type in the landscape.
\[ H = - \sum_{k=1}^{n} (P_k) \ln(P_k) \] (7)

The uniformity index can reflect the uniformity of the distribution of various land use coverage types in the region. The larger the value, the more uniform the distribution of land use coverage types in the region. Where \( P_k \) is the probability that plaque type \( k \) will appear in the landscape (usually estimated as the proportion of the area occupied by the plaque in the landscape), where \( n \) is the total number of plaque types in the landscape.

\[ E = \frac{H}{H_{\text{max}}} = \frac{- \sum_{k=1}^{m} (P_k) \ln(P_k)}{\ln(n)} \] (8)

The dominance index can reflect the degree of land use coverage of one or some types of dominant areas in the regional land use cover. The larger \( D \) value corresponds to one or a few types of dominant areas. Where \( P_k \) is the probability that plaque type \( k \) will appear in the landscape (usually estimated as the proportion of the area occupied by the plaque in the landscape), and \( m \) is the total number of plaque types in the landscape [7].

\[ D = H_{\text{max}} - \sum_{k=1}^{m} (P_k) \ln(P_k) \] (9)

The aggregation index can reflect the non-randomness or aggregation degree of different land use coverage types in the regional land use coverage types. The large value indicates that the regional land use cover is composed of a small number of large plaques, and the small value indicates that the regional land use cover is composed of many scattered small plaques. Where \( C_{\text{max}} \) is the maximum value \( [2\ln(n)] \) of the aggregation index, \( n \) is the total number of plaque types in the landscape, and \( P_{ij} \) is the probability that the plaque type \( i \) is adjacent to \( j \).

\[ C = C_{\text{max}} - \sum_{i=1}^{n} \sum_{j=1}^{n} P_{ij} \ln(P_{ij}) \] (10)

5. Results analysis

Comparing the land use cover change information of 2011 and 2016 in a certain place, the following results are obtained.

5.1. Plaque area change

The plaque area of each land use cover type has changed greatly due to the influence of human activities. The overall change trend is that the dry land, grassland and bare rock increase significantly, while the saline-alkali land, sandy land, bare land and wetland are significantly reduced, among which the dry land The increase was 582.68km², the grassland increased by 122.47km², the bare rock increased by 146.9km², the saline-alkali land decreased by 272.45km², the sandy land decreased by 357.21km², the Gobi decreased by 135.12km², and the wetland decreased by 251.25km². Due to the increase of people's awareness of environmental protection, the afforestation has increased year by year, which has led to an increase in grassland and grassland, while sandy land, saline-alkali land and Gobi have been greatly reduced. However, in order to meet the needs of economic and population
growth, it is necessary to expand cultivated land, expand cities, and open wetlands. In order to achieve temporary development, it has caused a large reduction in the area of wetlands and an increase in the area of dry land [8].

5.2. Spatial distribution of land use coverage
In terms of the number of patches, except for the increase of forest land, sandy land and Gobi, the number of other land use types decreased and the fragmentation index decreased, indicating that the land use type is relatively complete and there is no obvious fragmentation phenomenon in 2011 and 2015. The diversity index is high, close to the maximum diversity index of 2.35 and the change is not large, indicating that the land use in the region is relatively close, and the overall land use type is high. This is because the region has a wide coverage. In addition to the plain basin, there are also gully hills, which makes the proportion of each type balanced, and the uniformity index is higher, indicating that the land use coverage type is more evenly distributed, and the dominance index is not high. Explain that each land use type has the same status.

6. Conclusion
When conducting regional land use cover change measurement, the key is to eliminate the interference factors and select appropriate dynamic monitoring methods to ensure the accuracy and reliability of the obtained information. At the same time, with the high resolution of remote sensing and the gradual enrichment of hyper spectral data, it is necessary to actively explore new dynamic monitoring methods to make full use of these remote sensing data to obtain more reliable and effective regional land use coverage change information. In addition, according to the above results, human factors are a powerful driving force for the change of land use coverage.

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