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LETTER TO THE EDITOR

Remote Sensing Monitoring Method for Ecological Environment Restoration in Scenic Spots

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Abstract: Aiming at the problem that the ecological function of the scenic spot is gradually declining, a remote sensing monitoring method for the restoration of the ecological environment in the scenic spot is proposed. Remote sensing images are processed to extract remote sensing monitoring data. From the weighted values of the spectral heterogeneity and shape heterogeneity of the object, the spectral difference is obtained, and the shape heterogeneity is obtained. The vegetation index NDVI is calculated based on ETM + and CBERS remote sensing images. The vegetation coverage is calculated by combining the weighted values of spectral heterogeneity and shape heterogeneity of the object, and remote sensing monitoring method for ecological environment restoration in scenic spots is completed. Through the experimental results, it can be concluded that through five years of ecological restoration, the surface vegetation coverage has been greatly improved. To evaluate the environmental restoration effect of the implemented ecological restoration technology can provide effective technical data for future ecological restoration work.
Keywords: Remote sensing monitoring; Ecological environment restoration; Scenic spots.

1 Introduction

The increasing frequency of human activities in tourist attractions has gradually reduced the ecological functions of scenic spots, facing serious ecological problems such as water reduction, sediment deposition, and biodiversity loss. In order to regulate inter-regional microclimate and maintain biodiversity, the environment is urgent to being repaired. Remote sensing technology has become an indispensable means and data source for the acquisition, update and analysis of geospatial information in natural resource surveys and environmental dynamic monitoring (Zhang et al. 2018). Because it has the ability to perform large-area real-time monitoring, strong timeliness, large amount of information, objective and real information, good data comprehensiveness and comparability, it is the most economical and effective means to obtain information on surface vegetation coverage change (Leura Vicencio et al. 2017, Zita Lagos et al. 2017, Ramon Leggieri et al. 2017).

Yuwei Zhang, Luhe Wan, Zhendong Li published an article in the journal of Ekoloji onIssue 106, 2018, entitled “Forest Vegetation Type Extraction and Dynamic Monitoring - A Case Study of Heilongjiang Province, China”. In this paper, maximum likelihood classification method and support vector machine classification method were used. Heilongjiang Province was taken as the experimental area and TM image was as the basic data. Comparing the classification accuracy of the two methods, the SVM classification method was effective for detecting vegetation changes. In summary, M image was an effective method for detecting vegetation changes. At the same time, through the extraction of change information and coverage analysis, the dynamic changes of large-area forest types were monitored and suggestions for sustainable forest development were proposed. On the basis of changes in forest vegetation, it could be extended to the level of vegetation change in the ecosystem of tourist attractions.

Ecological restoration is based on the evolution of ecosystems, especially the principles of holistic, coordinated, and regenerative. Natural and human forces are used to reconstruct damaged or degraded ecosystems, and to restore the benign cycle and function of the ecosystem (Lu et Al. 2018). At present, although there are some reports on the effects of ecological restoration on soil properties, hydrological and ecological effects, forest vegetation changes, etc., there are few studies on the overall ecological environment effects of ecological restoration projects. In view of this, the remote sensing monitoring method for the restoration of ecological environment in tourist scenic spots is proposed. The quantitative research on the ecological restoration effect of the basin is carried out from the aspects of land use type and structure, vegetation coverage and soil erosion, in order to provide scientific basis for ecological restoration.

2 Perspective

2.1 Image selection and preprocessing

The basic data used in the study include: 1:50 000 digital elevation model (DEM), observations of 6 meteorological stations in the 2013-2017 scenic area and nearby areas, 1:50 000 soil type maps, remote sensing images, related literature statistics, etc., where the remote sensing data is TM/ETM images in the fall of 2015 and 2017 with a spatial resolution of 30 m. In addition to the above information, two field surveys are conducted on the basin. Taking remote sensing image as one of the main criteria for selecting the line, GARMINGPS12C handheld GPS, topographic map and other reference materials are used for positioning and navigation. The field is carried out to understand the basic characteristics of land use and the distribution law of soil erosion. The soil in the scenic spot is investigated. After applying the ERDAS and Arc GIS software, the basic maps are geometrically registered and resampled by data, they can be uniformly calibrated to match the TM image (RMS≤0.5 pixels), that is, the grid unit size is 30m×30m. These maps and their attribute data are used to build a scenic space database, and the spatial analysis function of Arc GIS is used for data processing and analysis (Guo et al. 2018). Multi-scale segmentation is performed on the detection object, a classification rule set is established, and finally the impact classification is performed, to extract the remote sensing monitoring data. The basic process is shown in Figure 1.

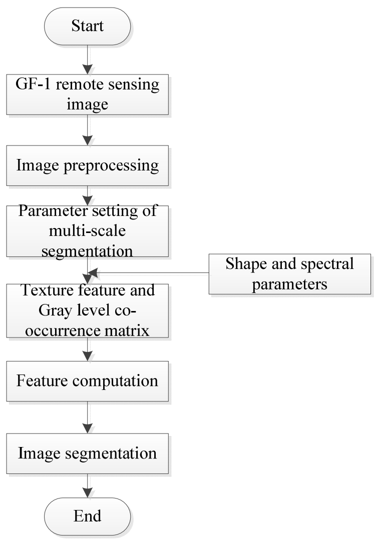

Figure 1 Flow chart of the research method

The spectral difference is calculated from the spectral values of the object pixels:

$$h_{color}=\sum_{1}^{c}\omega_c\cdot\left(n_m\cdot\sigma_m-\left(n_1\cdot\sigma_1+n_2\cdot\sigma_2\right)\right)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where: c is the number of bands of the image; ω_1 is the weight of each band in the image; n_m is the number of cells of the object after merging; σ_m is the standard deviation of the object after merging; n_1, n_2 is the number of pixels of the two adjacent objects before merging; σ_1, σ_2 is the standard variance of the two adjacent objects before merging (Hu et al. 2017).

Shape heterogeneity is calculated from the spectral difference of the object:

$$h_{shape}=\omega_2+h_{com}+\left(1-\omega_2\right)\cdot h_{smooth}h_{color}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where: ω_2 is the weight of the compactness; h_{com} is the compactness heterogeneity; h_{smooth} is the smoothness heterogeneity.

Vegetation index NDVI: It is mainly used to detect vegetation growth state, vegetation coverage and eliminate some radiation errors.This form can partially eliminate the error caused by the change of illumination conditions, inclination and observation posture, so it can reflect vegetation well. Differences with soil and vegetation coverage are closely related to biomass in different growth stages of plants (Chen et al. 2017). Since both the infrared and near-infrared bands of ETM+ and CBERS remote sensing images are B3 and B4, the NDVI calculation formula based on ETM+ and CBERS remote sensing images is:

$$\mathrm{NDVI}=\left(B_4-B_3\right)/\left(B_4+B_3\right)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Vegetation coverage (Liang 2017) is calculated by weighting the spectral heterogeneity and shape heterogeneity of the object. The formula is:

$$f=\mathrm{NDVI}\omega_1\times h_{color}+\left(1-\omega_1\right)\times h_{shape}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

3 Personal View

The vegetation coverage area of the scenic spot is distributed according to the level as shown in Figure 2. It can be seen from Figure 2 that through five years of ecological restoration, the surface vegetation coverage has been greatly improved, especially the area of medium and low coverage has been significantly reduced.Compared with 2013, the area occupancy between coverage < 30% and 30% - 45% decreased by 37.1% and 44.5% respectively in 2017, while the medium and high coverage increased significantly, with growth rates above 10%. The reason is that through the development and promotion of alternative energy sources, farmers' fuels are further solved, vegetation damage is reduced, and many low-coverage young forests are bred and their coverage is significantly improved.

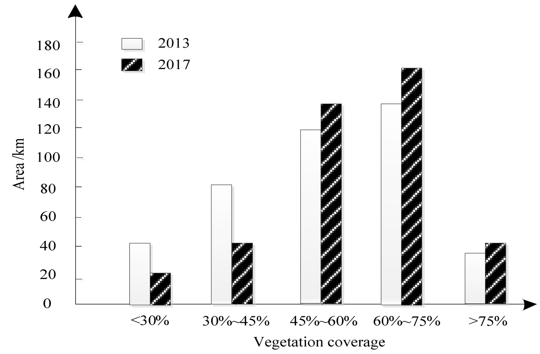

Figure 2 Vegetation coverage area of tourist attractions

According to the type of image, the image with the NDVI interval of 0.2~1 is extracted from the ETM+ image, and the pixel with the NDVI interval of 0.1~1 is extracted from the CBERS image to obtain the vegetation from 2013 to 2017. The change in growth is shown in Figure 3. Obviously, the area of the vegetation growth area is large, which proves that the environment recovery effect of the scenic area is better.

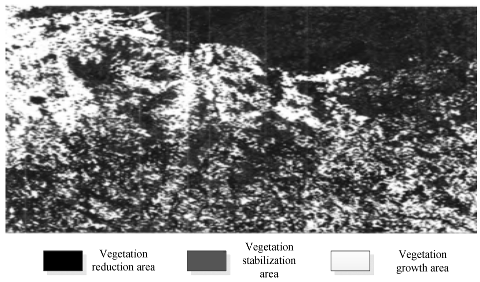

Figure 3 Vegetation growth trend of the experimental scenic spot from 2013 to 2017

4 Conclusion

(1) Through five years of ecological restoration, the ecological environment of the scenic spot has been significantly improved. The land use structure also tends to be reasonable, and the sloping farmland has been greatly reduced. The slope farmland with more than 25° has been returned to the forest, and the forest and grass cover rate has reached 83.23%. Not only the forest and grass cover rate has increased, but also the quality of the forest land has been greatly improved. The area of higher forest and shrubs increased by 18.1% and 9.1%. On the contrary, the area of sparse forest decreased by 37.9%.

(2) It needs to deal with the relationship between ecological restoration and artificial management. The scenic spot can achieve results in ecological restoration, which is largely achieved on the basis of the “Changzhi” project. Through the “Changzhi” project, the basic farmland that can solve the farmers’ food problems has been established in the basin. The industrial structure of the rural areas has been rationally adjusted, and the farmers’ economic income has been initially guaranteed.

(3) Ecological restoration requires reasonable manual intervention. Artificial governance is inseparable from the role of nature, and natural recovery is inseparable from the role of human beings. The two have their own emphasis and cannot be opposed. While relying on natural restoration of a good ecological environment, it is also necessary to replant, raise, control pests and diseases according to local conditions, rapidly increase the biomass of the restoration area, and maximize the ecological restoration capacity.

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