IMPERVIOUS SURFACE COVERAGE AND THEIR IMPACT ON OTHER COMPONENTS OF THE URBAN ECOSYSTEM IN BEIJING

Dan Meng,Huili Gong, Xiaojuan Li, Wenji Zhao,Yanfang Li

Key Laboratory of Resource, Environment and GIS in Beijing, Key Laboratory of 3D Information Acquisition and Application, Ministry of Education, College of Resources Environment and Tourism, Capital Normal University, CNU, Beijing City, P.R.China

Beijing city, capital of China, has experienced a rapid urban expansion over the past two decades due to accelerated economic growth. The fast urban spatial expansion has led to the substitution of the natural vegetation-dominated land surfaces by impervious materials. This has a significant impact on the ecosystem on a local to global scale. Therefore, a clear understanding the relationship of urban impervious surface area with vegetation, land surface temperature and rain-runoff is of meaningful for scientific urban planning and ecosystem restoring. Nevertheless, such a study is still very rare due probably to the difficulty in getting impervious surface data. Taking the advantage of the remote sensing and GIS technology, the information of urban impervious surface area, vegetation, land surface temperature and runoff characteristic can be extracted. Using Beijing city as a case, this paper analyzed the relationship between the above-mentioned components of urban ecosystem through HJ-1B remote sensing images, which is one of China's Small Satellite System for Environment and Disaster Monitoring and Forecasting developed independently.

The above constellation is composed with two optical satellites (HJ-lA , HJ-lB) and a SAR satellite(HJ-1C). HJ-lA and HJ-lB optical satellites were launched firstly for environment and disaster monitoring and forecasting on Sep.6 2008. The status of the operation and application has an important theoretical and practical significance for the development of the subsequent constellation. Based on the data acquired from CCD and IRS sensors of HJ-1B optical satellites, the authors have analyzed and estimated the usability of HJ-1 optical satellites comprehensively.

As a major component of the Ridd's vegetation-impervious surface-soil(V-I-S) model, urban impervious surface is important in monitoring urban expansion and understanding impacts from human activities on the environment[1]. By means of image processing technique, the impervious surface information can be extracted from remote sensing imagery. In this paper, a minimum noise fraction (MNF) transformation has been applied to a HJ-1B CCD of Beijing city. The first three components produced from the MNF transformation were selected. Through a linear spectral mixture model, four endmembers, i.e., low albedo, high albedo, vegetation, and soil

were identified to represent the heterogeneous urban land cover types. Finally the impervious surface fraction was estimated by combining low and high albedo components[2-4].

Because impervious surface maps are an essential input layer for the following analysis models, methods for accurately mapping and measuring the extent and quantity of impervious surfaces are of critical importance. Automated Feature Extraction with eCognition software combined manual interpretation using aerial photo with 0.5m spatial resolution were adopted for the accuracy verification of impervious surface extracted, and the result is satisfactory with 90% accuracy.

The SCS(Soil Conservation Service)method was used in this paper to model the rain-runoff relationship[5]. The impact of urban growth on urban heat island (UHI) was examined based on the land surface temperature (LST) which was retrieved by the generalized single channel algorithm proposed by Jiménez-Munoz and Sobrino[6], and relationships between urban growth, vegetation space variation, runoff and thermal environmental changes were analyzed using GIS spatial analysis techniques.

The result shows that the expansion of the impervious surface area has caused the increase of average runoff volume. Urban growth area coincides with the thermal intensified area and a good similarity between vegetation increasing area and thermal relieved. The characteristics of urban growth and thermal intensified area changes were similar, both spreading from the center of Beijing city to its outside in accordance with the ring road system. The result indicates that the increase of urban impervious surface has a negative impact on the urban ecosystem. In the end of this paper, some suggestions to improve impervious surface and thermal environment of Beijing city were given.

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