

International Conference on Geographies of Health and Living in Cities: Making Cities Healthy for All, Healthy Cities 2016

The Assessment of Urban Ecological Environment in Watershed Scale

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Abstract

Urban ecological environment is closely related to the harmonious development of the region. The interaction between ecological environment of the city and the watershed where it locates is less considered in current study. In this paper, making use of multi-source data with remote sensing data as the main data source and according to the "Technical Standard for Evaluation of Ecological Environment" (HJ192-2015) promulgated by Ministry of Environment Protection, we accomplished the quality assessment of ecological environment of Yanhe watershed in 250m × 250m pixel unit with synthetical index method. Based on this, we also combined demographic data, DEM data of Yanhe watershed to analyze the interaction between urban ecological environment and ecological environment status of the entire watershed. The results showed that: 1) The ecological environment quality levels of urban areas in Yanhe watershed were mainly "poor" and "worse", and the farther from the urban area, the better quality level of ecological environment in general, which indicated the existence of the city exerted stress on the ecological environment; 2) The ecological environment of the city at higher altitude was in poorer condition, indicating that the distribution of the topography of the watershed had a certain impact on the ecological environment of the city; 3) By comparing the distribution of the ecological environment quality of different cities in the watershed, the more concentrated population density of the city, the greater scope of the poorer ecological environment, indicating that human activities had great influences on the urban ecological environment. We can conclude that it is necessary to consider the interaction between urban ecological environment and watershed ecological environment where the city locates, so as to provide new ideas for the construction and protection of the ecological environment of the city.

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Peer-review under responsibility of the organizing committee of Healthy Cities 2016

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Keywords: RS/GIS; Watershed scale; Urban ecological environment; Yanhe watershed

Introduction

The ecological environment is the premise and foundation of human survival and development. It refers to the sum of various natural factors about human society and its surroundings. Based on the selected evaluation index system, the regional ecological environmental quality is assessed using comprehensive evaluation method. The results can provide fundamental basis for the management and construction of regional ecological environment^[1]. With the continuous increase in population and development of economy, urbanization is the mainstream of the world's population gathering development. At the same time, it is also an important driving force of the world's cultural pattern and environmental change^[2]. However, urbanization brings the problems of migration, the change of land use structure and urban environmental pollution and so on^[3, 4]. Urban ecological environmental quality assessment is an important research field of city ecology and it can provide scientific basis for its sustainable development of planning and management^[5]. Many foreign and domestic scholars have carried out relevant researches, for example, Queiroz^[6] studied the ecological environment of Stockholm from the perspective of landscape ecology using GIS technology; Steven^[7] made a comprehensive evaluation of ecological environment of a southern city in Mexico based on environment simulation model; Lang Yi^[8] had finished the quantitative evaluation of the ecological environment quality of Yulin City in 2010 based on 3S technology; Wei Wang^[9] analyzed the dynamic change of ecological environment quality in Beijing from 2001 to 2010.

However, the current studies mostly focus on the urban ecological environment itself, the interaction between ecological environment of the city and the watershed where it locates is less considered. As we know, the formation and development of the city is closely related to water, and for a long history, watershed is the most suitable place for human to live^[10]. Watershed is the cradle of human civilization and the foundation of ecological civilization. At the same time, it is also an important natural resource for human to survive^[11]. Since watershed is a complete ecological and geographic unit, the elements inside it have a high degree of correlation and integrity^[12]. The ecological environment of the watershed and the city is closely related to each other. On the ground of these facts and according to the "Technical Standard for Evaluation of ecological environment" (HJ192-2015) promulgated by Ministry of Environment Protection, we accomplished the quality assessment of ecological environment of Yanhe watershed in 250m × 250m pixel unit through making use of multi-source data with remote sensing data as the main data source. Based on this, we also combined demographic data, DEM data of Yanhe watershed to analyze the interaction between urban ecological environment and ecological environment status of the entire watershed. This research can provide new ideas for the protection and management of urban ecological environment. And it can also provide a theoretical basis for regional planning, ecological environment construction and management of Yanhe watershed.

2. Study area and data source

2.1. Study area

Yanhe watershed is located in the hinterland of the loess plateau in Shaanxi Province (Fig.1), and its total area is approximately about 7687km². This place is a typical semi-arid temperate continental monsoon climate region. Cold and dry in winter, drought and rainy in summer. The landform of Yanhe watershed is broken and it also has a serious problem of land degradation and soil erosion^[13]. This area includes the major cities as Yan'an City, Jingbian County, Ansai County, Zhidan County, Yanchang County. Yan'an City has a profound historical heritage. It is a sacred place of the revolution in China and also the political, economic and cultural center of North Shaanxi^[14]. However, with the development of economy, the ecological environment problems in Yan'an City, Ansai County, Jingbian County are more and more serious, which restrict the sustainable development of this region. So it is urgent

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