

Ecological Sensitivity of Urban Agglomeration in the Guanzhong Plain, China

ABSTRACT

In the past two decades, China's urbanization has advanced rapidly. In 2018, Xi'an was successfully selected as a national central city, and the Guanzhong Plain urban agglomeration (GZPUA) is emerging rapidly due to Xi'an. This study focuses on the current ecological status of the region and how to strike a balance between economic development and ecological protection. This study uses the ecological vulnerability of the Guanzhong urban agglomeration as a starting point to investigate the changes in its spatial and temporal distribution of ecological vulnerability and the primary driving factors, as well as to investigate the interaction between the changes in ecological vulnerability and urban agglomeration development in the GZPUA region. Using the "sensitivity-elasticity-pressure (SEP)" assessment framework model, this paper selects the spatial distribution data of natural, social, and economic sources in 2000 and 2020 based on the ecological environment characteristics of GZPUA. By using spatial principal component analysis, this paper quantitatively evaluates the ecological vulnerability changes of GZPUA in two periods, 2000 and 2020, with 1000 m × 1000 m raster as the evaluation unit, classifies the ecological vulnerability of the area into levels, and conducts a sub-regional in-depth study from different administrative regions. This research helps to comprehend the change in ecological environment quality in the GZPUA and provides a basis for ecological environment management decisions in the region. The results showed that (1) the ecological vulnerability of the Guanzhong Plain urban agglomeration as a whole is moderate, with the highest ecological vulnerability index (EVI) value of 0.89 and the lowest EVI value of 0.087 in 2000, and the highest EVI value of 0.93 and the lowest EVI value of 0.082 in 2020. The percentage of areas with the highest ecological vulnerability (moderate or severe) was 5.07% in 2000 and 15.11% in 2020. (2) The variation scope of the integrated EVI in the study region is 1.78–4.96 (2000) and 1.81–4.99 (2020), among which the EVI values in Xi'an, Bei Lin, Lian Hu, and Xin Cheng are the highest and the EVI values in Tai Bai, Zhou Zhi, and Feng Xian are the lowest. (3) In the central region of GZPUA, the spatial variation of CEVI is distributed in a circle that is highly congruent with the region's economic and population development characteristics, whereas the spatial variation of CEVI in the southern mountainous region of the study area is primarily constrained by the topography and natural conditions. This region has low CEVI because of the high mountains and thick forests, which is a crucial ecological barrier for the GZPUA. (4) The EVI, ecological sensitivity index (ESI), ecological elasticity index (EEI), and ecological pressure index (EPI) have a strong relationship with land use. Among them, farmland and built-up land showed highly significant correlations with the EVI, ESI, EEI, and EPI ($p < 0.01$).