

# Research on eco-environmental vulnerability evaluation of the Anning River Basin in the upper reaches of the Yangtze River

Huaiyong Shao · Meng Liu · Qiufang Shao · Xiaofei Sun · Jinhui Wu · Zhiying Xiang · Wunian Yang

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**Abstract** The Anning River Basin is located in the transitional zone of the Qinghai-Tibet Plateau, Yunnan-Kweichow Plateau and Sichuan Basin. This transitional zone is an important ecological barrier of the upper reaches of the Yangtze River and plays a significant role in the ecological security and ecological construction of Sichuan Province. However, the innate vulnerability of the eco-environment combined with the unreasonable development and use of minerals, hydropower, agriculture and animal husbandry resources contribute to prominent eco-environmental problems. In support of remote sensing and geographical information system, this study uses the spatial principal component analysis (SPCA) method to build the evaluation model for the vulnerability evaluation and analysis of the eco-environment in the Anning River Basin. The following indicators are selected for the SPCA: elevation, slope, vegetation index, land use, soil type, soil erosion, precipitation, temperature, and population density. Thereafter, the first four principal components are selected and their corresponding weights are determined. The eco-environmental vulnerability comprehensive index of the Anning River Basin is calculated by using these data. According to the calculated results, the eco-environmental vulnerability of the

Anning River Basin is divided into five levels, namely, potential vulnerability, slight vulnerability, light vulnerability, moderate vulnerability, and high vulnerability. Eco-environmental changes for the past 20 years (from 1990 to 2010) are discussed and analyzed as well as the driving forces. The analysis shows that the eco-environmental vulnerability of the Anning River Basin is at the moderate level, and exhibits obvious vertical distribution characteristics. The main reasons that cause eco-environmental changes are mainly human factors, socioeconomic factors, and environmental protection policies like “Natural Forests Protection” and “Grain-for-Green”. Based on the vulnerability classification results, the Anning River Basin is divided into three partitions for different degrees of eco-environmental reconstruction and protection, which provides foundation for the local eco-environmental reconstruction so as to reconstruct in order of the importance and urgency.

**Keywords** Eco-environmental vulnerability · The Anning River Basin · GIS · RS · SPCA

## Introduction

The Anning River Basin is located in the transitional zone of the Qinghai-Tibet Plateau, Yunnan-Kweichow Plateau, and Sichuan Basin. The transitional zone is an important ecological barrier of the upper reaches of the Yangtze River and plays significant role in the ecological security and ecological construction of Sichuan Province (Sichuan Outline of the 12th Five-Year Plan). However, this eco-environment is innately vulnerable because of its complex geological structure, broken rock, steep slopes, deep valleys, and concentrated rainfall. The combined interference of unreasonable development and improper use of minerals,

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Meng Liu is the co-first author.

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H. Shao (✉) · M. Liu · Q. Shao · X. Sun · J. Wu · Z. Xiang · W. Yang  
Chengdu University of Technology,  
610059 Chengdu, China  
e-mail: shaohuaiyong@cdu.cn

H. Shao · M. Liu · X. Sun · J. Wu · Z. Xiang · W. Yang  
Key Laboratory of Geoscience Spatial Information Technology,  
Ministry of Land and Resources of the P.R.China,  
610059 Chengdu, China