

Impacts of Land Use Patterns on Flood Risk in Henan Province: Current Assessments and Future Projections

李龙、陈俊

中国矿业大学

摘要: Land use is a critical factor that influences regional river systems and urban flood risk, making it imperative to integrate land use considerations into urban flood risk management strategies. This study aims to comprehensively evaluate how flood risk varies under different land use scenarios in Henan Province, Central China. This region suffered severe rain-induced floods in July 2021, resulting in hundreds of deaths and approximately 84 billion yuan in property losses. To assess the flood risk for the year 2021, we rigorously selected a total of 14 key environmental and socioeconomic indicators and determined their weights by the Criteria Importance Through Intercriteria Correlation (CRITIC) method. These weighted indicators were then applied within the hazard-exposure-vulnerability-resilience framework to measure hazard, exposure, vulnerability, and resilience indices, and overall flood risk. In addition, to forecast flood risk for the year 2035, we employed an integrated approach combining the Patchwork Land Use Change Simulation (PLUS) model with the Bayesian network (BN) analysis. This approach allowed us to predict flood risk for each city in the year 2035 under three different land use scenarios: natural, economic development, and sustainable development. Our findings reveal the spatial variability of flood risk in 2021, with a serious-level flood risk in north Zhengzhou, northwest Zhoukou, and northwest and central Shangqiu, and a low-level flood risk in cities including Jiyuan, Sanmenxia, and Hebi. For flood risk in 2035, our projections suggest a significant reduction in flood risk across most cities under the sustainable development scenario, whereas flood risk is anticipated to increase under the economic development scenario. In conclusion, our study highlights the importance of adopting land use patterns aligned with sustainable development goals to mitigate flood risk effectively. This underscores the critical role of urban planners and decision-makers in implementing strategic land use practices, optimizing spatial land use configurations, and proactively reducing the probability of future urban flood disasters.

关键词: land use, flood risk, risk assessment, PLUS, Bayesian network