

## Research on the Relationship between Landscape Pattern Change and Water Cycle in Haihe River Basin

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Due to rapid economic development and population explosion, Haihe River Basin has become one of those watersheds that suffer intensive interference from human activities. In particular, the water system of Haihe River Basin has been significantly changed. Specifically, watershed landscape pattern changed with the changes in land use, industrialization and urbanization, and with the construction of large-scale water conservancy projects, as well as the path and flux of water circulation that showed gradually reduction. This paper aims to investigate the influences of landscape pattern change on water cycle, providing a theoretical basis for future water resources management. The main contents and findings are presented as follows: (1) The temporal-spatial variability of water cycle and landscape pattern in Haihe River Basin were analyzed. Due to limitations of conventional landscape indices, a Runoff Landscape Index (RLI) was constructed to reflect the contribution of landscape factors to natural runoff. Then, correlation analysis for RLI and water flux was conducted, and a significantly correlation was found. (2) A water cycle intensity assessment model was constructed, with RLI and Patch Density (PD) of urban land selected as variables to establish a relationship between water cycle intensity and landscape indices. (3) Based on the intensity and structural evolution of water cycle, three states of the water cycle including Natural Circulation (NC), Moderate Development (MD), and Overexploitation (OP) were proposed and its thresholds of state evolution were recommended. States of water circulation from 1956 to 2000 were evaluated in water resources regions. According to the findings, we can conclude that water circulation pattern was significantly affected by human activities, and reflected by the landscape indexes.