Relationship between "source and sink"landscape patterns and river nutrient discharge in a peri-urban watershed

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Better understanding of landscape pattern affects water quality in the peri-urban watershed are essential for sustainable development and utilization of water resources.A peri-urban watershed refers to a watershed located in the transition or interaction zone, landscape features aresubject to rapid modifications induced by human activities.Humans alter land uses and the landscape patterns both temporally and spatially.Land uses in a watershed can be functionally grouped into “source” or “sink” landscapes based on their contribution to the formation of nonpoint-source pollution in the watershed.As a result, the surface runoff and nutrient loading from a watershed are affected not only by the proportion of “source” and “sink” landscapes but also by their spatial arrangement and distribution.The assessment of non-point source pollution in peri-urban and urban watersheds is challenging but crucial for bothwater resource managers and urban planners.
The Yuqiao Watershed located in northern Tianjin City and southern part of Hebei Province, China ,which was chosen as an example of a peri-urban watershed. Based on the "source-sink" landscape characteristic index of the river basin and combined with the water quality data of 33 sub-basins in the river basin of the bridge reservoir in recent years, The relationship between landscape pattern and water quality was analyzed by spatial analysis, correlation analysis and redundancy analysis (RDA) using landscape use and landscape index as explanatory variables and nitrogen and phosphorus load as dependent variables.Results show that Under the influence of urbanization, From 1984 to 2013, the percentage of "sink" landscape (forest and grassland) decreased from 46.5% to 31.9%, entirely the result of the sharp reduction in forested area from 37.5% to 18.9%. In contrast, the percentage of "source" landscape (urban, orchard, and cultivated land) increased from 49.6% to 62.5%. Among them, the urban land increased from 11.6% to 18.1%. The global Moran's I value of landscape spatial load comparison index (LWLI) is 0.637, $P < 0.01$, and tends to cluster in space.LWLI was significantly correlated with the spatial distribution of nitrogen and phosphorus in the basin. The complex correlation coefficient R^2 of TN and LWLI in peacetime was 0.811, and that of LWLI and TP in wet season was 0.741.The axial angles among patch density (PD) , Shannon Diversity index (SHID) and TN,TP were smaller,indicating that PD and SHID had more influence on the nitrogen and phosphorus in the catchment.Compared with other landscape characteristics indexes, LWLI has the largest impact on nitrogen and phosphorus in rivers, and urban residential land is an important contributor to water pollution in watershed. The results could potentially provide a thoretical support for the optimization of the landscape paterrn in watershed.

Keywords: watershed, landscape pattern, nitrogen and phosphorus , spatial analysis, urbanization

