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研究报告

高伟,伊璇,刘永,郭怀成.可持续性约束下开放流域系统氮磷环境承载力研究[J].环境科学学报,2016,36(2):690-699

可持续性约束下开放流域系统氮磷环境承载力研究

Environmental carrying capacity of nitrogen and phosphorus in an open watershed system under sustainability requirement

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摘要: 随着我国有机污染物控制力度不断加大,氮磷营养盐逐步凸显为流域环境质量改善与经济社会发展的重要约束因子.如何以流域氮磷环境承载力为约束,实现经济社会优化发展已成为我国流域环境管理面临的主要难题.传统的环境承载力研究局限于流域内部的自然资源约束和经济社会优化,忽略了流域内外物质交换对承载力的影响,结果往往以牺牲外部可持续性为代价.基于开放系统视角,本研究提出可持续性约束下的流域氮磷环境承载力概念与测度方法,认为流域氮磷环境承载力是指在流域内外氮磷营养盐交换平衡的前提下,流域水环境氮磷含量达标情况下所能承载的最大人口规模.以氮磷污染严重的滇池流域为例,构建了氮磷环境承载力优化模型,得到滇池湖体氮磷达标和流域内外氮磷交换平衡约束下流域的最大人口承载能力为538万人,相对于现状2010年可提升32%;此外,外流域调水、氮磷循环利用率和污水外排等措施对承载力有显著影响.

Abstract: As mitigation of organic pollution has become an increasing priority in China, the importance of nutrients such as nitrogen and phosphorus as controls for improving environmental quality and socioeconomic development has become more evident. A key question for environmental management in Chinese watersheds is how to sustain socioeconomic activity in compliance with environmental quality. Conventional environmental carrying capacity studies focus on the internal relationship between environment and human actions in watersheds and overlooks the interactions between activities inside and outside the watershed, resulting in decisions which may compromise the sustainability of external regions. We develop a concept and corresponding model of environmental carrying capacity from an open system perspective, in which the maximum sustainable population is determined that meets environmental standards for aquatic nutrient concentrations (nitrogen and phosphorus) and balances the exchange of nutrients across watershed boundaries. Using Lake Dianchi Basin, which suffers from severe nutrient pollution, as a case study, an optimization model of carrying capacity is established. Results show that the maximum sustainable population of the basin can reach 5.38 million, which is 32% higher than that of 2010. Water transfer, nutrient recycling rate and pollution transfer are important factors influencing the carrying capacity of the basin.

Key words: [nutrients](#) [environmental carrying capacity](#) [sustainability](#) [pollution transfer](#) [Lake Dianchi](#) [nitrogen](#) [phosphorus](#)

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