区域环境与发展

基于合作博弈的流域水污染治理成本分摊研究

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Cost Sharing of Watershed Water Pollution Abatement Based on Cooperative Game

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摘要 运用合作博弈理论，针对流域水污染治理的成本分摊问题构造成本分摊博弈，在传统的夏普利值解的基础上，提出运用新提出但更具有普适性的二项式半值解的概念。以长江流域三峡库区相邻3个行政区域——忠县、万州、云阳作为研究对象，以化学需氧量作为水质指标，在考虑联盟结构的情况下，通过多重线性扩展方法进行求解。研究结果满足二项式半值特征函数要求具备的超可加性、集体理性和个体理性3个条件，流域水污染治理成本在3个地区间进行了公平合理的分摊，证明了该方法的有效性。

关键词： 流域水污染 合作博弈 成分分摊 二项式半值 联盟结构

Abstract： Using the theory of cooperative game,the problem of cost sharing in watershed water pollution abatement was transformed into a cost sharing game.On the basis of the traditional Shapley value method,a new but more universal concept of binomial semivalue solution was brought forth and adopted.The three adjacent administration regions in the Three-Gorge Reservoir on the Yangtze River were set as research objects and chemical oxygen demand (COD) as water quality index.The problem was solved with the multilinear extension method,taking into account its coalition structure.Results show that the solution satisfied the three conditions,i.e. super-additivity,individaual rationality and collective rationality,that a characteristic function of binomial semivalue must have,and that the cost of watershed water pollution abatement was fairly and reasonably allocated among the districts,which validates the effectiveness of this method.

Keywords： watershed water pollution cooperative game cost sharing binomial semivalue coalition structure

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