Allocate river water in a cooperative way: a case study in the Dongjiang River Basin, South China

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Water resources provide foundation for human development and environmental sustainability. Water shortage more or less occurs in some regions, which usually causes sluggish economic activities, degraded ecology and even conflicts and disputes among water users. Game theory could better reflect the behaviors of the involved stakeholders and has been used in water resources management. This paper presents a framework to allocate water of a river basin in a cooperative way which applies the TOPSIS model combined with the entropy weight to determine stakeholder' initial water allocation and reallocates water and net benefit by using several solution concepts for crisp and fuzzy core-based games, providing technical support for water rights trade to relieve water use conflicts between stakeholders in the upstream and downstream and maintains healthy river system. The framework is demonstrated with an application to the Dongjiang River Basin, South China. The results show the effectiveness of this framework for water decision making in the context of water management in the river basin.