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Inexact multicriteria decision analysis for climate change impacts on small drinking water systems

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Unreliable water supplies, poor water quality, and water shortages associated with water pollution have been considered as major obstacles to sustainable development, leading to a variety of adverse impacts on social-economic development and human life. Small drinking water systems often have more difficulties on meeting regulated drinking water quality standards and objectives because of a lack of sufficient technical, managerial and financial resources. They are often located in geographically isolated rural areas surrounded by agricultural land, and the source water is subject to run-off pollution. In a changing climate, the characteristics of run-off pollutants have been changing due to shifting weather pattern and hydrological regime. The effects of climate change on the spatial and temporal variations of run-off pollutants are important for planning and management of small drinking water systems. In this study, an inexact multicriteria decision analysis approach is developed for analyzing the effects of climate change on small drinking water systems, which incorporates several multicriteria decision analysis techniques and interval fuzzy information transformation methods. The developed approach is then applied in a western Canada case study. Effective strategies can be generated for providing decision support for planning and management of small drinking water systems under changing climate conditions. The uncertain information expressed by interval values and/or fuzzy membership functions can be effectively handled.