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Let water live forever

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This paper aims to measure water scarcity level of a region and make predictions so as to make plans to alleviated water scarcity.

Based on the water supply and demand, we take both social and environment drivers into account and find 5 important indicators. We define two indexes (Physical Scarcity Index and Economy Scarcity Index) to describe physical water scarcity and economy scarcity respectively and Entropy method are used to get their weights. A two dimension evaluation system is built through which we can get comprehensive water scarcity degree and scarcity types which enable us to know main reasons caused water scarcity.

Then the model is applied into Shandong, a province of China where water is heavily overloaded and turns out to reflect the reality well and we find Shandong is both physical and economy scarcity. After analyzing the reasons caused water scarcity in Shandong, social and environment drivers are found. According to the results of GM (1,1) model prediction, Shandong will suffering more serious physical water scarcity while the economy scarcity be alleviated in 15 years.

Focus on the situation in Shandong, we raise an intervention plan with respects to social and environment drivers. The plan involves various measures and its impacts on water ecosystem and surroundings areas are discussed detailed. Adding economy costs into account, AHP method is used to make optimization of our plan. We add the plan into the model built before through introducing control factors and make prediction again. The results are satisfying: with the help of plan, ES is limited below 0.2 which means Shandong is no longer economy water scarcity. Although it will still suffer physical scarcity, things get much better and PS maintains about 0.5. In a word, Shandong can become less susceptible to water scarcity.

Finally, we analysis the sensitivity of our model by change key factors' data. Overall, our model take social and environment factors into consideration and could reflect comprehensive information of water scarcity. It works well in Shandong and with the help our plan, we successfully predict and alleviate water scarcity in future of Shandong