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Evaluation of water ecological civilization based on PSR matter element model

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The establishment of a suitable model for evaluating water ecological civilization plays an important role in researching the relationship between the water ecosystem and human social activities. As the water ecological civilization is a vague concept, quantitative evaluation is crucial for the water ecological civilization evaluation. In order to evaluate the level of regional water ecological civilization, the connotation and evaluation methods of water ecological civilization were discussed based on pressure state response (PSR) model. Water ecological civilization evaluation index system was proposed which consisted of 3 elements and 20 indicators. Index weight was determined by entropy method to reduce the interference of human subjectivity on the evaluation result. The matter element theory was adopted to analyze and solve the fuzziness and incompatibility of the evaluation index by constructing the classical matter element and the section matter element of the water ecological civilization. The correlation of each index and evaluation grades were analyzed. The model can reveal the real state of water ecological civilization and the existing problems. Combined with the model and the collected data, The water ecological civilization evaluation results of the suburbs in Jinan city in 2010, 2013 and 2015 were calculated. The results show: (1) The judgement grade of the indexes including water consumption, the standard of water quality and the degree of soil erosion were increasing rapidly. It meant that that this region was in continuous improvement in terms of the water resources utilization efficiency, water quality protection and water ecological restoration from 2010 to 2015. (2) The water ecological civilization of research region improved slightly overall. The ability of human beings to protect the water ecosystem was greatly improved. The health of the water ecosystem was enhanced. While the water ecosystem pressure was not reduced significantly. (3) The evaluation index system of water ecological civilization base on PSR model is comprehensive and logical. It is suitable for evaluation of water ecological civilization. By using the entropy weighted matter-element model can not only determine the overall status and stability evaluation of the object for the water ecological civilization evaluation, but also reveal the single evaluation index information. The method solved the problems of subjective uncertainty and non quantization caused by water ecological civilization concept. The water ecological civilization evaluation method can be used as reference for similar areas.