



Explore the impacts of river flow and quality on biodiversity for water resources management by AI techniques

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Water resources development is very challenging in Taiwan due to her diverse geographic environment and climatic conditions. To pursue sustainable water resources development, rationality and integrity is essential for water resources planning. River water quality and flow regimes are closely related to each other and affect river ecosystems simultaneously. This study aims to explore the complex impacts of water quality and flow regimes on fish community in order to comprehend the situations of the eco-hydrological system in the Danshui River of northern Taiwan. To make an effective and comprehensive strategy for sustainable water resources management, this study first models fish diversity through implementing a hybrid artificial neural network (ANN) based on long-term observational heterogeneity data of water quality, stream flow and fish species in the river. Then we use stream flow to estimate the loss of dissolved oxygen based on back-propagation neural networks (BPNNs). Finally, the non-dominated sorting genetic algorithm II (NSGA-II) is established for river flow management over the Shihmen Reservoir which is the main reservoir in this study area. In addition to satisfying the water demands of human beings and ecosystems, we also consider water quality for river flow management. The ecosystem requirement takes the form of maximizing fish diversity, which can be estimated by the hybrid ANN. The human requirement is to provide a higher satisfaction degree of water supply while the water quality requirement is to reduce the loss of dissolved oxygen in the river among flow stations. The results demonstrate that the proposed methodology can offer diversified alternative strategies for reservoir operation and improve reservoir operation strategies for producing downstream flows that could better meet both human and ecosystem needs as well as maintain river water quality.

Keywords: Artificial intelligence (AI), Artificial neural networks (ANNs), Non-dominated sorting genetic algorithm II (NSGA-II), Sustainable water resources management, Flow regime, River ecosystem.