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A Multi-Objective Approach for the Analysis of a Water-Food-Ecosystems Nexus at Basin Scale

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The severe water deficit in recent years has multiplied the economic, social and environmental significance of water resources globally, making optimal planning in water resources necessary for a sustainable socio-economic development. Iran is no exception in this; one of the regions in Iran which is most affected by this is the Sistan region and its Hamoon wetland, located in south east Iran. Water policies are essential to sustain current basin ecosystem services, maintaining a balance between conflicting demands including agriculture, the protection of wetland ecosystems and domestic water consumption.

In the present study, a hydro-economic model is linked with the WEAP software to analyse water allocation decisions. We formulate and parameterise a two-objective optimisation problem where the net benefit of agriculture and the supply of environmental requirements were maximized, in order to analyze the trade-off between different stockholders. This problem is modelled and implemented for the study area with detailed socio-economic and environmental data for 30 years. In addition, fuzzy theory sets are used to consider uncertainty due to vagueness, ambiguity and the impreciseness of observed information in parameters such as crop yield, crop price, water inflow and domestic consumption.

Key Words: Water-Food-Ecosystems Nexus, Water Allocation, Cropping Pattern, Multi-objective Optimisation, Uncertainty Analysis