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Preserving the World Second Largest Hypersaline Lake under Future Irrigation and Climate Change

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Urmia Lake, the world second largest hypersaline lake, has been largely desiccated over the last two decades resulting in socio-environmental consequences similar or even larger than the Aral Sea disaster. To rescue the lake a new water management plan has been proposed, a rapid 40% decline in irrigation water use replacing a former plan which intended to develop reservoirs and

irrigation. However, none of these water management plans, which have large socio-economic impacts, have been assessed under future changes in climate and water availability. By adapting a method of environmental flow requirements (EFRs) for hypersaline lakes, we estimated annually $3.9 \bullet 10^9$ m^3 water is needed to preserve Urmia Lake. Then, the Variable Infiltration Capacity (VIC) hydrological model was forced with bias-corrected climate model outputs for both the lowest (RCP2.6) and highest (RCP8.5) greenhouse-gas concentration scenarios to estimate future water availability and impacts of water management strategies. Results showed a 10% decline in future water availability in the basin under RCP2.6 and 27% under RCP8.5. Our results showed that if future climate change is highly limited (RCP2.6) inflow can be just enough to meet the EFRs by implementing the reduction irrigation plan. However, under more rapid climate change scenario (RCP8.5) reducing irrigation water use will not be enough to save the lake and more drastic measures are needed. Our results showed that future water management plans are not robust under climate change in this region. Therefore, an integrated approach of future land-water use planning and climate change adaptation is therefore needed to improve future water security and to reduce the desiccating of this hypersaline lake.