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**Groundwater Level Response to Climate Change and Human Activities in Dry Regions:
A Case Study in the Amu Darya Delta**

by

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KEYWORDS. — Aral Sea; Ecosystem Restoration; Groundwater Management; Future Scenarios.

SUMMARY. — The Aral Sea's decline, primarily caused by inefficient irrigation and water resource management, represents a dire ecological issue. To figure out the cause, trend, response to the surroundings and future possibilities, a series of studies have been carried out. Subsequently, a restoration proposal has been raised regarding the properties of local landscapes. As one of the important issues, groundwater water management also relates to the recharges of the Aral Sea, salinity control and crop yield. Our study on the Amu Darya Delta's groundwater (GW) from 1999 to 2017 revealed significant variations due to irrigation and proximity to the South Aral Sea. We projected increased evapotranspiration and a slight rise in river runoff, with GW being the primary water source for the lake. Yet, without improved water management, the lake is set to shrink further. We explored efficient irrigation's impact on GW through four scenarios, with results favouring improved practices that could reduce water table decline and potentially aid in partially restoring the South Aral Sea. A developed multi-objective genetic algorithm for GW management optimized pumping rates, indicating sustainable GW use, is feasible and crucial for ecological and socio-economic stability in arid regions.

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