Salton Sea Hydrology

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Abstract

Hydrology, the study of water and its distribution, quality, and environmental impact, is crucial for understanding the complexities of water systems vital to human existence. This report explores the hydrological challenges facing the Salton Sea watershed, situated in Southern California and the Mexicali Valley in Mexico, where human activity intersects with ecological sensitivity. Achieving a balance between agricultural water needs and ecological integrity requires a deep understanding of the hydrological processes and interactions with groundwater.

Introduction

Hydrology can be broken into "hydro" and "ology." "Hydro" comes from the Greek word for water, and the suffix "ology" means the study of, so hydrology is the study of water! Hydrology has evolved as a science in response to the need to understand the complex water systems that humans depend on for life. Water is one of our most important natural resources; without it, there would be no life on earth. The supply of available water for human use is limited by nature, and although there is plenty of water on earth, it is not always in the right place, at the right time, and of the right quality. Hydrologists, or scientists who study water, play a vital role in understanding these complex systems and finding solutions to water problems.

The Salton Sea Watershed

The Salton Sea watershed, or an area or ridge of land that separates waters flowing to different rivers, basins, or seas, is an endorheic (closed) basin located in Southern California and the Mexicali Valley in Mexico. This particular watershed is one of the most productive agricultural regions in the United States and includes the Salton Sea. Endorheic basins and lakes play a crucial role in the hydro-ecological functioning and aquatic biodiversity of arid (a region with little to no rain) and semiarid regions. They provide numerous ecosystem services to humans and serve as critical habitats for wildlife and unique microorganisms. Nearly half of the endorheic basins around the world, including the Salton Sea, are in water-stressed regions, where the lake storage is maintained by the balance between inflows (i.e., rain, surface runoff, and groundwater inflow) and outflows (i.e., evaporation and discharge to groundwater).

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The lake's storage losses can be attributed to losses in groundwater, surface water, and soil moisture caused by climate variability and water management. Annual precipitation in the region during 1980–2018 indicates cycles of wet and dry periods relative to the long-term mean annual precipitation, which since 2010 has been lower than the 39-year average.

In recent years, the average Colorado River inflows to the Salton Sea watershed have declined, with lake level observations indicating a total decline of 8.7 ft since 1988. Satellite imagery also shows a decrease in lake area from 369.1 square miles to 339.5. Significant declines in lake water level and area between 1995 and 2018 coincide with declining trends in annual inflows to the Salton Sea, suggesting that lake-level declines may accelerate with future increases in air temperature and higher evaporation rates.

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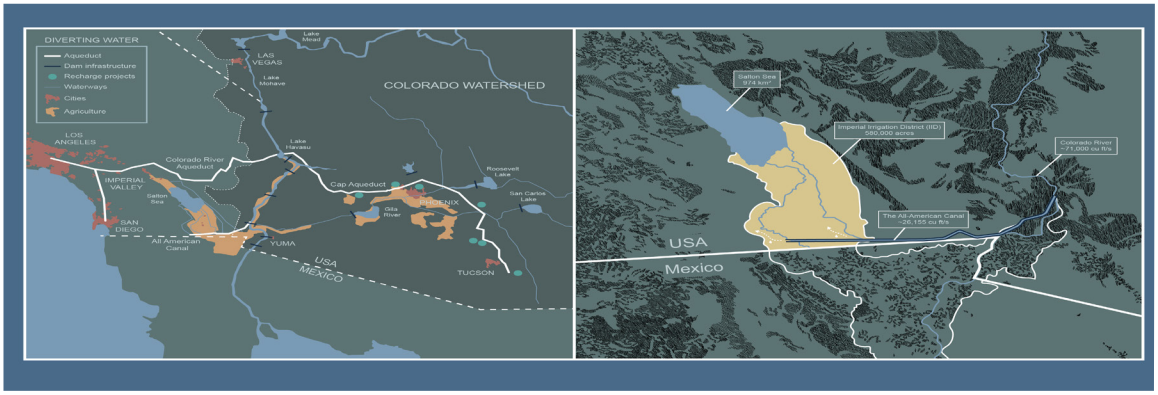
Given the air quality issues and deterioration of internationally significant wildlife, restoring the Salton Sea is of state and national interest. To determine the optimum lake water level to reduce lakebed dust and maintain wildlife habitat while recognizing the intersection between the Salton Sea and agricultural water use in the watershed, research efforts have been focused on understanding the hydrologic processes and lake-groundwater interactions. Recent research has shown that decreases in the Colorado River allocation are causing the Salton Sea to shrink, which coincides with the 1998 conserved water transfer agreements and 1999 Colorado River Water Use 4.4 Plan.



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