Geophysical Research Abstracts
Vol. 21, EGU2019-6427, 2019
EGU General Assembly 2019

Groundwater Development-Induced Basin Closure: An Unrecognized Threat to Water Quality Sustainability

Graham Fogg (1), Richard Pauloo (1), Zhilin Guo (1), Yang Zhan (2), Xin He (2), and Chunmiao Zheng (2)
(1) University of California, Davis, United States, (2) Southern University of Science and Technology, China

Much of the world's food supply comes from irrigated agriculture in sedimentary basins containing major aquifer systems that supply much of the irrigation water. Owing to the effects of not only groundwater overdraft, but also seemingly sustainable groundwater development, many of the basins have become hydrologically closed such that most of the groundwater, rather than exiting via stream baseflow and lateral flow to adjacent groundwater systems, exits predominantly by evapotranspiration from the irrigated lands. In these newly closed hydrologic basins, just as in other closed basins, groundwater salinization is inevitable because the dissolved solids that are produced constantly by rock-water interactions cannot escape. The only way to reverse salinization of groundwater basins that we have closed, is to open them via a re-imagining of water storage schemes that puts sufficient emphasis on subsurface storage to recreate the natural mechanisms of discharge of groundwater and the entrained solutes. Resolution of this challenge in the face of climate change and drought can be accomplished by long-term planning and alternative land management that produces much greater groundwater recharge during wet periods and a greater emphasis on subsurface storage instead of the traditional emphasis on surface storage. The other, much less desirable alternative would be the eventual desalination of much of the irrigation water. Groundwater and salt balance analyses in two major aquifer systems, the southern Central Valley of California and the North China Plain, indicate that basin closure is creating massive salinization of shallow groundwater on decadal time scales and will render much of the groundwater unsuitable for irrigation or drinking on time scales of one to three centuries. Currently, civilization is more than a half century into this troubling experiment.