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Editorial

Groundwater Depletion: Current Trends and Future Challenges to Mitigate the Phenomenon

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Groundwater constitutes the primary source of drinking water for more than two billion people across the globe. Additionally, groundwater contributes to food and energy security, as well as human health and ecosystem preservation. However, groundwater depletion is a common phenomenon worldwide. This phenomenon appears when extraction surpasses the recharge of the aquifer, and it is triggered by the socioeconomic framework and controlled by the aquifer regime. Groundwater depletion can lead to seawater intrusion in coastal aquifers, a reduction in river base flow, upconing of deep geothermal water, and increased pumping costs. Groundwater depletion has been reported on both a global and regional scale. This Special Issue, entitled "Groundwater Depletion: Current Trends and Future Challenges to Mitigate the Phenomenon", attempts to highlight the efficiency and adequacy of global and regional strategies to mitigate the phenomenon and to promote the transition from regional to aquifer scale. Additionally, it is critically important to appraise the role of climate variability, management practices, and the monitoring of groundwater reserves. The Special Issue also provides the state-of-the-art of tools and methods to map, model, and forecast the phenomenon.

Particularly, this Special Issue includes 11 articles, providing all aspects of the groundwater depletion phenomenon in several different countries incorporating aquifers with different hydrogeological conditions. In an article by Papadopoulos et al. (Contribution 1), the fuzzy logic approach was used to develop a multi-criteria model for the selection of groundwater recharge sites. The model was developed for the aquifer system in the agricultural plain of the Prefecture of Xanthi in northeast Greece. In the unconfined aquifers of the Campania region in southern Italy, a simulation model was obtained in order to determine the dynamic and the impact of boundary conditions on groundwater budget. The non-uniform extinction depth is highlighted as the most influential in aquifer dynamics, while both sea level and rivers scarcely affect groundwater budgets (Contribution 2). Contribution 3 estimated the groundwater storage changes/anomalies (GWCs) in the Indus River Basin, using data from GRACE and the WaterGAP Hydrological Model. Groundwater storage is mainly triggered in the study area by climatic variations and increased pumping for irrigation.

Contribution 4 suggested the use of a closed-surface coal mine as lake to store water and use it for energy production, irrigation, and as a recreation park. Tzampoglou and Loupasakis (Contribution 5) used satellite and in situ data to provide evidence of the overexploitation of the aquifer in the Amyntaio basin, both by dewatering wells of an open-pit coal mine and irrigation wells. Contribution 6 introduced a comprehensive methodology for water resource management, including "framing", "mapping", "involvement", "co-production", and "sharing" phases. Contribution 7 suggested a nature-based solution for the restoration of groundwater level decline in the Gansu Province of China. Contribution 8

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provided the results of the APLIS model for the estimation of groundwater recharge in Karst aquifers in southern Greece. The occurrence of microplastics was identified in the groundwater of SE Attica, Greece (Contribution 9). Contribution 10 highlighted the complementarity of long-term piezometric data combined with hydrogeophysics and fracture analysis to understand complex aquifer structure and groundwater dynamics. Groundwater flow dynamics were estimated using a numerical model (FEFLOW) in the Moghra desert of Egypt (Contribution 11).

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We believe that this work will stimulate researchers to quantify groundwater depletion at several sites worldwide and suggest strategies to mitigate the phenomenon at the aquifer scale.

Conflicts of Interest: The authors declare no conflict of interest.

List of Contributions

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