INTEGRATED GROUNDWATER QUALITY MONITORING NETWORK DESIGN CASE STUDY: EOCENE AQUIFER, PALESTINE

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Groundwater quality monitoring is an essential component in sustainable water resources management, especially for groundwater-dominated systems. This study introduces a methodology to design a groundwater quality monitoring network that incorporates the economic value of information (VOI), the health risk consequences, and uncertainties in climate and aquifer properties. VOI is represented here by the willingness to pay for groundwater quality monitoring in the Eocene Aquifer, Palestine, which is an unconfined aquifer located in the northern part of the West Bank. The aquifer is used by 128,000 Palestinians to fulfill domestic and agricultural demands. The study takes into account the health-related consequences of pollution and the supply options the decision-maker faces. Since nitrate is the major pollutant in the aquifer, the consequences of nitrate pollution were analyzed, which mainly consist of the possibility of methemoglobinemia (blue baby syndrome). In this case, the value of monitoring was compared to the costs of treating for methemoglobinemia or the costs of other options, such as water treatment, using bottled water, or importing water from outside the aquifer. Finally, an optimal monitoring network that takes into account the uncertainties in recharge (climate), aquifer properties (hydraulic conductivity), pollutant chemical reaction (decay factor), and the value of monitoring is designed by utilizing a sparse Bayesian modeling algorithm called a relevance vector machine.