Decision Support System for Integrated Water and Land Management in Agriculture-Dominated Watersheds: A conceptual study to Faria watershed, Palestine

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Abstract

Arid and semi-arid regions are generally characterized by water scarcity and low per capita water allocation. This situation is further exacerbated when such areas are agriculturally dominated and encounter a high population growth rate. Faria watershed, Palestine, is one of these semi-arid regions where the recent prolonged drought periods in the watershed have negatively affected the existing obtainable surface water and groundwater resources. This situation has compelled the motivation for developing optimal water allocation policies that consider the available water resources under the dramatic climatic changes in the watershed such that the economic revenue is maximized. Since the available water resources in the watershed have a sustainable-yield limits that should not be exceeded and owing to the fact that water demand is increasing to fulfill the agricultural and residential requirements, alternative water resources need to be utilized including the use of wastewater effluent and brackish water. In addition, possible changes in land use classes and associated practices impact the water resources availability, spatially and temporarily. The utilization of wastewater and brackish water though economically feasible yet leads to the long-term degradation of water resources accompanied with possible serious harmful health ramifications and the likelihood of negatively affecting the land productivity especially when dealing with brackish water. Therefore, decision criteria have to be developed to account for the economic ramifications, environmental consequences, and water resources availability. This paper conceptually demonstrates a decision support system to integrate different work plans and components in order to assess the conjunctive use of the different water resources in the watershed under different management scenarios driven by climatic changes and land use planning. The framework involves diverse modules for the development of scenarios and management options, a GIS technology to facilitate processing and visualization, mathematical models of surface water and groundwater quantity and quality, an economic model to evaluate the economic ramifications for different management options, and a multi-criteria decision analysis module.

Keywords: Decision support system, multi-criteria decision analysis, GIS, surface water, groundwater, economic analysis, agriculture