



Watershed planning using MODSIM Simulation Model under Different Management Strategies, A Case Study: Maharlou-Bakhtegan Watershed

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Abstract

With a rapid population growth and consequent increasing in water demands in the last few decades, the management of water resources considering environmental protection issues in a watershed scale is under increasing pressure all over the world. Determination of optimal water resources management strategies is relatively complicated because many parameters and disciplines are dealing with extracting optimal water resources management strategies. In this paper, a scenario-based analysis approach was examined for water resources management and planning of Maharlou-Bakhtegan watershed using MODSIM model as a generic river basin management decision support system (DSS). This approach is used to assess the effects of water and land resources development strategies, climate change, groundwater withdrawal levels and irrigation efficiency on municipal, industrial and agricultural water supply as well as environmental water demand satisfaction. For Evaluation of system performance, performance indices including reliability, resiliency and vulnerability are calculated to evaluate the results of the proposed approach. Results showed that MODSIM model has profound capabilities as a DSS tool in facilitating and evaluating the water resources management strategies in watershed scale.

Keywords: MODSIM model, decision support system, water resources management and planning

1. INTRODUCTION

While irrigation is the dominant water use in many arid and semi-arid river basins, agricultural activities account for the majority of water withdrawals from surface and groundwater resources [1]. The decision problems regarding water resources such as water use and allocation, development, conservation, sustainability and sustenance of fragile ecosystems can be confusing and a DSS tool may bring about clarity [2]. Sprague and Carlson (1982) [3] defined a DSS as "an interactive computer-based support system that helps decision makers to utilize data and models to solve unstructured problems." Zaman and et.al in 2009 [4], developed a DSS for integrated water resources management in Bangladesh to assist policy makers and planners by providing information about likely impacts of water-related projects. The DSS has been designed to be a communication and educational tool for non-technical users and key project stakeholders [zaman]. River basin management DSS's are designed to aid stakeholders in developing a shared vision of planning and management goals, while gaining a better understanding of the need for coordinated operations in complex river basin systems that may impact multiple jurisdictional entities. They allow evaluation of hydrologic, economic, environmental, and institutional/legal impacts as related to alternative development and management scenarios [5].

One optimization approach for water resources management problems is to model water resources as a dynamic multi-period network flow problem, where all data are fixed and no level of uncertainty is considered [6, 7]. It is well known that stochastic optimization approaches cannot be used when there is insufficient statistical information on data estimation to support the model, when probabilistic rules are not available, and/or when it is necessary to take into account information not derived from historical data. In these cases, the scenario analysis technique could be an alternative approach [8, 9].

MODSIM is a generic river basin management decision support system originally conceived in 1978 at Colorado State University [10], making it the longest continuously maintained river basin management software package currently available.