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Research Article

Feasibility study and integrated water resources management: Garmsar alluvial fan

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Extended Abstract

Introduction

In recent years, the increasing population, changing lifestyles, and expanding urban and industrial areas have led to a rising demand for water worldwide. This growing demand coincides with the limitation of freshwater resources, particularly in arid and semi-arid regions. Surface water and rivers, which have more concentrated and intense flows, are often the first options considered for extraction and use in these areas. Water is essential for survival, industry, and economic growth, making effective water resource management crucial. Integrated water resource management, particularly the conjunctive use of surface and groundwater, is vital for sustainable rural development. This research emphasizes the need for comprehensive, evidence-based strategies to manage water resources in the marginal desert areas of Iran, particularly in the Garmsar alluvial fan region. The study aims to contribute to maintaining a balance between sustainable development and the protection of natural resources, highlighting the importance of innovative and integrated approaches in water management.

Materials and Method

The study area is located in Garmsar County, which is the westernmost county of Semnan Province in Iran. The region is characterized by its geological setting and the presence of alluvial fans formed by the Hableh River. This research adopts an applied, descriptive-analytical approach, utilizing both library and field methods to gather necessary data. Initially, relevant literature was reviewed to establish a theoretical framework for the study. Field data were collected through observations and consultations with local organizations. The SECA (Simplicity, Efficiency, Clarity, and Accuracy) method was employed for multi-criteria decision-making, allowing for the simultaneous weighting of criteria and ranking of options. This approach enhances accuracy and flexibility by integrating qualitative and quantitative inputs. The research identified three key variables based on seven criteria, which were organized hierarchically for analysis.

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Results and Discussion

The application of the SECA method yielded significant insights into the prioritization of water resource management criteria. The decision matrix was established, and normalization processes were conducted to facilitate analysis. The results indicated that the climate criterion received the highest weight (0.1817), followed by the water consumption rate (0.1564) and water quality (0.1521). Among the options assessed, the efficiency and productivity of resource use ranked first, while water resource sustainability and management systems followed. The study highlighted that integrated and innovative approaches to water resource management could significantly improve water resource conditions and support sustainable development. Effective conjunctive use of surface and groundwater can alleviate pressure on existing resources and contribute to a sustainable water consumption pattern. The findings suggest that enhancing agricultural water efficiency through advanced irrigation systems and smart technologies can significantly improve water use productivity.

Conclusion

In regions where both surface and groundwater resources coexist, surface water may suffice during wet years, while groundwater becomes essential during droughts. However, unplanned and excessive extraction from groundwater resources can lead to irreversible damage to natural ecosystems. The management of these resources requires a comprehensive understanding of the interactions between surface and groundwater, as well as the impacts of extraction and recharge. This study on the conjunctive management of water resources in the Garmsar alluvial fan emphasizes the importance of integrated strategies for sustainable water management. The results indicate that climate, water consumption rates, and resource quality are critical factors in assessing water management options. Implementing effective conjunctive use strategies can enhance water security and sustainability in arid regions, serving as a model for similar environments globally. Overall, the findings underscore the need for smart policies and data-driven approaches to address the challenges of water resource management in arid regions, ultimately contributing to sustainable development and improved quality of life for local communities.

Keywords: Feasibility study, Exploitation management, Water resources, Garmsar alluvial fan, SECA method