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**EXTENDED ABSTRACT**

# Locating the Potential Areas for Executing Surface and Pressurized Irrigation Systems Using Fuzzy Analytical Hierarchy Process Method in Miandoab Plain

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## Introduction

It is necessary to coincide the conditions and specifications of field with the characteristics of the irrigation systems. Feasibility and investigation of the most susceptible regions for implementation of different irrigation systems according to water quantity and quality have great importance and prevent energy and capital resources losses. Different effective variables in selecting irrigation systems types cause that various regions have different potential in water harvesting. Due to different parameters have a different effect on the selection of the suitable location for water harvesting, each element needs to be weighed based on its importance degree. For this purpose, the analytical hierarchy process (AHP) (Saaty, 1980) is used. By combining this method with GIS, multi-criteria decision making is possible at large and high precision levels. In this research, the possibility of implantation of different irrigation systems (surface, sprinkler and drip systems) was evaluated using the fuzzy analytical hierarchy process method (FAHP) based on the quantity and quality of groundwater in Miandoab plain.

## Methodology

In the present study, the effective required qualitative and quantitative indices in implementation of each three irrigation systems were determined. Point data of each effective parameter in the decision was interpolated using Kriging method and the zoning maps were obtained using the Arc-GIS software. For all raster layers, a weight between 0 to 1 was applied using increasing S-shaped and deceasing Z-shaped fuzzy membership functions. Therefore these layers were transformed to fuzzy layers and fuzzy maps were obtained.

Because each of the variables has a different effect on water harvesting, the paired comparison method was used. Then, the weight of each criterion was obtained using Expert Choice software. Using the AHP technique, the weights were multiplied by the fuzzy layers of each of the parameters and the final map of the water harvesting was obtained by the summation of the obtained data as follows:

$$s = \sum_{i=1}^{n} w_i . \mu_i \quad (1)$$

Where, $\mu$ and w are membership function and assigned weight to each of the parameters, respectively.

**Results and Discussion**

The final groundwater classification map for the utilize in surface irrigation showed that groundwater in adjacent regions of Urmia lake has a very high restriction so that the area of mentioned regions is about 32.32% of the studied area. This issue can be attributed to unsuitable condition of groundwater transmissivity and its high salinity and sodicity in these areas. Also, a large part of the central areas of the plain has high restriction (about 57.38% of the plain). In the southeastern regions and far from Urmia lake where has high altitude, ground water restrictions decrease for utilizing in surface irrigation because of reducing the salinity and sodicity of ground water.

The investigation of final map of sprinkler irrigation showed that the adjacent areas of Urmia lake has seriously restrictions for using the ground water. However, in the southwest area of the studied region ground water restrictions reduce. The results demonstrated that in most areas of the plain (about 66/40 % of the studied area), moderate or minor restrictions exist. In the southeastern parts, the aquifer has no restrictions for the implementation of sprinkler irrigation. The reason of the bad condition of the groundwater in the northwest of the plain can be related to the water transferring limitations of the aquifer, as well as high concentrations of sodium and chloride ions in this area. In the southeast areas, the aquifer transmissivity coefficient tends to increase and sodium and chloride ions concentration decreases. Also, in most areas and with attention to the bicarbonate concentration, the aquifer has low to moderate restrictions for the implementation of the sprinkler irrigation systems.

Similarly, ground water in adjacent Urmia lake has serious restrictions for utilizing in drip irrigation, (about 51.89% of the investigated regions). The reason of the considerable restriction can be related to the low transmissivity of the groundwater, the high salinity, total soluble salts concentration, and high sedimentation risk in these areas due to high water hardness and LSI index. In other areas, which start from the middle parts of the plain and extend to the southeastern part, about 46.11 % of the plain have low to moderate restriction with attention to the quantitative and qualitative factors of water.

**Conclusion**

The zoning maps of Miandoab plain restrictions in implementation of surface and pressurized irrigation systems showed that 32.32%, 19.02% and 51.89% of the studied plain have serious restriction in surface, sprinkler and drip irrigation systems implementation, respectively. The results showed that in the case of using the ground water resources for the implementation of pressurized systems it is necessary to apply suitable solutions for selecting and using irrigation systems. These lands are located on the vicinity of Urmia lake and getting away from the lake cause to reduce the restrictions.

**References**

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