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Research Paper

Zoning suitable areas for underground dam construction in the Beyza plain using Landsat 8 data

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Abstract

Underground dams are considered as a modern solution for the conservation of underground water resources. The location of underground dams is based on the morphological and hydrological conditions that is necessary for construction. In this study, Bayez plain which is located in Fars province, is investigated. First of all, 6 information layers as land use, lithology, slope, topography, streams density and lineaments density were chosen. Each layer is also classified in substrates and each one has assigned the appropriate weight by using AHP and considering their qualitative effects. The final integration map was obtained by combining the layers of information in Arc map. This map shows the proper and inappropriate areas in Bayez Plain for constructing underground dams. The results showed that the weights of canal density, lithology, slope, land use, topography and line density were 44.8, 23.4, 15, 8.8, 5 and 3 respectively. At last, three locations were proposed for the construction of underground dams by monitoring the final map, by considering the factors of the upstream conditions and the location of the dam axis. Among these locations, the upstream area of Mansh, known as Tang Bang, had better conditions for the construction of an underground dam. Underground dams in these areas, in addition of creating new sustainable water resources, also prevents flood and helped to feed the aquifers.

Keywords: *Underground Dam, Landsat 8, GIS Software, Beyza plain*

Extended Abstract

Introduction:

The limited amount of available water with increasing in population and the development of industrial and agricultural uses, on the other hand, has made groundwater a valuable source of water supply. The importance of this issue is particularly emphasized in arid and semi-arid regions or areas that have limited surface water for various reasons, including high evaporation and permeability of surface soils. In such areas the control and management of groundwater resources and strategies to increase the potential of harvesting these resources through storage are of high sensitivity and value. In

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order to overcome seasonal water scarcity we must use groundwater, but in some areas during the dry season even groundwater supplies are scarce and not available. It requires drilling deep wells and installing the pump, which is not economical. In these areas due to the specific climatic conditions and high evaporation rate, the storage of substrate water flow within the alluvial reservoirs of underground dams is economical solution.

Methodology:

In this study, by using the Landsat 8 satellite data and ENVI and GIS software, the information layers for underground dam location include waterway density, lithology, and slope, land use, topography and flow direction. Plants and vegetation were prepared and extracted. From the selected layers, the vegetation layers are prepared for the purpose of knowing the status of the vegetation and are not included in the weighting. According to the studies, the most important layers in terms of positive impact on the location of the underground dam construction are the condensation layer, lithology and slope, and the flow direction layer is considered as negative impact.

Results and discussion:

In order to concentrate locating in plain as a suitable location for locating underground dam construction, slope heights were classified in the map. It is considered more effective in weighting the topography of the slopes. Then By using the DEM layer, the slope map of the area, which is important in locating the underground dam, was also drawn (Figure 7). It can be seen that most of the central and eastern regions have low and suitable slopes for the construction of underground dams, and most of the steep slopes are in the marginal elevations of the area. . Also in this study, a supervised classification method using the nearest neighborhood in ENVI software was used for lithological separation. This was done with the help of the Geological Map 1/100000 and taking 10 classes for classification. In order to locate the underground dam, 6 layers of information including line density, waterway density, topography, slope, lithology and land use were prepared. For determining the weight of each layer the AHP method is used, first the main layers and then the substrates are compared with each other and a weight matrix is formed for each layer.

Conclusion:

Beyza Plain in Fars province has long been considered as a suitable area for agriculture. The wide alluvial zones that cover much of the plain have provided a good subsurface for water storage. Underground dam construction in addition to providing a new source of water for drinking and agriculture in urban areas also helps feeding the region's underground resources. In this study, according to available information and type of study area, six layers of information including water density, lithology, slope, land use, topography and flow direction density were considered. For this purpose, Landsat 8 satellite monitoring method was used. In this method, some identified locations were first introduced to the software, and the software classified according to the spectral data obtained from the satellite data and grouped similar areas into one cluster. Based on the available information, the map was subdivided into areas effective in locating the underground dam. Remote sensing filtering technique was also used for extraction of the lines. Selection of target points was considered in order to identify the upstream conditions of the dam and the location of the dam wall and suggested suitable locations for the construction of the underground dam. At last three sites proposed for the construction of the underground dam, the upstream area of the manhunt had more favorable conditions for the construction of the underground dam. This area is located downstream of a catchment and all the inflow into the basin is concentrated in the outlet of the watershed. The existence of alluvial storage as well as suitable rock walls to accommodate the axis of the underground dam will make the construction of the underground dam successful at this point.