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Evaluation and Zonation of Karst Development in Tamtaman Nazlo Chai Urmia Using the Analytic Hierarchy Process (AHP) Method

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1-Introduction

Karst is a unique and non-renewable resource with important biological, hydrological, mineral, scientific, cultural, recreational, as well as economic values (British Columbia, Ministry of Forests, 2003: 18). The karst transformation and improvement are predisposed by numerous factors, among which are very significant the combined rock role and its hallmarks and structural factors such as faults and joints. Karst landforms are formed in pathways that are controlled by structural factors (Ford and Williams, 1989: 33). Karst scientists and environmental tourists are vulnerable to rock breakage in caves. In addition, underground fluxes that occur underground can have indirect effects on the surface and cause potential damage to the environment, Building anse a significant risk to engineers (Parise, 2008: 275). An asphalt road has been drawn to the villages of Tamtaman and Mir Davood on the road connecting Urmia to Seroo, next to the bridge over the Nazlo Chai River, which is considered in the southern part and Nazlo Chai village functions Tamtaman is a cave and is located between $37^{\circ}\ 38'00''$ - $37^{\circ}44'00''$ north and $44^{\circ}\ 40'30''$ - $44^{\circ}\ 59'\ 30''$ east in northwestern Iran, approximately 15 km northwest of Urmia. According to foreign and domestic studies and due to the role of paleoclimate and the prodigious dissimilarity between the ancient climate of this region and the current prevailing climate in karst transformation in the region. This study selects important factors and possible common methods and the subsequent factors have been considered for this study: Geology (lithology, distance from fault), hydrology (distance from waterway), topography (direction of slope, height, and slope), climate, human factors, and land use (garden, agriculture, barren land, road, and village). This study aimed to investigate the role of effective factors in the current development of karst in the Tamtaman region in the northwest Urmia and emphasize the Analytic Hierarchy Process method of within the zoning (ARC GIS) of the province in West Azerbaijan by enchanting the transformation advantage and karst development.

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2-Methodology

This article is based on field, library, and office methods. The zoning method (Analytic Hierarchy Process) in this study has been used and based on existing study sources, karst transformation in northwestern Iran is one of the factors involved in karst transformation. Distance from the waterway, climate, distance from the fault, and land use was considered as criteria maps and the above layers in different information environments by applying expert judgment and assigning weight to each layer in the relevant software and field visits. It is classified as standard maps and to prepare the karst development potential model, the above information layers were introduced to the software (Arc GIS) According to the importance of each parameter, a rank of 1 to 9 was given to the method (Saati, 1980). The selection of these values has been based on studies, field visits, and attention to the past climate and the development of the region's long-standing karst, as well as the expert application opinion and knowledge of the region. After evaluating the different categories, they were given the appropriate weight to determine the effect of each factor (AHP) on each of the layers based on the export method and the karst method degree development. It should be noted that the sum of the weights was considered to be 1. Table 1 shows the weight of the information layers. In this case, software (Expert Choice), designed based on the hierarchical analysis method, has been used to weight the parameters. Subsequently, a raster map was prepared and classified.

3-Results and Discussion

A final zoning map of the Tamtaman karst area using geological, fault, land use, slope, slope direction, climate, altitude, and hydrology layers was obtained by combining the weights obtained from the hierarchical analysis method of each layer with their overlap in the environment (GIS). The results were extracted as a map with four karst development classes, such as (1) very poorly developed, (2) less developed, (3) normally developed, and (4) developed. The outcomes indicated that 6.68% of the study area was located in a very poorly developed class, 15.64% in a less developed class, 42.50% in a normally developed class, and 35.18% in a developed class. The Tamtaman region is located in the normal to developed development class based on the obtained results in terms of karst formation, and this issue indicates the measuring karst development accuracy in this area. The key to the karst growth index in the study area in creating stresses from the performance of faults in limestone and dolomite rocks in the study area is that the performance of faults in karstic limestone layers leads to major instabilities in the region. The lithological and tectonic factors have the highest weight and are the most important factors controlling the karst development potential among the eight karst improvement factors in the Tamtaman area, while the land-use factor has the least impact on karst formation.

4-Conclusions

This study aims to identify and zoning the potential development of karst in the area of Tamtaman cave in west Azerbaijan province using the AHP method. In this study, the information layers of lithology, tectonics, topography, slope, aspect, hydrology, land use, and climate have been considered as factor maps. The above layers have been called to extract the karst potential model in the GIS environment. Different information layers were classified as Criterion maps by applying expert judgment and assigning the weight of each layer in Expert Choice software and field visits. Finally, according to the obtained weight, the karst development zoning map in the Tamtaman area was obtained. The results obtained in this region exhibited a total area, of 6.68% within the very poorly developed class, 15.64% in the less developed class, 42.50% in the normal developed class, and 35.18% in the developed floor are located. The results show that in the Tamtaman region, the lithological and tectonic factors have the highest weight and are the most important factors controlling potential karst growth, while the land-use factor has the least impact on karst formation.

Keywords: Karst Development, Analytic hierarchy process method, Zoning, Tamtaman cave, Northwest of Iran

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