RESEARCH PAPER

# Determining the potential of Bistoon Forest Park using hierarchical analysis method (AHP)

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**Abstract**

The aim of this study was to assess the recreational power of Bistoon forest park and identifying areas with different levels of recreational power. In this paper a hierarchical analysis method (AHP) was used. For this purpose the map of geomorphological sub-criteria (slope, aspect, elevation, and texture soil) and environmental (vegetation density) was prepared in GIS environment. In the next step, sub -criteria classes were weighted and overvalued. Next, to prepare the map of potential of Bistoon forest park using Hierarchy Process (AHP), standard maps of classification and valuation related to studying sub-criteria maps were incorporated by Weight Sum function. Then, the final map of recreational power of Bistoon forest park was reclassified in 5 classes. The results showed that 22 percent of the park area had a very high recreational power, 17 percent with a high recreational power, 18 percent with medium recreational power, 23 percent with low recreational power and 20 percent with a very low recreational power. In other words, much of the study area (57%) had average to high recreational power.

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**Introduction**

Considering that the natural environment has a limited ecological power for human use, ecological evaluation as the kernel of environmental studies and preventing the existent crisis, provides a suitable base for environmental planning (Mahbobi aghdam *et al.,* 2012). Potential seeking of recreational in tourism based on nature not only as a tool to promote social and economic levels for native people but as conservation functions for management, planning of it in the field of natural resources provide the dynamic conservation (Laurance, 2005). Extensive urban forest parks with recreational facilities can play an important role in ensuring the city's needs, since one of the most important resources that can enhance the quality of recreation are natural areas with few changes including forest parks (Majnounian, 1990).

Although the provision of food, clothing and shelter are the basic needs of human beings and his survival required achieving them, but it is necessary to meet spiritual, mental, and social needs. Increasing in leisure time and decreasing in labor time have made the new form of recreation. Considering that one of the emotional, mental, and social needs of human is recreational enjoyment then, these kinds of activities cause fatigue removal, calmness and new talent. Recognizing the importance of this issue it is essential to create recreational centers which are one of the basic needs of urban-industrial societies to provide a healthy environment for further development (Majnounian, 1995). Therefore, it is necessary to use the natural potentials such as forests and forest parks to obviate this need. Bistoon Forest Park can provide tourists, citizens and local people needs.

The evaluation process of ecological power has been done manually without the use of powerful tools, which was very difficult, costly, time consuming with error. Today, the Geographic Information System (GIS) is considered as a powerful tool with high precision in identifying the resources and optimal analysis of usage (Hathout, 2002). Today, by using GIS the combining of different ecological, economic and social data considering various conditions, time and cost is possible (Saroinsong, 2006). In this regard, some researches have been done about recreational power of parks and recreational areas, which is summarized as following: (Bunruamkaewa *et al.,* 2011) in Surat Thani Province, Thailand, had evaluated appropriate sites for ecotourism using GIS and AHP. Evaluation processes were done based on 9 selected criteria (attraction areas, land use, cache, species diversity, elevation, slope, proximity to cultural places distance from roads and habitat size). To identify the places with ecotourism potential. (Lawal *et al.,* 2011) used multi-criteria decision making technique and AHP for identifying the suitable places for recreational parks to improve educational output of students of the University of Technology in Malaysia. In the final zoning, the study area was classified into 5 classes of improper, low propriety, average propriety, proper and the most proper. For planning the tourism development in conservation area of eshtarankoh the model of ecology ecotourism for Iran with the help of RS, GIS and AHP were used (Torabi, 2006). The results showed that the area had the potential of concentrated recreational Also, in another study in Nazhvan, Esfahan to assess the landscape potential for recreational uses, the GIS and AHP were used. The results of this study showed that regarding to provide weights for each criterion affecting the recreational uses, three criteria of accessibility, proximity to the attractions and river were more important and criteria of usage and facilities are of secondary importance (Sadat Mousavi *et al.,* 2011). The purpose of this study is to identify areas with recreational potential of Bistoon forest park using AHP and GIS to use them in future planning

**Materials and method**

*Study area*

Bistoon is one of the parts of Harsin, Kermanshah. Minimum and maximum altitude above sea level is 1320 and 3358 m, respectively. Bistoon is in the center of this zone, about 30 km northeast of the city of Harsin and is located between 47° 29' 45" E longitude and 34° 25' 35" N latitude, between Bistoon

mountain and Gamasiab river, in the main way of center to west of the country. Bistoon is limited to historical part of Dinawar from north, to center part of Sahne city from east and to center part of Harsin city from south and west.
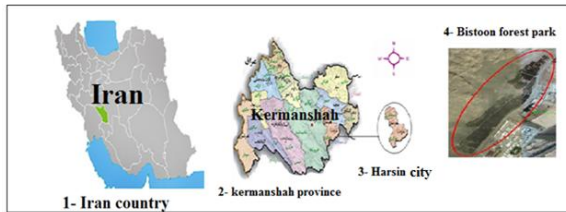


**Fig. 1.** Overview of the position of Bistoon forest park.

*Methods*

In order to zone the study area first, it is necessary to identify and determine the effective criteria on assessing the recreational capacity. Identified criteria include geomorphological criteria such as slope, aspect, elevation and texture soil and environmental criteria include vegetation. Evaluation criteria are often not equal therefore, due to importance of the criteria and point it directly to the evaluating in order to incorporate, weighting criteria is required. Given that the study area is similar to Telar forest park, Ghaemshar in terms of topography and study factors and given that the goal of this study is only studying the recreational potential not the condition and proper factors for the growth of tree therefore, the previous studies about evaluation of recreational potential which used AHP have been used to determine the appropriate weight for each affective factor in recreation (provided digital maps) (Sohrab, 2011). To determine the potential of forest park following steps have been performed.

*A) Mapping of geomorphological and environmental sub-criteria*

For recreational zoning in the study area, it is necessary to identify the resources and make maps. So the criteria used in this study turned into layers in GIS using digital maps and geo-referencing the scanned manual maps.

*B) Standardization of criteria*

In order to combine sub-criteria maps first, various maps should be standardized. To this end for combining criteria to determine appropriate areas with recreational value criteria should be prioritized in an appropriate format therefore, in order to combine the affective maps in recreational zoning of Bistoon forest park each date layer to an equal distance reclassified between 1-9 values and higher values were assigned to those study criteria classes which have classified after classification and had higher recreational potential.

*C) Weighting criteria*

At this stage priority or weight of each sub-criteria is determined in relation to other sub-criteria. To determine the degree of importance of each affective layer for recreational zoning and priority classification of location of recreational activities, weighting criteria will be necessary (Sohrab, 2011). To this end, the calculated weights in previous studies were used (Sohrab, 2011) which the binary comparison method or AHP has been used.

*D) Provide map of recreational potential of Bistoon forest park*

By combining the sub-criteria maps in GIS which have been standardized and have raster format, the map of Bistoon forest park was provided. For this purpose, the Weighted Sum function was used. The value of each cell of the map indicates the relative ability of the cell for recreation. This map reclassified in 5 classes (areas with very low recreational potential, low, medium, high and very high).

**Results**

*Results of the weighting of affective sub-criteria in determining the recreational potential of Bistoon forest park by AHP*

Effective sub-criteria in determining the potential of Bistoon forest park in order of importance are: Park slope (41%), aspect (26%), elevation (19%), Texture soil (9%) and vegetation density (3%).
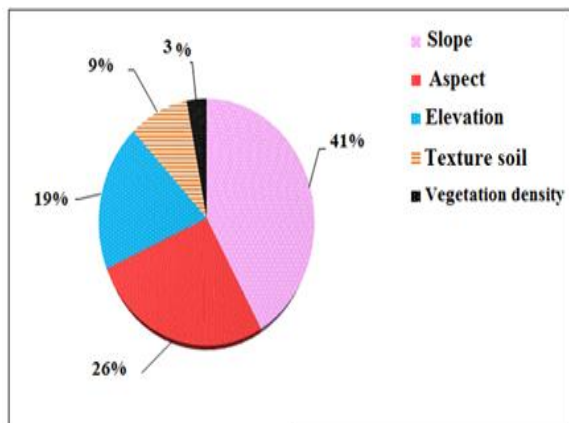
**Fig. 2.** Comparison of the importance of effective sub-criteria in determining the potential of Bistoon forest park.

*The results of provided maps of determining the potential of Bistoon forest park using AHP*

In order to provide maps of determining the potential of Bistoon forest park by AHP, standard maps of classification and valuation related to the sub-criteria maps, were incorporated using the Weight Sum function and finally, 5 classes were reclassified (Figure 3).
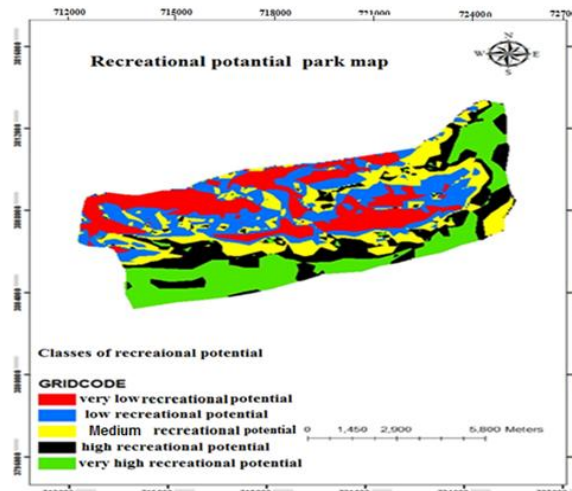


**Fig. 3.** Recreational potential of Bistoon forest park map.

Results of figure 3 showed that the 22% of the park area had very high recreational potential, 17% high recreational potential, 18% medium recreational potential, 23% low recreational potential and 20% very low recreational potential. In other words, much of the study area (57%) had average to up recreational potential (table 1).

**Table 1.** Classes and valuation of recreational potential of Bistoon forest park using AHP.

| Classes | Area (%) | Area (ha) | recreational potential |
|---------|----------|-----------|------------------------|
| Class 1 | 22 | 1464 | Very high |
| Class 2 | 17 | 1279 | high |
| Class 3 | 18 | 1311 | medium |
| Class 4 | 23 | 1599 | low |
| Class 5 | 20 | 1451 | Very low |
| Total | 100 | 7104 | |

**Conclusion and Discussion**

The importance of studying the capacity and facilities development of the area in point of recreational perspective, tourism and planning short and long-term programs in order to promote the physical, structural and environmental impact and reduce the adverse effects of tourism activities in the areas and economic– social development in the local society by using facilities, capabilities and area potential are the necessity of performing this research. Regarding to the final results of this research Bistoon Forest Park has a high potential in developing and planning different kind of recreational activities and nature walking. Since nearly 57 percent of the park area has average, high and very high recreational potential and nearly half the park is appropriate for planning to create a variety of recreational activities. These programs can be improved by a comprehensive plan. The results showed that the performance of AHP could identify the recreational areas, which are

corresponded to existing reality based on field evidence comparing obtained results. Considering the results of the comparison between field evidence and recreational potential map of AHP, it can be stated that AHP method has a higher flexibility and precision in detail and more accordance to the area condition. It is in agreement with (Shirvani, 2009; Sohrab, 2011; Karami ,2011). According to use of 5 ecological factors for determining potential of Bistoon forest park in this study, it is suggested to consider the factors of economic, social, noise pollution, access routes, neighboring villages and landscapes with ecological factors in evaluating of recreational potential of parks. Importance and priority of used parameters in determining the potential of Bistoon forest park using AHP in order of importance are slope, aspect, elevation, soil and vegetation. This shows that in various areas the priorities of used parameters are different which is in accordance with (Shirvani, 2009; Sohrab, 2011) . Slope is one of the most important and limiting factors in recreational planning (Makhdoom, 2006; Brzh kar, 2008). Regarding to slope, Bistoon forest park has the capacity of planning a variety of activities. The entire area except those places with more than 65 percent slope and unsuitable for different recreational activities, the rest has the ability and potential to attract tourists. This is in agreement with (Esmaili Sari, 2004; Rezvanfar, 2008; Shirvani ,2009; Sohrab, 2011).

In this study slope with 41% weight is placed in first priority. As a result, slope is one of the most important factors in determining and planning the recreational potential.

Due to the location of Bistoon forest park near to historical area it is suggested to perform management plans and attracts investment of private sections to improve the recreational potential of the park.

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