Ecotourism Zoning In Protected Areas Using Gis

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ABSTRACT

Zoning has a vital importance in ecotourism management and defines the optimum use of an area based on its environmental capabilities. It also requires the use of applied information technologies such as Geographical Information Systems (GIS). The aim of this paper is to identify the governing factors in ecotourism zoning. Jahannama protected area was selected as study area which is in Golestan province, Iran. For such research geographical and attribute data were gathered which included land use/land cover, geological, transportation, infrastructures, and tourism attraction map. The data were reprocessed to be used in ArcGIS software for further analysis. Finally, ecotourism zoning map was generated that include four categories. They were (1) Strict Protected Zone in which a conservation zone is demarcated (2) Extensive Recreation Zone that covers most of the study areas (3) Limited Development Zone which is in north east of the study area and (4) Specific Use Zone that includes Jahannama plain. Recommendations are then made for each zone to use them optimally. The recommendations must accompany any long term plan of the parks.

Key words: GIS, Ecotourism, Jahannama protected area, Zoning

Introduction

Tourism is known as the world’s largest industry and one of the fastest growing sectors in human society so that covers over one-third of the total value of global trade services [33]. In many areas, tourism is seen as an answer to economic development, particularly areas of natural beauty. However, the increasing numbers of tourists bring with themselves a range of sociocultural and environmental issues for host communities [18].

Ecotourism is a kind of tourism required the implementation of environmentally responsible recreational activities within the designated natural areas [8,1]. Despite ecotourism means different things to different people, its key components include nature-based product, minimal impact management, environmental education, and contribution to conservation [6]. In recent years, ecotourism has been a major activity in protected areas and this urges change in environmental management and planning of such areas, because of its considerable impacts.

One useful tool in environmental planning and management of ecotourism is zoning which can help better management of these type of activity especially in protected areas. It is the principal method used to deploy visitors, and hence critical in achieving the appropriate combination of concentration and dispersal [11]. Zoning as part of the process of visitor management is likely to relate specifically to the types of activities that are permitted in particular zones, as well as delineating those activities that are not permitted [23].

Geographic information system (GIS) is considered an essential tool for natural resources management. The manner that maps are stored or filed as information layers in GIS makes complex analysis possible to perform [9]. GIS is able to link and integrate various kinds of data. It also combines mapped variables to build and analyze new variables [12].

Today, advanced techniques are used in zoning of protected areas which among them, GIS has extensive application and is considered as an essential tool for natural resources management [9]. GIS is a digital database management system designed to manage large volumes of spatially distributed data from a variety of sources [1]. It is able to link and integrate various kinds of data. It also combines mapped variables to build and analyze new variables [12].

Due to the ability of the software in efficient storage, retrieval, analysis, and display information
according to user-defined specifications, it can be ideal for advanced site selection studies. It can be effectively used in the gathering, weighting, analyzing, presenting spatial and attribute information to facilitate any location endeavor [3].

In spite of almost 40 years’ history, GIS has been used in natural resources management and eco-environmental assessment only for the last 25 years [27,20,2,24]. During the last few years, GIS has been used as a system for management, manipulation, representation and analysis of geo-spatial data to facilitate and cut down the cost of land capability evaluation process [31]. As the fourth dimension, it can also consider time to research dynamic change of regional environment quality [35].

As mentioned above, GIS seems a suitable approach for ecotourism zoning, especially in protected areas which have a sensitive environment. Hence the aim of this paper is to apply GIS in zoning of a protected area and a popular tourist attraction.

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**Materials And Methods**

**-Study area:**

With the area of 30511 hectares, Jahannama protected area (JPA) is in the south east of Caspian Sea on a longitude of 54°, 08’ to 54°, 36’ E and a latitude of 36°, 35’ to 36°, 42’ N [16]. In IUCN protected area management categories, JPA is designated as a Category V or Protected Landscape/Seascape [32] which tourism and recreation is a primary object of such category [25].

Based on National Master Plan for Tourism and Ecotourism Development and Management, Iran is divided into 7 tourism regions [14]. A regional strategy has been compiled for each regions. JPA is in the region known as Alborz or Region One (Figure one).

As a protected area, fauna of JPA includes many significant rare and endangered species such as Roe deer, Red deer, Brown bear, and many types of birds of prey. Tarkat (3,000 ha) and Maghazi (2,000 ha) are two ‘Safe Area’ in the region which have a critical role in wildlife conservation. In fact, these areas are considered as preliminary zones for conservation [19].

Human settlements of JPA include two permanent villages (Ziarat and Haji Abad) and two recreational ones (Sa’d Abad Mahalleh and Kafshgiri Mahalleh) which have their unique cultural, social, and economic characteristics [25].

Previous studies show that the visitors of JPA cause significant environmental impacts because they can visit every site of the area, and the management office have no control on distribution of them [10]. Table one shows major environmental impacts of
tourism in JPA. Tourism infrastructures which is shown in table 2 include transportation, accommodation, access roads, and service centres. The main ecotourism sites in JPA are Jahannama Plain (includes Sa’ad Abad Mahalleh and Kafshgiri Mahalleh), Ziarat village, Haji Abad village, and Chaharbagh village [10].

### Table 1: Major environmental impacts of tourism in JPA*

<table>
<thead>
<tr>
<th>Type of impact</th>
<th>Distribution</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste pollution</td>
<td>All sites</td>
<td>Mainly solid waste</td>
</tr>
<tr>
<td>Wastewater pollution</td>
<td>ZV</td>
<td>House sewage, Animal husbandry</td>
</tr>
<tr>
<td>Chemical pollution</td>
<td>JP, ZV</td>
<td>Chemical fertilizers, Detergents</td>
</tr>
<tr>
<td>Noise pollution</td>
<td>JP, ZV</td>
<td>Cars, Motorcycles</td>
</tr>
<tr>
<td>Visual pollution</td>
<td>ZV</td>
<td>Villas, Accommodation</td>
</tr>
<tr>
<td>Soil destruction</td>
<td>JP, ZV</td>
<td>Soil erosion</td>
</tr>
<tr>
<td>Vegetation destruction</td>
<td>JP, ZV</td>
<td>Fires, Trampling, Forest clearing</td>
</tr>
<tr>
<td>Wildlife disturbance</td>
<td>JP, ZV</td>
<td>Roads, Hunting, Shooting</td>
</tr>
</tbody>
</table>

*Abbreviations: ZV: Ziarat Village; JP: Jahannama Plain; CV: Chaharbagh Village; HV: Haji Abad Village* Based on Dorbeiki (2004)

### Table 2: Major tourism infrastructures in JPA

<table>
<thead>
<tr>
<th>Type of infrastructure</th>
<th>Distribution</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>JP, CV, ZV</td>
<td>4WD vehicles</td>
</tr>
<tr>
<td>Accommodation</td>
<td>JP, CV, ZV, HV</td>
<td>Cottage, Villa</td>
</tr>
<tr>
<td>Access road</td>
<td>JP, CV, ZV</td>
<td>Trails, Roads</td>
</tr>
<tr>
<td>Service centre</td>
<td>JP, ZV</td>
<td>Traditional restaurants, Village shops</td>
</tr>
</tbody>
</table>

Based on Dorbeiki (2004)

- **Study process:**

Considering the extent of tourism development, types of tourism in Iran are as follows [21]:

- **Extensive Outdoor Recreation (EOR)** includes those recreational activities such as strolling, hiking, mountain climbing, fishing, hunting, and bird watching which need limited facilities and infrastructures and rely on resort natural assets.

- **Intensive Outdoor Recreation (IOR)** includes those recreational activities such as camping, picnic, scrambling, rally racing, biking, motor biking, visiting heritage and historical monuments which require resort development as well as kinds of facilities.

According to assessment of EOR in Iran and other studies such as Banerjee [4], Pandey and Chakraborty [28], and Shojaei [30], effective parameters of ecotourism zoning were determined and related data provided including:

- Topographic maps
- Maps of access roads, cities and villages
- Maps of land use patterns
- Soil and geological maps
- Maps of water bodies
- Infrastructure maps
- Maps of ecotourism attractions

Different maps were provided including 1:25,000 scale maps of National Cartographic Center of Iran (NCC); 1:50,000 scale maps of National Geographical Organization (NGO); and 1:100,000 scale maps of Geological Survey of Iran (GSI). Since the maps had different scales, map generalization process was done.

To speed up the process, Micro-station DGN files were changed to DWG using AutoCAD software. Data layers were prepared and converted into SHP format. Some data were converted into vectors because they were in JPG format.

The following steps were taken before using the layers in index overlaying:

1. All layers were initially converted to shape files (topographic layers have DGN format).
2. The coordinate system of all layers were uniformed (land use and land sources layers have Lambert coordinate system).
3. To precede the overlaying process, all vector map layers such as land use and land sources were converted to the raster format.
4. The extent of layers was uniformed.

Methods of data gathering and management of ecotourism were according to Beckman et al. [5], Buckley [6], Phillips [29], and Dorbeiki [10]. Information on environmental conditions and tourist attractions were adapted from Dorbeiki [10]. In addition to the above methods, other zoning classifications were used such as those which were proposed by Moharamnejad and Dorbeiki [25], and Holden [13]. The flowchart for the study is presented as figure 2.

### Results:

According to the methodology, infrastructure map was produced. This type of map presents shopping, medical, and educational centres, accommodations, communication centres, types of roads, access roads etc. Attractions map was produced by existent data which shows historical sites, wildlife distribution, water bodies, vegetation, landscapes, etc.
In addition to the above maps, conservation maps (including two safe areas) were produced. According to data, ecotourism sites were determined in all over the protected area. Figure 3 and 4 shows distribution and type of ecotourism sites in JPA, respectively.

Fig. 2: Flow chart of the study

Fig. 3: Distribution of ecotourism sites in JPA

Fig. 4: Type of ecotourism sites in JPA
After determination of effective parameters in preparing maps, zoning map of JPA was produced regarding environmental sensitivity, safe areas, access roads, accommodations, tourist attractions etc. Four zones were produced in the process includes:

1) Zone I or ‘Strict Protected Zone’ which is protected strictly. Maghazi and Tarkat Safe Areas are located in this zone.

2) Zone II or ‘Extensive Recreation Zone’ which includes most of JPA.

3) Zone III or ‘Limited Development Zone’ which is suitable for rural development including Ziarat village.

4) Zone IV or ‘Specific Use Zone’ which includes central parts of JPA including Sa’d Abad and Kafshgiri.

**Fig. 5**: Ecotourism zoning in JPA

**Discussion:**

According to different studies, most of northern Iran including JPA has ecological capability for extensive tourism and are suitable for ecotourism development. GIS as an applied tool was used for ecotourism zoning. According to the results four zones were identified in JPA. These zones need their management approaches which can be defined as follows:

Visitor accesses to Zone I is limited and only limited number of researchers or university students can reach this zone. Any human presence or even light development must be banned because this zone includes those areas which are identified as safe areas. As these areas were identified as safe areas previously, it is suggested that these zones and their peripheral areas are selected as this type of zone. The road of Maghazi must be blocked. There are no accommodation for ecotourists in this zone and visits must be one day.

Zone II includes vast areas which are as a presentation of JPA. Visitors can have activities such as sightseeing, camping, walking, hiking etc. the best known of such areas are Zebleh Mt., Talambar, Shahpasand, Kalkat, Loolian etc. in this zone primary infrastructure for ecotourism can be set and night stay is allowed.

In Zone III in addition to conservation facilities such as ranger station, infrastructures of intensive recreation are allowed. This type of zone is suitable for those ecotourists which are not interested in heavy and hard activities. Since Ziarat village have suitable conditions for such activities, the village is proposed as the heart of the zone. Its infrastructure and easy access to main transportations (highway, airport, and railway) makes it as a central unit for ecotourism in JPA.

Zone IV is designated as special use zone which defined as a zone with vast and adverse environmental impacts. This zone is not adapted to management objectives of JPA but management cannot manage it properly because of political and social pressures. It consist of two villages (Sa’d Abad and Kafshgiri). The zone is suitable for short term or long term stay.

Each zone has its management objectives which must be seen in environmental planning of the area.
And adoption of existing facilities should be based on each zone characteristics. Examples are new design and construction of a new road (Zone I); Design of new nature trails and using village houses and reconstruct them for accommodation (Zones II, III, and IV); use of traditional architecture in design and reconstruction them for accommodation (Zones II, III, and IV); and design a visitor center in Jahannama plain and Ziarat (Zones III and IV).

Suggested zones and plans should be integrated with Master Plan of JPA. This leads to better management of ecotourism activities.

References