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ENVIRONMENTAL RISK ASSESSMENT OF TOURIST ROUTES; THE CASE OF DOHEZAR FOREST ROAD, IRAN

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Abstract

As one the most important ecosystems of the world, conservation of forests is a significant action in management of tourism activities in such areas. The aim of this study is determination and prioritization of environmental risks aspects in Dohezar, which is a forest tourism site in Iran. After collection of related data and using a hybrid method in GIS, environmental capability of tourism of the area was assessed. The results show that 118.73 and 487.72 ha of total area are suitable for intensive and extensive recreation, respectively. The rest of the area has a conservation value. Qualitative and quantitative methods of risk assessment was used in determination of degree and level of all factors. Climate change and natural hazards have the highest level of risk, while air pollution is at the lowest risk level.

***Keywords*:** Risk assessment; tourism; environmental aspects; Dohezar forest

Introduction

Tourism is the fastest growing industry in the world. In the year 2000, it generated 212 million jobs directly or indirectly (UNWTO, 2001). On the other hand, the predictions indicate that in 2020 the industry will be the world's first industry in terms of economic turnover (UNWTO, 2010). Iran has the 5th and 97th places in the world in terms of tourism potential and use, respectively (George, 2003). One of the most important sectors of tourism in Iran is nature tourism especially in forests.

As tourism is a complex, multidimensional and interdisciplinary system that is always dynamic (Inskeep, 1991), therefore, systematic approach is a relatively comprehensive method for understanding, analyzing, planning and dynamism of tourism (Ghasemi, 2011). Gunn suggests that tourism should be considered as a system: all its sectors have relationship with others and its success and dynamism relate to cooperation, mutual interaction, efficiency and success of its various elements (Gunn, 2002). With development of tourism systems, more risks and hazards threatened them. Each tourism destination faces with many threats that can harm tourists and other elements of tourism system such as unpleasant foods, poor accommodation, robbery and pickpockets, deaths, bad weather, inappropriate behavior of local people, plane crash, terrorism, crime, political insecurity, diseases and natural disasters (Fuchs & Reichel, 2006; Deng, *et al*., 2002; Bentley & Page, 2008; Fuchs & Reichel, 2011). Hence, these negative factors are considered as risks that disturb tourist activities (Bentley & Page, 2008; Tsuar *et al*., 1997).

In general and from a systemic view, risks can disturb the order of a whole system or parts of it, and disrupt its stability. On the other hand, all systematic activities have an open system that can be easily attacked and degraded (Glaesser, 2003). Tourism is mainly an open system and any change in any element can affect other elements; it also has a mutual relationship with local, national, regional and international systems (Masoumi, 2009; Ritchie, 2009; Ghasemi, 2011).

In each region, tourism activities have unreliable characteristics, which make their controls and planning more difficult. As a result, they have low certainty and prediction of their results depends on probabilities. Risks not only damage the infrastructure of a tourism destination, but also jeopardize destination image, and economic and political basis (Aschauer, 2010). Hence, risks cannot be completely eliminated, but should be managed to reduce their vulnerability. According to Smith (1995), this approach often leads to risk assessment and management that reduce risk elements and factors or vulnerabilities for human societies (Ritchie, 2009).

Risk assessment is an approach to estimate quantity of environmental risk and its quantitative nature provide objectivity and transparency in impacts assessment (Shengping, 2010). As an important tool in environmental management, environmental risk assessment is used in reduction of risks of projects, for achieve the sustainable development, and is considered in planning and policy making in most countries of the world (Song *et al*., 2010).

Forests are very important ecosystems that their roles are beyond the habitats of fauna and flora. Table1 shows the nature of forest goods and service according to Pearce & Pearce (2001). As shown in this table, recreational value of a forest are both market and non-market service.

Table 1 : Nature of the forest good and service

Ecosystem good and service	Nature of market
Climate benefits	Non-market
Conflict Setting	Non-market
Water flow regulation	Non-market
Water supply	Market & non-market
Erosion control and prevention of sedimentation	Non-market
Soil formation	Non-market
Nutrient outflow	Non-market
Waste treatment	Non-market
Biological control	Non-market
Food production	Market
Raw material	Market
Genetic resources	Market & non-market
Recreation	Market & non-market
Cultural values	Non-market

Table 2 : Literature review of similar studies

Researchers	Year	Subject
Rahmani et al	2015	Environmental impact assessment of tourism in Tonekabon, Iran
Khademi & Saremi	2012	Risk prediction model for tourism in Tehran, Iran
Chung–Hung Tsai, & Cheng–Wu Chen	2011	Risk assessment model for natural hazards in tourism industry
Peattie et al	2005	Determination of environmental and health risks in tourism sites
Lepp & Gibson	2003	Tourist roles, perceived risk and international tourism

There are many studies on tourism risk assessment and management in natural ecosystems, which summary of some of them are shown in Table 2. The aim of this study is environmental risk assessment in tourist sites in forest. Dohezar forest in Tonekabon County, Iran is chosen as the case study.

Materials and Methods

Case study

Tonekabon is a city in the coast of the Caspian Sea in north of Iran which has one of the most beautiful forest roads in the country called 'Dohzar'. It is a mountain forest area with pleasant climate and attractive landscapes, river, rich medical plants, etc. The study area consists of the main tourist attraction (about 2096.85 ha) that includes over 10 kilometers of the main road and its buffer zone (one kilometer). Figure 1 shows map of the study area.

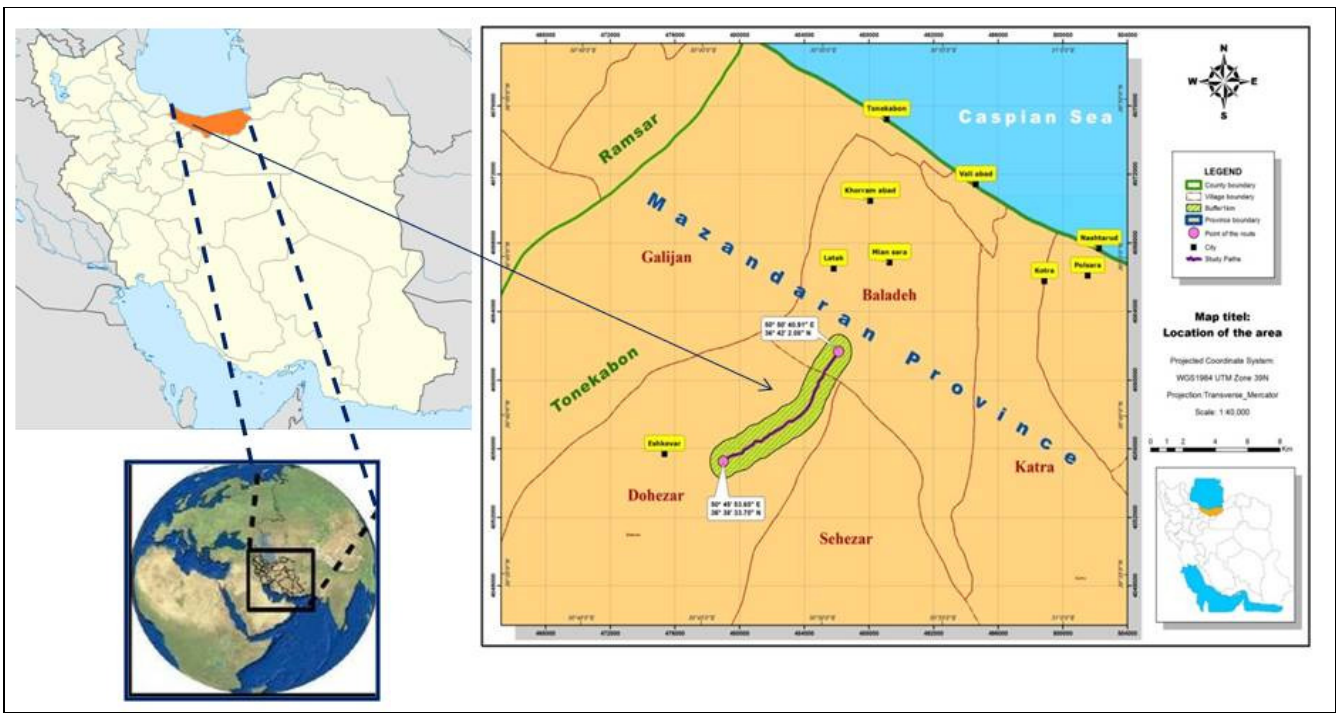

Fig. 1 : Map of the study area

Methodology

At the first step of this study, possible risks of similar tourism projects were identified and classified. In addition, field surveys showed some sources of risk in the study area. The Delphi technique (including 15 experts) was used to prioritize potential risks. Environmental capability of tourism development was assessed using a hybrid method, which consists of Makhdoum (2008), FAO (2006). All data layers were analyzed using ArcGIS (v. 9.2). Table 3 shows the assessment criteria.

In table 3, extensive tourism means those activities, which don not need high level of infrastructure such as hiking, climbing, bird watching, wildlife watching, nature photography etc. Intensive tourism need infrastructure such as camping, cycling, etc. (Makhdoum, 2008). Figure 2 presents the process of environmental capacity assessment for both types of tourism in the study area.

Table 3 : Ecological model for tourism

Criteria	Sub criteria	Description of ecological model for tourism					
		Intensive Tourism			Extensive Tourism		
		The most suitable (1st class)	suitable (2nd class)	Unsuitable (constraint)	The most suitable (1st class)	suitable (2nd class)	Unsuitable (constraint)
Land form	Slope	Until 5%	0-15%	More than 15%	Until 25%	50% - 25%	More than 50% (except for mountain climbing)
	Aspect	Eastern in summer	Northern in summer	Southern& western in summer	-	-	-
		Southern in winter	western in winter	Eastern and northern in winter	-	-	-
Water	Litre of drinking water per capita	40-150	12-40	Less than 5	5-12	5	Less than 5
Soil	-	Well drainedloam or alluvial soil	sand Sand- loam	Clay and Hydromorphic soil	-	-	-
Vegetation	Tree coverage	40%-80%	20%-40%	Less than 20% and More than 80%	-	-	-
	Specie composition	Monocotyledon in most of the area	Composition of Monocotyledon And dicotyledonous	dicotyledonous in most of the area	-	-	-
Climate	The number of sunny days in use season	More than 15	7-15	-	More than 15	7-15	-
	Temperature c°	21-25	21-30	-	21-25	21-30	-

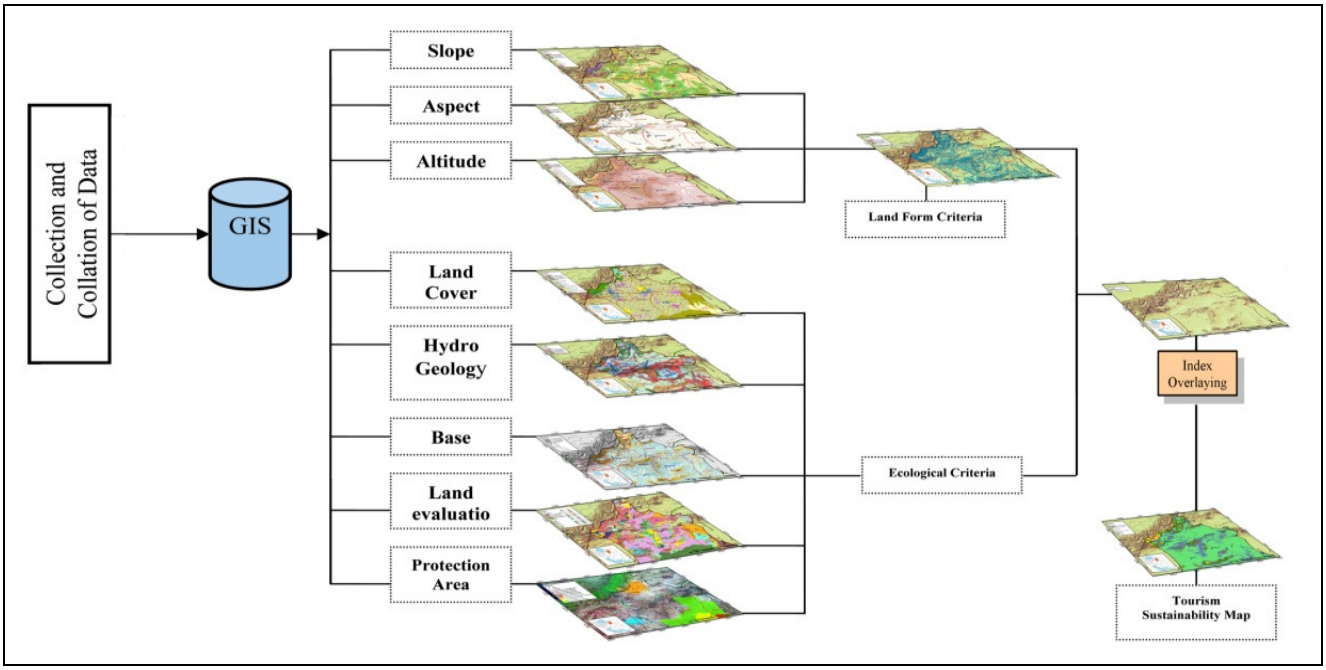

Fig. 1 : Process of environmental capacity assessment for of tourism in the study area

For determination of environmental aspects of tourism risks, some indicators were selected using studying of similar resources, literature review and experts. At first, according to the William Fine procedure, expert panel tried to prepare a list of all risk sources. After review and scoring of the indicators by experts, three aspects were identified which are shown in Table 5.

Both qualitative and quantitative (William Fine) methods were used for risk assessment. The William Fine risk assessment method is derived from the multiplication of the following three factors:

$$R = C \text{ (Consequence)} \times E \text{ (Exposure)} \times P \text{ (Probability)}$$

After calculating the risk score according to level of risk of William Fine model, ranking the risk levels are undertaken. These rankings determine the effective corrective actions that must be performed in the risk management process (Table 6). Figure 2 shows the study process.

Table 5 : Environmental aspects of tourism risks

Description (indicator)	Subject (aspect)
Healthy ecosystems and tourism sites	Environmental pollution and health
Climate diversity; natural hazards potential	Climate
Risk of wild animals attack and bite; threatening ecosystem health and biological carrying capacity; non-polluted ecosystem	Natural resources and attractions

Source: Tsaure et al., 1997; Farsari & Prastacos, 2002; WTO, 2004; EPA, 2010

Table 6 : Risk score summary and actions (Moradi & Pirsaheb, 2012)

Score	Action
200–1,500	Immediate correction required; activity should be discontinued until hazard is reduced
90–199	Urgent; requires attention as soon as possible
0–89	Hazard should be eliminated without delay, but situation is not an emergency

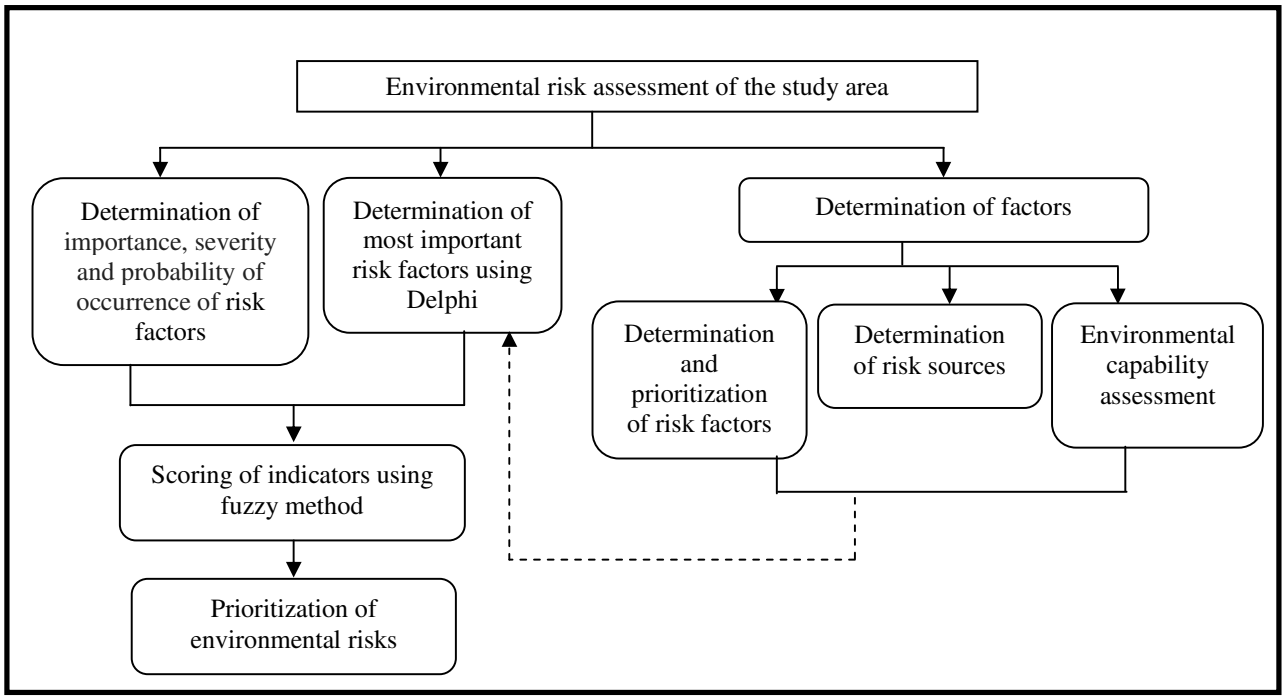

Fig. 2 : The study process

Results

1. Environmental capability assessment

Using the above method, the results of environmental capability assessment of the study area is shown in Table 7. As shown in the above table, extensive tourism is more than the other type and parts of the region are only suitable for conservation. Figure 3 and 4 show suitable zones for both type of tourism mentioned before.

Table 7 : Suitable areas for tourism development in the study area

Area (ha)	Extensive	Area (ha)	Intensive
487.72	Second class	118.73	First class
985.22	Conservation (unsuitable for tourism)	1669.98	Conservation (unsuitable for tourism)
1472.94	Total	1788.71	Total

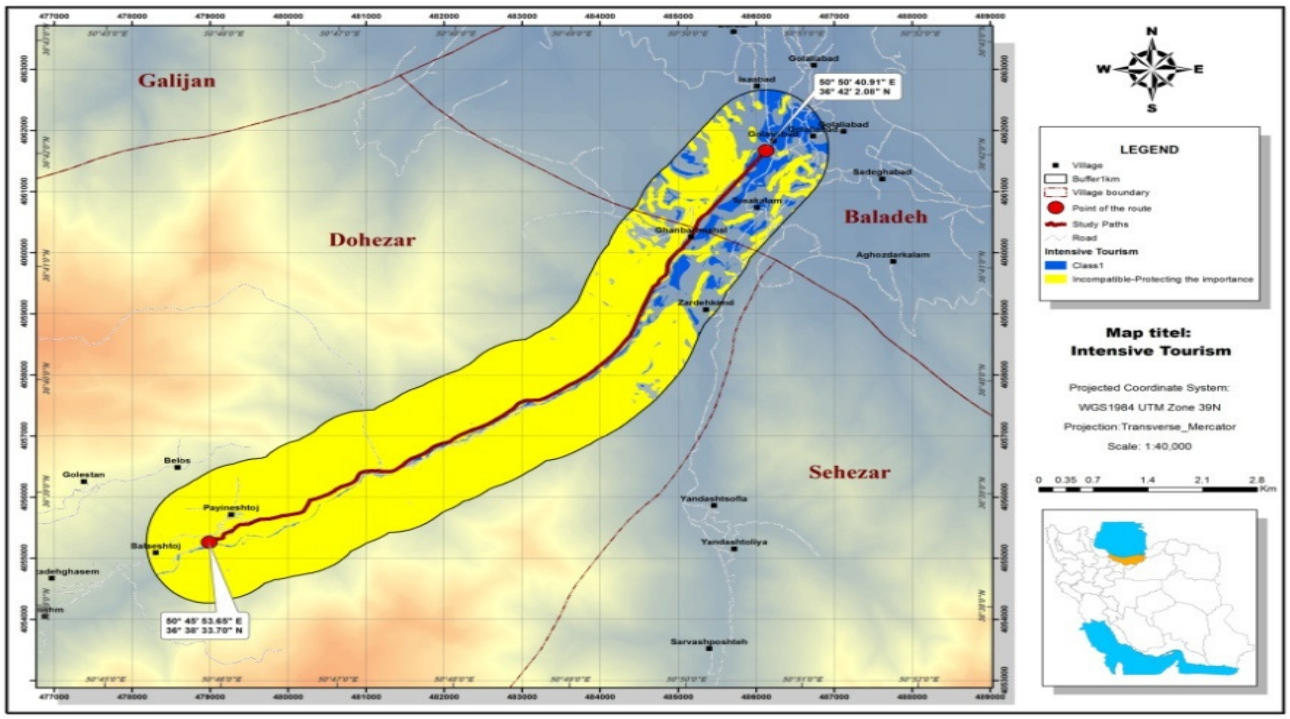

Fig. 3 : Zoning of intensive tourism and conservation

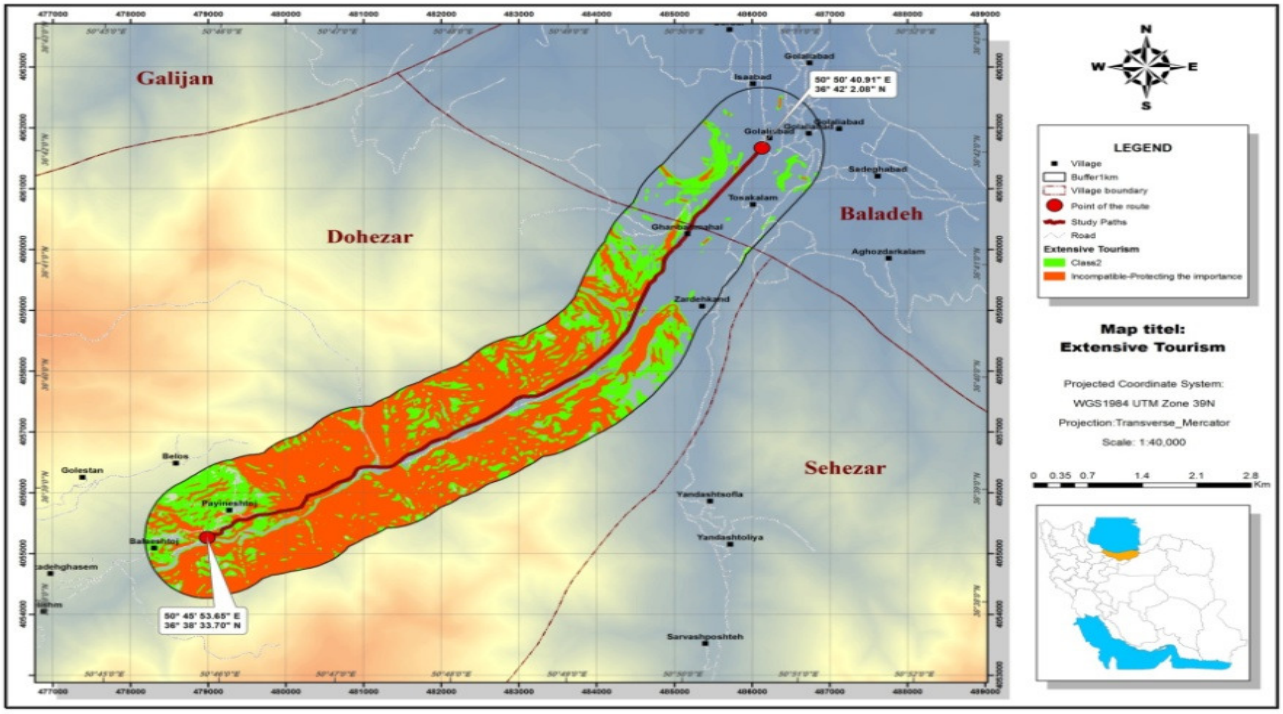

Fig. 3 : Zoning of extensive tourism and conservation

2. Risk assessment

2.1. Climate

2.1.1. Climate diversity: As data of the area was general and unreliable, qualitative risk assessment was used. Since the study area is in temperate climate with high humidity, it can intensify the precipitation and sultry air in cold and warm seasons, respectively. Nearly half of year, it is possible to occur climate risks such as sudden rains, unexpected snow, excessive heat, strong winds etc. Table 8 shows the risk assessment of climate factor.

Table 8 : Qualitative risk assessment matrix (climate)

Severity/Probability	Low intensity	Medium intensity	High intensity
Very unlikely	Minor risk	Tolerable risk	Medium risk
Unlikely	Tolerable risk	Medium risk	Significant risk
Likely	Medium risk	**Significant risk**	Unbearable risk

2.1.2) Natural hazards potential: Geological and meteorological data show that the study area has a great and low potential for severe earthquakes and drought occurrence, respectively. On the other hand, high slope of some areas and cleanup of forests has increased the possibility of flood in the region (Figure 4 and Table 9).

2.2) Natural resources and attractions

2.2.1) Risk of wild animals attack, bite, etc.: There is no official record about these types of incidents but according to field survey and interview with local people, some attacks of wild or domestic animals have been observed in the region especially in dense forest areas.

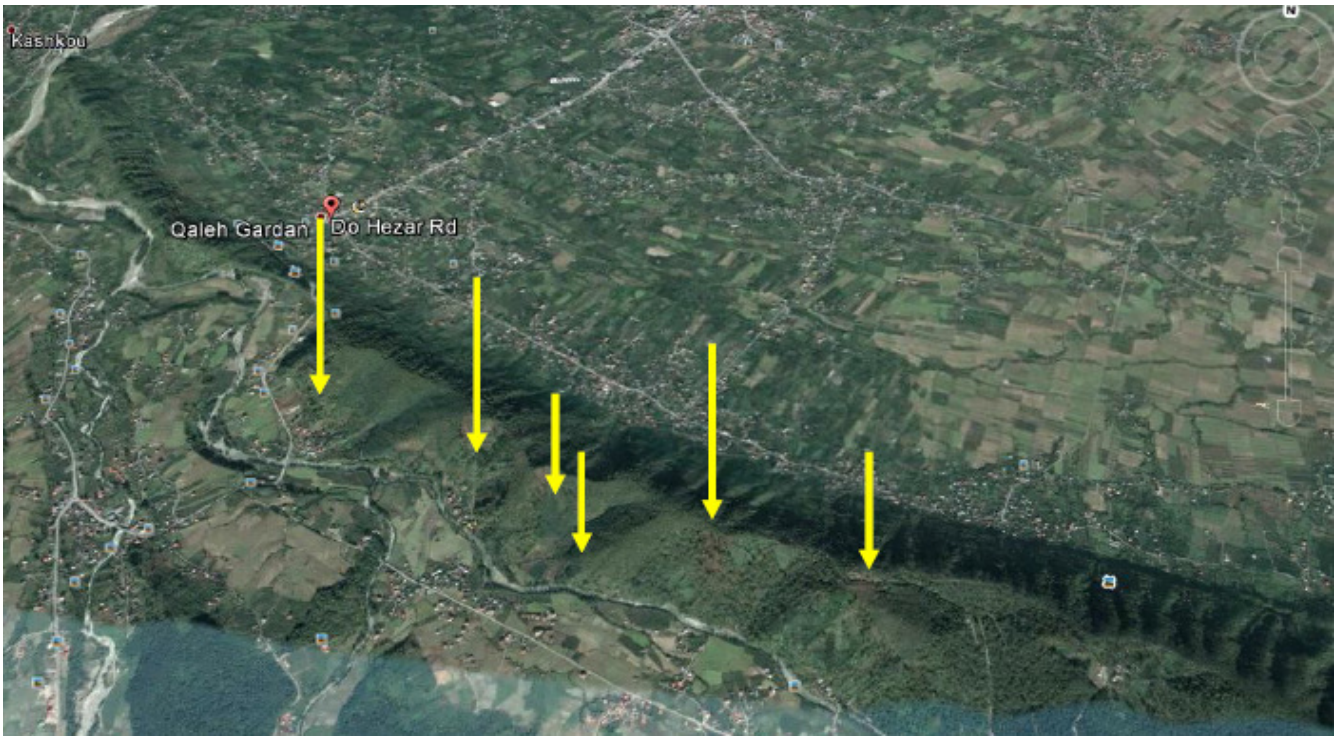

Fig. 4 : Areas with high potential of flood in the study process

Table 9 : Qualitative risk assessment matrix (natural hazards potential)

Severity/Probability	Low intensity	Medium intensity	High intensity
Very unlikely	Minor risk	Tolerable risk	Medium risk
Unlikely	Tolerable risk	Medium risk	Significant risk
Likely	Medium risk	**Significant risk**	Unbearable risk

Table 10 : Qualitative risk assessment matrix (risk of wild animals attack, bite, etc.)

Severity/Probability	Low intensity	Medium intensity	High intensity
Very unlikely	Minor risk	Tolerable risk	Medium risk
Unlikely	Tolerable risk	Medium risk	Significant risk
Likely	Medium risk	**Significant risk**	Unbearable risk

2.2.2) Threatening ecosystem health and biological carrying capacity: Quantitative and qualitative assessment was used for environmental and health risks. In this section, field surveys provide enough data about the subjects.

The region has no industrial area and as a result, loads of environmental pollutants is not heavy. There is no official data on traffic, but in a sampling in the region, 27, 313, and 278 trucks, cars, and motorcycles were counted, respectively. Waste is one of the biggest problems, which are produced and dispensed over the region, by both tourists and local people. Noise level was measured in several stations and show that it is high in both Dohezar and Sehezar roads (Figure 5). Based on the field survey, numbers of tourists has not been exceeded than biological carrying capacity. No serious water pollution has been recorded officially in the region.

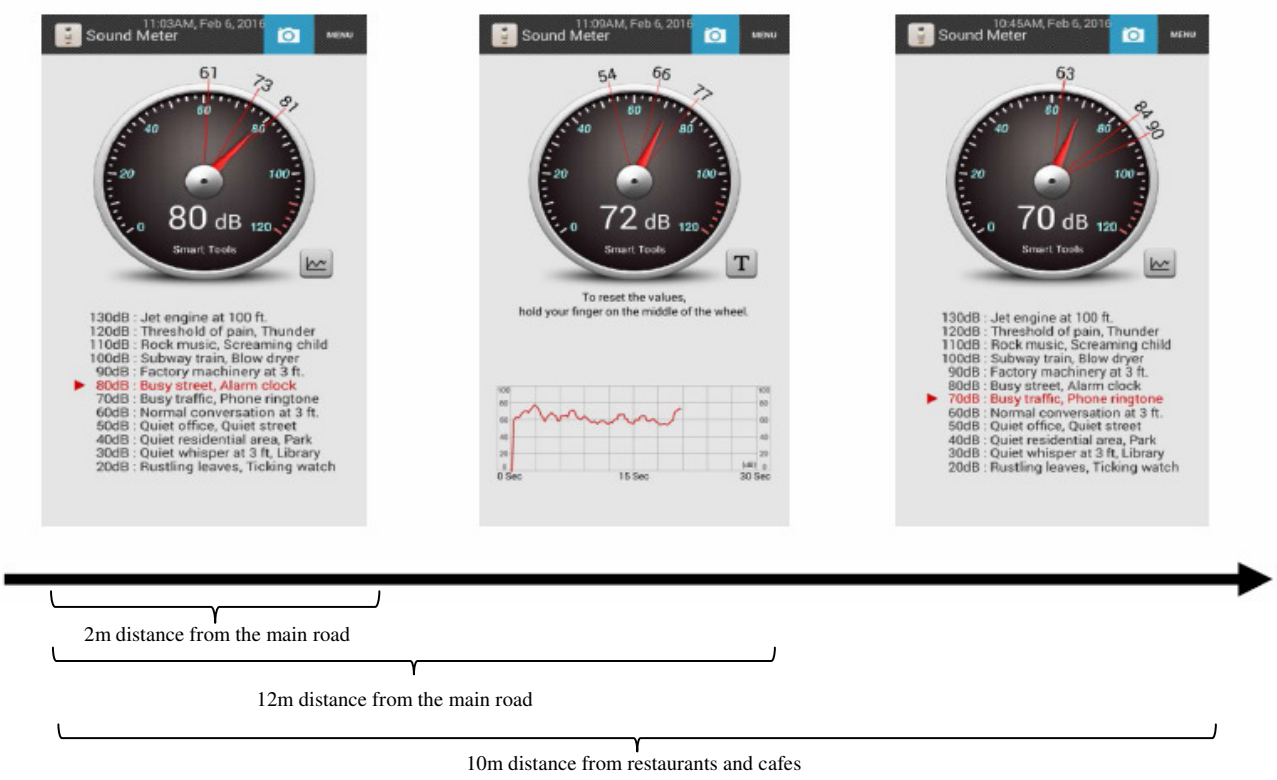

Fig. 5 : Summary of noise pollution in selected stations

According the results, severity and repetition of pollution in the region are estimated as borderline and likely or medium, respectively, which leads to a 2B degree of risk (Table 11).

Table 11 : Assessment matrix for threatening ecosystem health

Repetition \ Severity		Catastrophic	Important	Borderline	Partial
		4	**3**	**2**	**1**
Frequent (High)	A	4A	3A	2A	1A
Probable (Moderate)	B	4B	3B	**2B***	1B
Occasional (Low)	C	4C	3C	2C	1C
Partial (Rarely)	D	4D	3D	2D	1D
Insignificant	E	4E	3E	2E	1E

2.3) Healthy ecosystems and tourism sites

2.3.1) Non-polluted ecosystem: Based on the status of ecosystems and pollution, risk level for air, water and soil pollution was assessed as follows (according to William Fine method):

Risk level = Probability × Consequence × Exposure

Air = 5 × 2 × 2= 20

Water and soil = 15 × 3 × 6= 270

The results indicate that the level of risk for air pollution is not high and immediate action is not required. However, in the case of water and soil pollution, the case is different and, given the high level of risk, quick management action should be taken.

Discussion

As shown before, the results show that 118.73 and 487.72 ha of the region are suitable for intensive and, extensive and conservation, respectively. According to the risk assessment, proposed risk management plan are presented in Table 12.

Table 12 : Risk management plans based on risk assessment of each factor

Risk factor	Risk level	Proposed management plan
Climate change	Significant	Work should not be done until the risk is not diminished. Many resources should be assigning to reduce and control the risk.
Natural hazards potential	Significant	Work should not be done until the risk is not diminished. Many resources should be assigning to reduce and control the risk.
Threatening ecosystem health and biological carrying capacity	Medium risk	Control actions and periodical monitoring should be adopted
Air pollution	High	There is a need to immediate improvement of risk control and periodical monitoring
Water and soil pollution	Low	The risk is under control and there is a need to periodical monitoring

The results of this study are consistent with some of other researches. It is similar to Ghadami and Aligholizadeh (2012), Faraji *et al*. (2013), Rahmani *et al*. (2015), Tsur *et al*. (1997), and Chung – Hung Tsai, Cheng – Wu Chen (2011). It is not consistent with Eitzinger and Wiedemann (2007).

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