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Tourism Environmental Zoning Powers of Mazandaran Province to Develop Ecotourism

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Abstract: Locating potential areas of ecotourism is one of the important ideas in management and tourism development. This trend of tourism plays an important role in protecting environmental and economic resources of countries in the world. Its development in any country requires effective management and planning in this field. This research aims to identify potential areas of ecotourism in Mazandaran Province to protect natural resources and prepare the ground for sustainable financial resources for city management in this province. In terms of purpose, this research is applied and research method is descriptive-analytical. AHP, MCDM, fuzzy set interval value, and using results in geographical information system were used in order to identify potential areas of ecotourism in Mazandaran Province. The results indicated that the criterion of tourism potential (with relative normalized weigh of 0.311) had the most impact and the criterion of facilities and travel services (with normalized score of 0.120) had the least impact among four detected main criteria. However, detected areas for ecotourism development had the closest distance to tourism prominent centers and the farthest with undesirable areas as well.

Keywords: Locating, tourism, ecotourism, fuzzy AHP model, Mazandaran Province
JEL Classification: P48, C38, N75, Q57

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1- Introduction

Tourism industry, as one of the most important phenomena of the third millennium had increasingly significant impact on economic growth, dynamism and cultural exchanges in countries over the past half century. The global experiences indicate whenever tourism develops accidentally and without planning, environmental and social problems will emerge and tourism problems have exceeded on its benefits in long run since uncontrollable development and lack of tourism management reduce the attraction of tourism destinations strongly preventing other interested tourists' travel to these places, followed by serious socio-economic problems for host societies (SeyyedAlipour, et.al, 2010).

Identification of prone areas to develop tourism activities is one of the most important issues of tourism planners and one of the most extensive and popular GIS[1] applications; tourism activities planning cannot be apart from finding suitable place by using GIS. Thus, in tourism issue, planners should look for combined models and methods of GIS (Biranvand, 2008). On the other hand, development of tourism industry in places that have potential to attract tourists can be applied as an efficient tool in line with comprehensive growth and development of host societies. Attraction is counted as a necessary but not sufficient element for tourism industry development and growth; therefore, development of tourism industry in any area requires accurate identification of the region, providing services and facilities required for tourists and introduction in order to attract tourists (Mahallati, 2001). Geographical-natural studies and feasibility of each of which investable ecological attractions in Iran represent ecotourism as a unique economic resource in our country (Akbari & Bemaniyan, 2008).

One of the most serious problems of planning is inattention to decision-making. This means that it results in the waste of national wealth in many cases. Identifying prone areas of ecotourism is one of the solutions preventing incorrect decision-making in the path of investment, leading to tourism development. Given that tourism can have many positive and negative impacts on host society, attention to sustainable tourism based on nature to reduce negative impacts has been regarded with serious discussion of sustainable development in recent years to protect nature features and prepare the ground for sustainable development.

In this regard, Mazandaran Province, as a tourism hub in the country, with its exclusive natural features that attract millions of domestic and foreign tourism annually, is likely that nature-based tourism to be considered in this area. Thus, identification of prone areas of ecotourism in the province is the first step for ecotourism cycle and introduction of its potentials. Considering existing complexities in it, identification of these areas requires to regard criteria for assessment. Different methods in multi-criteria decision-making have been introduced so far, but AHP[2] , with simpler mathematics, is more understandable for decision-makers than other ones. Because of using statistical data, uncertainty can be modeled better in Fuzzy sets in this type of data compared to certain numbers.

In this research, effective factors on identification of prone areas of ecotourism

1- Geographic Information Systems

2- Analytic Hierarchy Process

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in Mazandaran Province were detected by experts and to evaluate obtained indicators, AHP with Fuzzy sets of interval values to determine the importance of each criterion and sub-criterion.

Given classification of these indicators in this research, firstly, four maps were designed indicating four main criteria of communicative networks, natural hazards, ecotourism potential, and travel facilities and services. These maps were obtained by the outcome of any sub-criterion on corresponding layer in GIS. Finally, final map that identifies prone areas of ecotourism in Mazandaran Province was obtained that is a combination of importance value of each of which criteria on four maps obtained in previous steps.

2- Literature Review

a) Foreign Researches

Boyd et.al, (1995) located prone areas of ecotourism in an article titles "identification of ecotourism criteria and parameters in the northern Ontario, Canada" after identifying criteria including nature, wild life, cultural heritages, perspective, and society.

Fung and Marafa (2002) studied ecological perspective and ecotourism potential of Feng shui forests by using IKONOS satellite pictures and GIS. They specified prone areas of ecotourism in northern Ethiopia by using parameters like height, slope, vegetation density, temperature, rainfall, and a combination of these indicators and using them in GIS.

Ok (2006) identified effective criteria on ecotourism planning in the forest area of Igneada, North West of Turkey. He also detected activities in environmental, social, and economic activities as effective factors on ecotourism planning. By using AHP and ELECTRE methods, he assessed selected activities.

Bunruamkaew and Murayam (2011) identified and prioritized ecotourism areas in Surat Thani Province in Thailand by using GIS and AHP. Evaluation process was done according to experts' views and based on 9 criteria of perspective and view, land cover, protected areas, species diversity, height, slope, proximity to cultural centers, distance from roads, and settlements.

Bukenya (2012) evaluated 10 national parks in Uganda with 10 selected criteria in an article titled "application of GIS in ecotourism development decisions: Evidence from the Pearl of Africa". The evaluation was to develop ecotourism and invest in each of these parks due to their specific features.

b) Iranian Researches

Shayan & Parsi (2007) considered parameters such as form of the land, geology, vegetation, lithology, protected areas, and climate and water flow in an article titled "feasibility of prone areas of ecotourism in Kohgilooyeh & BoyerAhmad Province" for zoning of prone areas of ecotourism. Data were evaluated by GIS and the results indicated that Dena and Gachsaran cities are more capable to provide services and support tourism.

Joozi et.al, (2009) evaluated ecological ability of Bolhasan area in Dezfool given its ecological features. By using AHP and GIS, criteria were evaluated and ecological ability was shown on map.

Farajzadeh Asl & Karimpanah (2008) identified suitable zones in an article titled "analysis of suitable zones of ecotourism development in Kordestan Province by using GIS" by detecting indicators and integrating information layers in GIS and Boolean model. The results indicated that

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nearly 80 percent of the Province zone has required potential for ecotourism development.

Behniyafar & Mansoori Deneshvar (2010) did zoning of spatial planning with multi-criteria evaluation approach and using AHP in order to develop tourism in GIS in watershed area of Golmakan.

Karami & Modiri 92010) identified prone areas of tourism aiming to investigate the role of tourism development in Kalpooragan area. The results indicated that development grounds could be prepared for regional tourism due to natural and historical attractions and potentials in the area including pottery workshops, in case of proper management and providing a regional comprehensive plan.

Hakimi Abed et.al, (2011) studied suitable tourism areas based on limited ecological criteria by using GIS in the southern shores of the Caspian Sea of Gilan province. This research aimed to determine proper zones to develop coastal tourism that have the least adverse effects in the current and long run.

Amirahmadi & Mozaffari (2012) identified appropriate zones of ecotourism development in Zanjan Province by using GIS. The results indicated that more than 30 percent of area of the Province has good potential for a variety of ecotourism activities.

This research looks for methods to obtain sustainable revenue resources from natural tourism development in order to create a more favorable urban management in the studied area by identifying natural tourism potential. One of the distinctions of this research with similar domestic and foreign studies is the use of type-2 Fuzzy technique combined with GIS. However, zoning accuracy was investigated with sample tourism areas in the province.

3- Theoretical Principles

One of the most important concerns of urban management is to guide and control physical-spatial development of cities systematically. This requires resources and tools including sufficient resources. The important point in the finance of financial resources is sustainability and utility of revenue sources since abandonment of urban management in obtaining financial resources leads to unsustainable revenue from building taxes, and particularly selling construction surplus density (Lalehpoor, 2014). However, researches have indicated that active tourism sector and accurate planning in this arena would have positive impacts on economic components and achieving urban sustainable revenue, and achievement of desirable city management as a result.

The Role of Tourism Development in Economy

Today, tourism has developed in such a way that it is counted as the world's third most lucrative industry after important industries such as oil and automobile. Economists refer to it as "invisible export." (Estelaji & Khoshniyat Bayati, 2012). Tourism, as a dynamic industry with evident and exclusive features, has allocated an important part of economic and productive activities of developed and developing countries to itself (Ebrahimzadeh, et.al, 2011). Tourism is a key to economic growth (Zarrabi & Eslami Parikhani, 2011); in a way that its development in advanced countries results in a variety of incomes and reducing imbalances in economy, and it is an opportunity for export, foreign exchange, and employment in developing countries

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as well (Ebrahimzadeh et.al, 2011). Moreover, tourism, as one of the ways to make money, has high value added (Rezvani, 2000). It refered as a gateway for development (Zarrabi & Eslami Parikhani, 2011). Some of the major achievements of tourism are employment (Ebrahimzadeh, et.al, 2011), development of regional infrastructures (Zarrabi & Eslami Parikhani, 2011), mobility of critical economies and improving developmental activities (Eftekhari, et.al, 2011), and raising public awareness in order to protect the natural environment (Techera & Klein, 2013); therefore, enjoying unique privileges, this industry provides several goals in the country simultaneously while other industries can provide only a part of intended purposes (Kazemi, et.al, 2010).

Thus, tourism is the most important current human activities. By creating significant changes in the face of the earth, political, economic, and cultural situation, it transforms human beings' way of life (Mahallati, 2001). It is also counted as one of the ways to achieve sustainable development since it can increase economic growth, protect resources, and improve quality of life in the host society, by meeting tourists' needs (Lee, 2013).

Ecotourism and Sustainable Development

According to the International Ecotourism Society, today, 30 percent of tourism is ecotourism (Joozi, et.al, 2009). As a result, considerable part of the world tourism activities is based on taking advantage of the nature. In ecotourism activities, individuals or tourist groups travel high mountains, forests, desert and sea aiming to take advantage of natural beauty and stunning visual effects (FarajzadehAsl, 2008). In fact, ecotourism is a kind of returning to nature. It has been emerged as a type of tourism in recent years and it has been developed rapidly (Zhang et al., 2012). Today, it is regarded as the fastest developing sector in tourism industry (Jones, 2005). Ecotourism is one of the most important resources of money, employment, and infrastructure to achieve sustainable development (Entezari & Aqayipoor, 2014); therefore, it has been recognized to develop areas that have suitable natural features (Zhang et al., 2012). It can be used for underdeveloped countries that have comparative advantage in natural resources to support economic activities (Che, 2006). However, the growth of this industry in any country requires an appropriate strategy and effective managerial plan (Joozi et.al, 2009).

Yet, there is no need for macro investment to develop ecotourism since it does not need luxury accommodations. Living in free and pristine environment is more attractive for them. If natural environment is not considered in long run, it will have many changes. Thus, the backbone of this industry is natural resources. In other words, ecotourism is more interested in taking advantage of natural beauties and amazing aspects of nature such as waterfalls, mountain, river basins, valleys and deserts and it does consider skyscrapers, star hotels (Molaei & Rajabi, 2011).

Finally, it can be stated that ecotourism is one of the tourism tendencies compatible with nature and environment that requires travel and visiting natural areas without interfering in it to enjoy, realize, and investigate natural attractions of these areas (Cruz et al., 2005). In this regard, the evolution of ecotourism, in its modern concept, is related to three main issues: 1. Ecotourism is a reaction against negative

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impacts of mass tourism 2. It is a reaction to increasing demand to travel to natural areas and attractions. 3. Ecotourism is a result of increasing understanding and acceptance of environmental protection and sustainability (Seydayi, et.al, 2012).

4- Research Method

Geographical Scope of the Research

Mazandaran Province, with a land area of 23842 square kilometers, centrality of Sari, is located in geographical location between 35 degrees and 46 minutes, 35 degrees, and 58 minutes north latitude, and 50 degrees and 21 minutes, and 8 minutes east adjacent to Caspian Sea in the north, with Golestan Province in the east, with Semnan, Tehran, and Qazvin Provinces in the south, and with Gilan Province in the west. According to the census of housing and population in 2011, the province has a population of 3073943 people. 931469 households live in Mazandaran Province. It has 20 cities, 55 counties, 58 town, 129 villages and 2975 hamlets. The climate is almost Mediterranean (Statistical Center of Iran, 2011) (Bakhtiyari & research center of cosmography, 2005).

Determining Sample Size

By using Tsaur et.al, (2006), and environmental comparison in three groups of related funds (resources-community, community-resource, and resource-tourism), and considering minimum ability of 80 per cent for ANOVA[1], and significance level of 0.5, the mean weights of the index in three groups are respectively (6.22, 6.43, and 9.24), and standard deviation of 2.40, sample size is 16 for each group and totally 48. The sample size was performed using NCSS & PASS software.

Determining Research Indicators

This research has used Delphi method for two reasons. Firstly, to identify effective indicators on locating prone areas of ecotourism in Mazandaran Province, and secondly, to determine the importance of each indicator. For the second purpose, Delphi method was combined with Fuzzy AHP.

Thus, given previous researches, sample size includes 48 M.Sc. and Ph.D. students and professors of urban development and tourism. However, due to the possibility of not returning all questionnaires from them, 100 ones were distributed in May 2012. 51 of them were returned. In this period, in order to specify indicators, an open-ended question was raised. This means that the question was "given features and limitations of Mazandaran Province, what indicators can be regarded to identify prone areas of ecotourism in the Province?" After checking questionnaires, incomprehensible and repetitive indices were removed. Finally, 23 indicators or sub-criterion in the form of four main criteria were selected on the recommendation of experts. The second period was started in August 2012. In order to specify participants' consent with selected criteria and sub-criteria, Likert-scale questionnaire was designed and presented to participants along with the results of the first period. Among them, 50 ones were returned. 50 percent of participants agreed 4 criteria and 18 sub-criteria. In the following, t-test was used to ensure about experts' views in the first period compared to the second one. The results indicated that α=0.05 and P-value of all indicators are more than 0.05 indicating participants' consensus in the first period to the second one.

1- One-Way Analysis of Variance

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Given selected criteria are not effective on locating prone areas of ecotourism equally, to determine the importance of each factor, another questionnaire was prepared, distributed among 50 experts in November 2012, and 49 of them were returned. In this questionnaire, for the convenience of comparison, the linguistic variables were used in Table 1. Each pair criteria are compared individually. Finally, given the expertise of each participant, 49 final questionnaires were combined together by using weight average function.

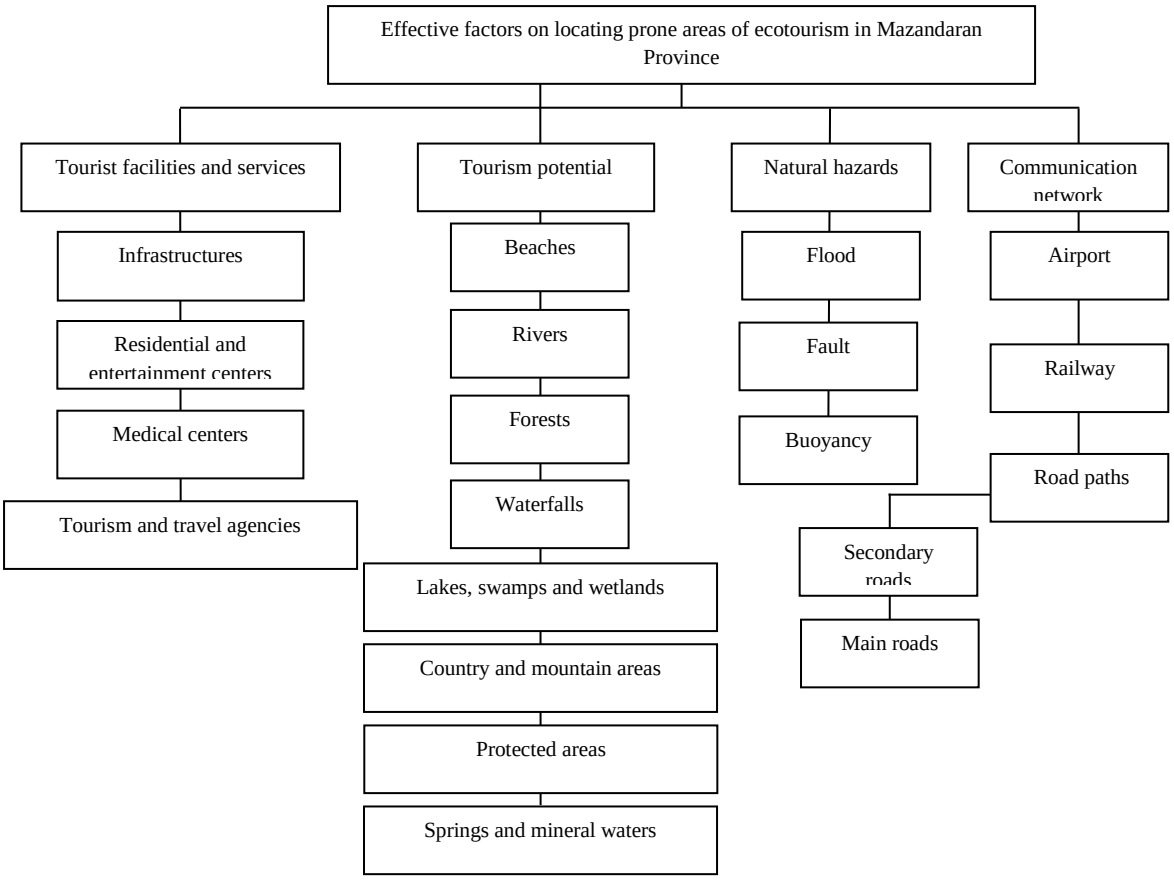


Fig1. Effective factors on locating prone areas of ecotourism in Mazandaran Province
Reference: (Researcher's findings)

Cumulative Matrix of Pairwise Comparisons

Generally, the relative importance of each decision cannot be equal in decision-making process given decision-makers' expertise and experience since some experts may have more experience than other ones in one issue. Thus, to collect data from experts, their relative importance should be counted on simultaneously. This is possible by using a weighted average (WA). This method will be explained in the following (Chen, 2012).

Suppose $E=\{E_1,E_2,\ldots,E_K\}$ is total decision-makers, and $\pi=(\pi_1,\pi_2,\ldots,\pi_K)$ is weight vector related to relative importance of decision-makers. We have $\pi_k\in[0,1]$ and $\sum_{k=1}^{K}\pi_k=1$. Assume $A_{ij}^k=(a_{ij}^k)$ is the result of binary comparison of i than j related with k decision-maker (E_k). The weighted average function (WA) on

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k will be the result of binary comparisons of k decision-maker as follows:

$$A_{ij} = WA(A_{ij}^1, A_{ij}^2, ..., A_{ij}^K) = (\pi_1.A_{ij}^1) \oplus (\pi_2.A_{ij}^2) \oplus ... \oplus (\pi_K.A_{ij}^K)$$
$$= \left(\sum_{k=1}^{K} (\pi_k \times a_{1ij}^k), \sum_{k=1}^{K} (\pi_k \times a_{2ij}^k), \sum_{k=1}^{K} (\pi_k \times a_{3ij}^k), \sum_{k=1}^{K} (\pi_k \times a_{4ij}^k) \right) \quad i, j = 1,2,...,n \quad (1)$$

In addition, cumulative comparison matrix is defined as follows:

$$\tilde{A} = \begin{bmatrix} 1 & A_{12} & \cdots & A_{12} \\ A_{12} & 1 & \cdots & A_{12} \\ \vdots & \vdots & \ddots & \vdots \\ A_{12} & A_{12} & \cdots & 1 \end{bmatrix} \quad (2)$$

Fuzzy AHP Method

The method presented here for the fuzzy AHP method is classical structure. This method will be used to calculate relative weight and total weights of options. This method is described below. Assume $E = \{E_1, E_2, \dots, E_K\}$ is total decision-makers related to decision-making process. Assume $\pi = (\pi_1, \pi_2, \dots, \pi_K)$ is decision-makers' weight vector. $\pi_k \geq 0$ for is $k = 1,2, \dots, K$ and we have $\sum_{k=1}^{K} \pi_k = 1$. All binary comparisons in this method are performed using trapezoidal fuzzy numbers. For convenience, we recommend decision-makers to use linguistic values for paired comparisons. A trapezoid fuzzy number attribute is given to each of these linguistic values as represented in Table 1 (Zheng et al., 2012).

Table1. Conversion of linguistic values to the trapezoidal fuzzy numbers*

Linguistic variables	Trapezoidal fuzzy numbers	The relative importance of values (absolute numbers)
Equally important	(1,1,1,1,1)	1
Slightly better	(5, 2.7,2.4,2)	3
Better (more favorable)	(4,9.2,11.2,6)	5
Much better	(6,13.2,15.2,8)	7
Excellent	(8,17.2,9,9)	9
Intermediate values	$(x-1, x-{}^{1}/_{2}, x+{}^{1}/_{2}, x+1)$	x= 2, 4, 6, 8

* For more convenience of decision-makers, paired comparisons were done by linguistic variables. In the following, to calculate relative weight in Fuzzy AHP method, trapezoidal fuzzy numbers have been represented in table1. The alternative of linguistic variables will be replaced.

Reference: (Zheng et al., 2012)

Calculating Relative Weight and Total Weight of Options in Fuzzy AHP Method

In this method, to calculate relative weigh of all cumulative matrixes, following method will be used:

Consider $\tilde{A}$ is Cumulative decision matrix. If any element of this matrix that is a trapezoidal fuzzy number displays as follow (Zheng et al., 2012):

$$\dot{A}_{ij} = (l_{ij}, m_{ij}, n_{ij}, s_{ij}) \quad (3)$$

Relative weight of each element in this matrix can be calculated as follows:

$$\alpha_j = \left[\prod_{j=1}^{n} l_{ij}\right]^{1/n} \quad (4)$$

$$\beta_j = \left[\prod_{j=1}^{n} m_{ij}\right]^{1/n} \quad (5)$$

$$\gamma_j = \left[\prod_{j=1}^{n} n_{ij}\right]^{1/n} \quad (6)$$

$$\delta_j = \left[\prod_{j=1}^{n} s_{ij}\right]^{1/n} \quad (7)$$

Moreover, we have:

$$\alpha = \sum_{j=1}^{n} \alpha_j \quad (8)$$

$$\beta = \sum_{j=1}^{n} \beta_j \quad (9)$$

$$\gamma = \sum_{j=1}^{n} \gamma_j \quad (10)$$

$$\delta = \sum_{j=1}^{n} \delta_j \quad (11)$$

The weight of each matrix in cumulative decision matrix will be:

$$\widetilde{W} = [\widetilde{W}_1, \widetilde{W}_2, \dots, \widetilde{W}_n] \quad (12)$$

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The vector of relative weight for each cumulative decision matrix is:

$$\widetilde{W}_j = \left(\alpha_j\delta^{-1}, \beta_j\gamma^{-1}, \gamma_j\beta^{-1}, \delta_j\alpha^{-1}\right) \quad (13)$$

5- Research Findings

Since presenting model results has wide operation size, some of major and prominent situation of running the model will be presented. In other words, some effective results were explained in the form of Fuzzy AHP output from MATLAB software. For weighting the studied indicators, we should move from the lowest level of decision-making toward purpose. For instance, secondary and main roads are compared as sub-criteria to the main sub-criterion of road routes together as represented in table2. As it can be seen, main routes with standardized score of 0.633 are in higher position than secondary routes.

Table2. A comparison of secondary sub-criteria to main criterion of road routes

	By-way	Main way	eigenvalues
By-way	[(1,1,1,1,1),(1,1,1,1,1)]	[(3.614,3.995,4.612,4.925,0.8), (2.899,3.603,4.987,5.646,1)]	0.367
Main way	[(0.274,0.306,0.390,0.481,0.8), (0.229,0.273,0.471,0.739,1)]	[(1,1,1,1,1),(1,1,1,1,1)]	0.633

Reference:

In the following, three main sub-criteria of airport, railroad, and road routes were compared to main criterion of communicative network (table3). In this regard, sub-criteria of airport with 0.403 normalized score, railway with 0.321 normalized score, and finally road routes with normalized score of 0.275 score were ranked respectively by experts.

Table3. A comparison of main sub-criteria to main criteria of communication network

	Airport	Railway	Road routes	Eigenvalues
Airport	[(1,1,1,1,1),(1,1,1,1,1)]	[(0.973, 1.269, 1.737, 2.008, 0.8), (0.577, 1.008, 2.004, 2.502, 1)]	[(2.228, 2.595, 3.212, 3.552, 0.8), (1.514, 2.203, 3.587, 4.246, 1)]	0.403
Railway	[(0.302, 0.340, 0.439, 0.548, 0.8), (0.252, 0.302, 0.530, 0.827, 1)]	[(1,1,1,1,1),(1,1,1,1,1)]	[(0.932, 1.099, 1.412, 1.656, 0.8), (0.717, 0.955, 1.639, 2.262)]	0.321
Road routes	[(0.315, 0.358, 0.479, 0.616, 0.8, 0.257, 0.313, 0.602, 1.053, 1)]	[(0.973, 1.269, 1.737, 2.008, 0.8), (0.577, 1.008, 2.004, 2.502, 1)]	[(1,1,1,1,1),(1,1,1,1,1)]	0.275

Reference: (Researchers' calculations)

Table4 represents paired matrix of main criteria comparison to purpose. As it can be seen, each element consists of an interval fuzzy number that is the outcome of experts' views by using WA matrix (equation2). Relative weight of each element in this matrix can be obtained by using this method. The criterion of tourism potential has the highest importance among main criteria with relative normalized weight of 0.311. Communication network with normalized score of 0.277, natural hazards with normalized score of 0.271, and travel facilities and services with normalized score of 0.120 ranked respectively.

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Table4. Paired comparison of main criteria to purpose

	Communication network	Natural hazards	Tourism potential	Travel facilities and services	Eigenvalue
Communication network	[(1,1,1,1,1),(1,1,1,1,1)]	[(0.323, 0.269, 2.737, 2.008, 0.8), (0.577, 1.008, 2.014, 2.502, 1)]	[(1.851, 2.284, 2.621, 3.278, 0.8), (1.303, 1.915, 3.278, 3.921, 1)]	[(0.228, 2.595, 0.228, 2.595, 3.262, 3.552, 0.8), (1.514, 2.203, 3.587, 6.246, 1)]	0.277
Natural hazards	[(0.332, 1.099, 1.412, 1.356, 0.83), (0.717, 0.955, 1.639, 2.252,1)]	[(1,1,1,1,1),(1,1,1,1,1)]	[(0.202, 0.740, 0.439, 0.501, 0.8), (0.252, 0.302, 0.530, 0.827, 1)]	[(1/848,2/384,3/021,3/378,0/8), (1/400,2/015,3/378,4/021,1)]	0.271
Tourism potential	[(0.312, 0.353, 0.461, 0.432, 0.8) (0.259, 0.312, 0.563)]	[(1.848, 2.384, 3.021, 3.358, 0.8), (1.420, 2.025, 3.378, 4.021, 1)]	[(1,1,1,1,1),(1,1,1,1,1)]	[(3.614, 3.965, 4.612, 4.905, 0.8), (2.899, 3.663, 4.987, 5.646, 1)]	0.311
Travel facilities and services	[(0/315,0/348,0/439,0/616,0/8), (0/257,0/313,0/602,1/033,1)]	[(0.301, 0.320, 0.739, 0.546, 0.8), (0.252, 0.302, 0.530, 0.827, 1)]	[(0.874, 0.306, 0.399, 0.461, 0.8), (0.229, 0.273, 0.471, 0.799, 1)]	[(1,1,1,1,1),(1,1,1,1,1)]	0.120

Reference: (Researchers' calculations)

In the next step, sub-criteria are compared to main criteria in pair. For this purpose, relative eight of elements consisting of each cumulative decision matrix in fuzzy numbers can be obtained by using equations 3 to 13. Then, using the center of gravity method, the relative weights were defuzzified to change absolute numbers as represented in table5.

Table5. Effective criteria on locating prone areas of tourism in Mazandaran Province

Final weight	The weight of secondary sub-criteria	Third level (secondary sub-criteria)	Final weight	The weight of main sub-criteria	Second level (main sub-criteria)	The weight of main criteria	First level (main criteria)
			0.110	0.398	Airport	0.277	Communication network
			0.088	0.316	Railway		
0.028	0.367	Secondary route	0.075	0.271	Road routes		
0.048	0.633	Main route					
			0.141	0.522	Flood	0.271	Natural hazards
			0.038	0.14	Fault		
			0.088	0.323	Buoyancy		
			0.097	0.311	Beaches	0.311	Tourism potential
			0.034	0.109	Rivers		
			0.069	0.223	Forests		
			0.023	0.074	Waterfalls		
			0.019	0.061	Lakes, wetlands, lagoons		
			0.026	0.085	Country and mountain areas		
			0.021	0.067	Protected areas		
			0.016	0.052	Springs and mineral waters		
			0.043	0.357	Infrastructures	0.120	Travel facilities and service
			0.032	0.268	Residential and entertainment centers		
			0.025	0.208	Medical centers		
			0.020	0.168	Travel agencies		

Reference: (Researchers' findings)

The weight of main and secondary sub-criteria and final weight have been calculated separately. Among sub-criteria related to communication network, airport, with normalized score of 0.398, had the highest importance, and the most important ecotourism potential in this province are beaches (0.311), and then forests (0.223).

Identifying Prone Areas of Ecotourism Development

The use of approach based on GIS is very effective to identify prone areas of ecotourism development since this system has exclusive features in designing, classifying, weighting, analyzing, and integrating data with spatial capability, as a system supporting decision-making (Hai-ling & Liang-qiang, 2011). Practically, it helps managers to know about events affected by different decisions and scenarios (Boers & Cottrell, 2007).

Tourism industry is beyond an industry, as a global and social phenomenon with specific features (Zarrabi & Safarabadi, 2013). Its features and limitations need to be identified in any area. Thus, according to experts' views, four main criteria of communication network, natural hazards, tourism potential, and travel services and facilities, that each of them has sub-criteria, have been considered in this research.

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A combination of AHP and Fuzzy sets was used to evaluate selected factors and GIS was used to analyze spatial data. Thus, after prioritization of effective factors with the help of Fuzzy AHP, specific weight was given to each layer. By using Raster Calculator tool, overlapping operation performed on data layers. Four obtained maps have been represented below.

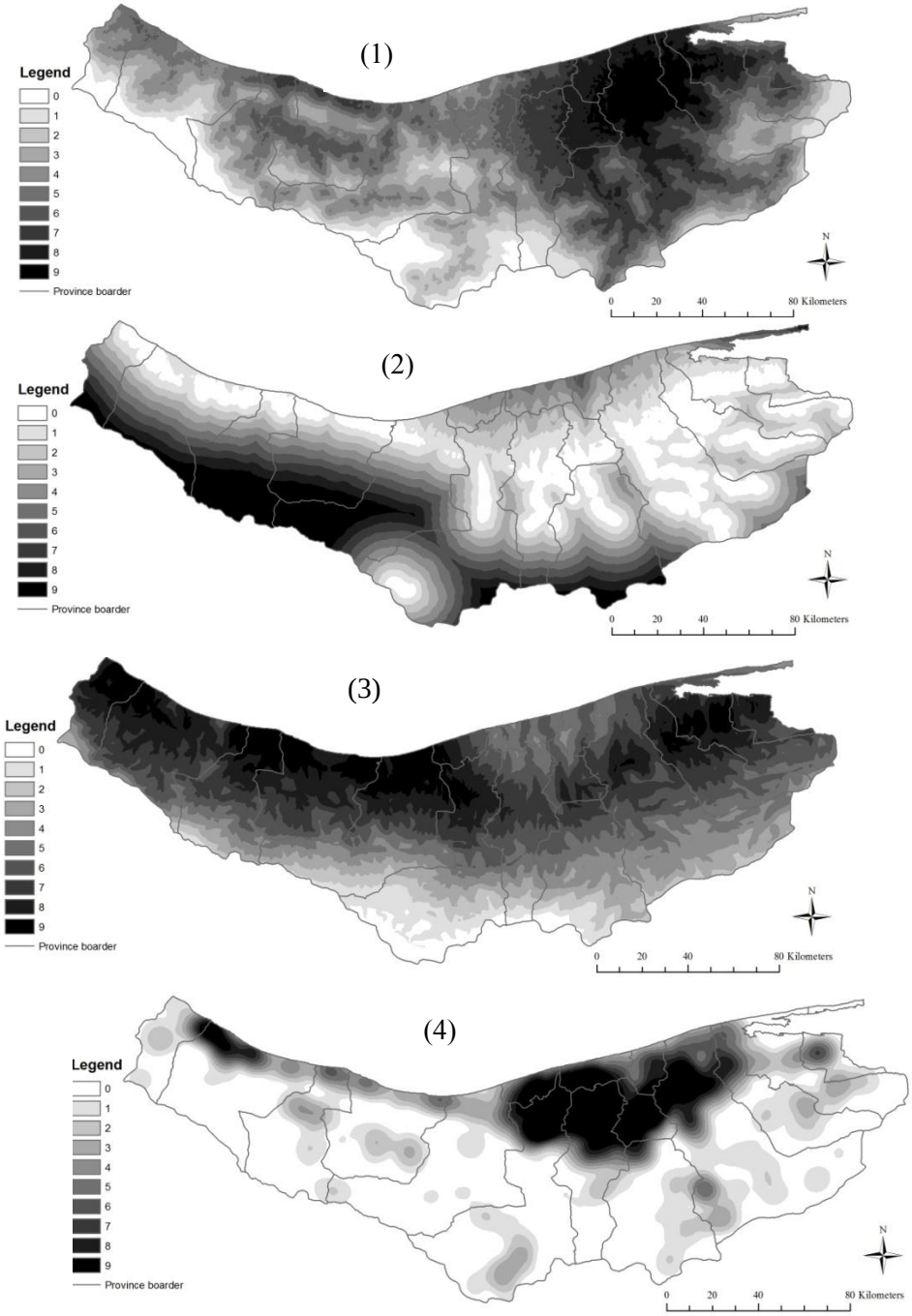


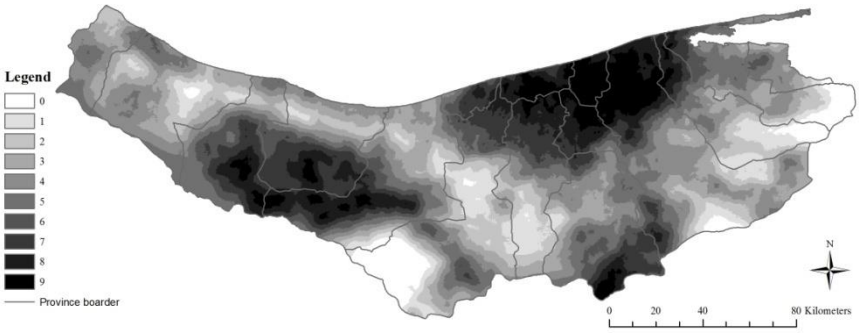
Fig2- (1) Communication networks, dark area with the greatest access (2) natural hazards, dark areas with the greatest amount of natural hazards (3) ecotourism potential, dark areas with the highest potential for ecotourism, (4) travel facilities and services, dark areas with the best accommodations and travel services

Reference: (Researchers' findings)

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In the following, given the weight of each main criterion and repeating the above process, map1 represents prone areas of ecotourism development in Mazandaran Province. It is worth mentioning for better readability, the output of maps has been graded on a scale of 9-0 from the worst to the best areas.



Map1. Prone areas of ecotourism in Mazandaran Province by integrating main criteria, dark areas represent the highest potential for ecotourism

Reference: (Researchers' findings)

In order to ensure test accuracy of final output, introduced as prone areas of ecotourism in the Province, firstly, the area of each utility of 0 to 9 (from the worst to the best represented in the guide of map1), has been calculated in the Province.

In the following, to ensure the utility, for example utility 9 has the best area for ecotourism and the highest capacity for investing in the province, 56 sample tourism centers were identified in Mazandaran Province. For each of these areas, a belt or buffer to a distance of 1 to 5 kilometers was considered. Then, the area of utility from 0 to 9 was calculated separately in each of these buffers of 1 to 5 km. Finally, the average area of buffers was calculated separately as represented in table6.

Table6. The area and percentage of utilities in the Province and scope of prominent tourism areas

Utility index	Area (Province)	Area percentage (Province)	The average size of buffers in prominent tourism areas	Percent of the buffers in the tourism
0	1306181196	5.5	206399036	1.7
1	2040401667	8.6	393784753	3.3
2	2960015056	12.5	786768843	6.6
3	4583001877	19.3	1773336026	14.8
4	3895700175	16.4	2775390463	23.1
5	3042790080	12.8	2048592099	17.1
6	1261329003	5.3	955303614	8
7	1112075759	4.7	882521419	7.3
8	2072656408	8.7	1082377049	9
9	1576139778	6.6	1107108361	9.2

Reference: (Researchers' findings)

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As it can be seen, areas with the utility of 9 i.e. the highest potential for ecotourism development in the province, has allotted 6.6 percent to itself. This is 9.2 percent in the buffers of tourism center. For the utility of 0 i.e. the least potential for ecotourism development in the province, this figure is 5.5 percent while it is only 1.7 percent in the surrounding areas of tourism centers. For the average of lower utilities (0 to 4) in Mazandaran Province, the average of 12.4 percent has been considered while this figure is 9.9 percent for the best tourism centers. Conversely, in higher five utilities (5 to 9) in the Province, the average of 7.6 percent has been regarded while this figure is 10.1 percent for tourism areas. This indicates that identified areas were in the closest distance to the prominent tourism areas in the Province and the farthest with undesirable ones.

6- Conclusion and S uggestions

In terms of tourism attractions, Iran enjoys a variety of climates, environments and seasons. In terms of recreational areas and natural beauties, it is equal with developed countries in the tourism industry. Today, a very important part of tourism activities in the world is based on natural resources. Given the abundant natural features, Mazandaran Province is of great importance and it hosts many tourists from Iran and the world annually. However, there are some problems in this area. Ecotourism development has a crucial role in the protection of these resources in the province.

This research aims to identify prone areas of ecotourism in Mazandaran Province in order to prepare the ground for protecting natural resources in this province, and providing sustainable financial resources for urban management as well. By focusing on prone areas of ecotourism development, urban management can prepare grounds that are more appropriate. Explaining the outcome, natural resources of the province are attractive center in this type of tourism. Thus, to provide infrastructures, there is no need for massive investment. By more accurate planning, considerable return on investment (ROI) can be prepared for urban management.

In this regard, since ecotourism aims to take advantage of natural beauties and stunning visions, identifying prone areas of ecotourism development is counted as the first step in this area. Because of complexity, it needs to consider several criteria for evaluation; therefore, Fuzzy AHP was used in this research to consider multiple criteria and use linguistic values to for evaluation, and to able to combat against uncertainty in linguistic values. The results indicated that the criterion of tourism potential, with relative normalized weight of 0.311, had the greatest importance among main criteria. Communication network, natural hazards, and finally travel facilities and services ranked next respectively. The most important sub-criteria related to the potential in the Province were beaches (0.311), and forests (0.223) respectively. It is worth mentioning that spatial analysis was done in GIS to enable optimum display to be provided for ecotourism development in the province (map1). Identified areas were in closest distance with prominent tourism centers and farthest with undesirable areas indicating one of the strengths of this research.

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The final output of this research (map1) specifies a range of priorities and investment capabilities. This means that areas with the priority of 9 were in very special conditions in terms of natural features, safety against natural hazards, access to communication network and tourism facilities. As we move toward low priorities, the capabilities would be reduced.

The areas that are a combination of the most important effective factors on locating ecotourism of Mazandaran Province from the perspective of experts are of great importance for private sector and urban management. It has introduced special investment opportunities to private sector. Urban management can provide many socio-economic benefits for host society by adopting financial policies in line with supporting it. Purposeful and accurate use of exclusive features of natural tourism in Mazandaran Province can create employment, reduce unemployment in this province, and have positive impact on increasing employment in adjacent provinces.

Undoubtedly, given the results and effective factors on choosing top areas, any planning and investment by urban management in them would have better and more appropriate outcome than other places. However, it should be noted that interference in environmental and natural landscapes should not lead to its destruction. For other researches, it is recommended to use other multi-criteria evaluation methods and compare with present study to attain optimal method in identifying prone areas of ecotourism in Mazandaran Province. Moreover, it is worth mentioning that used criteria in this research have been for Mazandaran Province in particular, and use of them in other areas need to be investigated.

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