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Evaluating of Kerman Province's geomorphosites by using prolong

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Abstract

Geomorphosites or special geomorphologic sites are new concepts which have entered tourism literature with an emphasis on special sites. Basically, the goal for discussing such concepts is to identify landforms with special importance on understanding the geomorphologic structure of a region and their scientific, ecological, cultural, aesthetic, and economical values. Generally, they are used for comprehending and exploiting human tourism. The tourism industry is, however, multidimensional and has economic, social, cultural and environmental (ecotourism, geotourism) aspects. As a green and clean industry, ecotourism plays a major role on national tourism development planning in Iran as well as attracting nature's tourists which is a fundamental necessity forthis industry. Due to high natural tourism capacities such as caves and diapirism, unique geological and geomorphological attractions along with social and historical attractions, Kerman province is among the five historical and superior provinces for tourism. This studyattempts to evaluate the geomorphosites of Kerman Province through Prolong approach and field studies. Quadruple alloys studied in terms of their potential ability of geomorphosites in this research include external, scientific, historical, cultural, social and economical beauty alloys. Two variables, exploitation value and quality were taken into consideration. According to the results, Loot field desert geosite had the highest score. As regards the values for exploitation level and quality, Meymand village obtained the highest score requiring greater attention from the authorities.

Keywords: Geomorphotourism; Geomorphosites; Pralong model; Kerman Province; Climatology tourism

1. Introduction

The tourism industry has significant economic and social influences. Creating jobs, obtaining sustainable and appropriate foreign exchange revenue, mutual cultural recognition in accordance with international peace and harmony are among the economic and social benefits of this industry (Mousaiee, 2004). Considering the 4 to 5% growth in tourism in the 1990s indicates that this industry's revenue will reach 1.55 trillion dollar and the number of tourist will reach 1 billion people in 2010 (Hosseinzadeh Dalir, 2001). Paying attention to income-generating industries in order to end the tragedy of a single-product economy is the first step for the country's sustainable growth and development (Azad Manjiri, 2008).This industry has experienced great tendency towards nature in recent years. Ecotourism with her inherent objective (protecting the environment), local communities' obligation and respect for the cultural features of the host society are some planning choices which show the greatest compatibility with the sustainable development concept (Fannel, 2006). One of the most important branches of tourism which is greatly similar to ecotourism is Geotourism which is coined from combining the words Geo (earth) and Tourism (Rahimpour, 2007). Geotourism, in fact, is a kind of cultural-environmental tourism which takes place in areas with special memorials orgeological features. Through her attractions, it can provide new moves in scope of globalization through establishing a dynamic and creative relation between a region's nature and culture with tourists for global tourism, peace

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and sustainable peace (Drumm & Moore, 2005). Sites which are the goal of Geotourism are mostly geotops or geographical phenomena which can be used for tourism development as geological heritages in form of efficient instrumental Geoparks (Abdi *et al*., 2004). No independent study of Geotourism management has been conducted so far and the majority of researches study the obstacles and strategies for developing tourism in countries. Yet, developing geotourismrequires accurate recognition of challenges and useful strategies for developing it. This study will briefly study some of the researches conducted. Zomorrodian (2003) studied the geomorphologic infrastructures of ecotourism in Iran and introduced mountains and other terrain accidents which have high potential for mountain sports, slope climbing, rock climbing, etc. Kamyabi (2008) in his study "Evaluating natural and geotouristic attractions of Hable Rood (River Hable) basin and national park of Semnan's desert" proposed that the aforementioned area is capable of becoming a Geoparkthrough planning management development and appropriate exploitation of geotouristic systems. Hongzhe & Zhu (2008) studied sustainable tourism in China and introduced Geotourism as an inseparable component of third-generation industries whichin turn, invoke other industries like transportation, catering, and touring agencies and make major contribution to sustainable economical development. With approximately 18 Geoparks, China is a pioneer in Geotourism development in theworld. Brilha (2009) studies the challenges of Geotourism development in Portugal's Geoparks and considers legal means as the most important strategy to protect natural heritages. This study shows the Geotourism capabilities of Kavir National Park and studies the feasibility of transforming it to a Geopark. Karimi et al. in their study titled "Surveying the capability of geomorphosites and time-terrain management", they used Pralong model and wind climate indicator (ke) to study Kashmar' sgeosites and concluded that waterfall would gain the highest score. In terms of exploitation quality and level value, fluvial terrace geositesobtainedthe highest score.Given the wind climate indicator (ke), the best climate for tourism in the area is in June and August. Azizi *et al*. (2012) in a research titled "Studying the capability of Geomorphosites and time-terrain management using Pralong model" studied Javanrood'sgeosites and their results indicated that waterfalls gained the highest score. Concerning exploitation quality and level value, fluvial terrace geosites gained the highest score and climate indicators showed that the best climate for tourism in the area was observed in March, April, May, June, and August. Generally, geosites are sites with interesting geological and geomorphic shapes and processes which can become geosites if appropriate tourism infrastructures are built (Haj Aliloo & Nekoi Sadr, 2011: 28). Thus, Geomorphosites or special geomorphic sites are surface shapes which have especial values in scientific, ecological, cultural, aesthetic, and economical fields for comprehension and human tourism exploitation (Pereira *et al*., 2007: 159).

2. Material and methods

2.1. Methodology

Evaluating geomorphosites studied with Pralong approach consists of the following steps:

Table 1. Scoring scale and criteria in evaluating the external beauty alloy of geomorphologic sites

Score of paragraph 1 + score of paragraph 2 + score of paragraph 3 + score of paragraph 4 + score of paragraph 5 + divided by 5 = total score of external beauty					
Criteria / Score	0	25%	50%	75%	1
Number of tourist attractions	-	1	2-3	4.5-6	More than 6
Paragraph 1: in this paragraph, we only study the number of accessible tourist attractions. Each one of these attractions must have certain aesthetic features and their distance from other geomorphologic sites should be no more than 1 kilometer.					
Average distance from tourist attractions (meters)	-	Less than 50	50 to 200	200 to 500	More than 500
Paragraph 2: this paragraph includes the sum of the shortest distances between any one of the tourist attractions and geomorphologic sites divided by the number of tourist attraction site mentioned in paragraph 1					
Area	-	Small	Average	Large	Very large
Paragraph 3: total area of the site is considered. A quantitative scale (km) is set for each site (glaciers, caves, etc) and her size will be set compared to other identified sites in the area studied					
Height	Zero	Low	Average	High	Very high
Paragraph 4: the total height of the site is considered. A quantitative scale of height is set for each site (glaciers, caves, etc) in comparison withother identified sites in the area studied					
Color contrast with environment	Similar colors	-	Various colors	-	Contrasting colors
Paragraph 5: it highlights the color contrast between site and her direct environment. A distinct color includes all her infinite shade colors. Dark, grey, and light grey are known as distinct colors.					

Table 2. Scoring scale and criteria in evaluating the scientific alloy of geomorphologic sites

Score of paragraph 1 + score of paragraph 2 + score of paragraph 3 + score of paragraph 4 divided by 4 = total score of exploitability					
Criteria / score	0	25%	50%	75%	1
Attraction in terms of Paleogeographic	-	Low	Average	High	Very high
Paragraph 1: These indicators along with geomorphologic capabilities of sites are measured in reconstructing the morpho-climate of the site. The attraction of geomorphologic sites with historical value is more					
Visual properties	Zero	Low	Average	High	Very high
Paragraph 2: it is about the features of morphological sites in educating people about morphological knowledge					
Area	-	Less than 25	Between 25 to 50	50 to 90	More than 90
Paragraph 3: like paragraph 3 in Table 1, this score is calculated as a portion of area of the desired morphological site divided by thetotal area of sites similar to the site studied. It is stated in percentage.					
Rarity	More than 7	Between 5 to 7	Between 4 to 3	Between 1 to 2	Unique
Paragraph 4: this indicator is defined as the number of similar sites in the area studied. A unique geomorphologic site can be an unparalleled sample of a morphoclimaticsite of thepast which cannot be found today.					
Condition of the site	Damaged	Heavily damaged	Averagely damaged	Somehow damaged	Without any manipulation
Paragraph 5: this indicator is dependent upon natural disasters, the development of site and human factors that influence geomorphologic development and the degree of protective actions					
Ecological attractions	Zero	Little	Average	Much	Very much
Paragraph 6: this indicator is stated in terms of the rarity of various species (number of species) and the natural dynamics (environment's ability for natural development) of vegetation and animal dispersal.					

Table 3. Scoring scale and criteria in evaluating the historical-cultural alloy of geomorphologic sites

Score of paragraph 1 + (score of paragraph 2*2) + score of paragraph 3 + score of paragraph 4 + score of paragraph 5 divided by 6 = total score of historical-cultural value					
Criteria / score	0	25%	50%	75%	1
Historical-cultural aspects	No attachment	Weak	Average	Great	Very great
Paragraph 1: this indicator depends on the emotional attachment and the historical importance of the site to people. This criteria is evaluated by considering the historical and cultural values of the geomorphologic site, regardless of physical works and places.					
Iconography sites	Zero	1 to 5	6 to 20	21 to 50	More than 50
Paragraph 2: all historical images of the geomorphologic site such as paintings, designs, cravings and pictures are considered for this indicator. The quality of pictures can make major contribution to the site's score.					
Historical and archeological aspects	Without any	Weak	Average	Great	Very great
Paragraph 3: this indicator is calculated according to availability of historical, architectural, and archeological sites and buildings in geomorphologic site. Its quality can be taken into consideration in the score which is given to the site.					
Historical and spiritual aspects	Zero	Weak	Average	Great	Very great
Paragraph 4: this indicator is calculated based on the religious and spiritual value of the geomorphologic site and her criteria is people's belief.					
Artistic and cultural events	Never	-	Sometimes		At least once a year
Paragraph 5: to calculate this indicator, we need to consider the cultural and artistic events held in the geomorphologic site. These evens might be either held in the geomorphologic site itself or in another place in vicinity of the area studied. This score can also be given to short time and less important events.					

Table 4. Scoring scale and criteria in evaluating the social-economical alloy of geomorphologic sites

Score of paragraph 1 + score of paragraph 2 + score of paragraph 3 + score of paragraph 4 + score of paragraph 5 divided by 5 = total score of social-economical value					
Criteria / score	0	25%	50%	75%	1
Accessibility	More than 1 kilometer distance	Less than 1 kilometer	Accessible through local road	Accessible through important regional roads	Accessible through important national roads
Paragraph 1: this indicator depends on the distance of geomorphologic site from main transit roads. If access is made possible through train or cable car, scales must be defined accordingly.					
Natural disasters	Uncontrollable	Uncontrolled	Somehow controlled	Optional control	Without danger
Paragraph 2: this indicator is defined in terms of geomorphologic site dangers and the control policies applied (awareness level, protectoral infrastructures, etc). Dangers caused by human activities are not considered in this indicator.					
Visitors per year	Less than 10000	10 to 100 thousand	100 to 500 thousand	500 thousand to 1 million	More than 1 million
Paragraph 3: it is defined as the ability of the morphologic site to attract visitors. Thus, the score is considered to belong to the whole geomorphologic site					
Level of protectoral actions	Full	Limited	-	Unlimited	Without protection
Paragraph 4: this indicator studies the protection level of the geomorphologic site. As for this indicator, there is a reverse relation between economical exploitation and reduction of protection level.					
Attraction	-	Local	Regional	National	International
Paragraph 5: there is great dependence between this paragraph and paragraph 4. Absence of security can act as a barrier in attracting visitors and tourists.					

Table 5. Scoring scale and criteria in evaluating the exploitation alloy of geomorphologic sites

Score of paragraph 1 + score of paragraph 2 + score of paragraph 3 + score of paragraph 4 divided by 4 = total score of exploitation quality					
Criteria / score	0	25%	50%	75%	1
Area used	0	Less than 1 acre	1 to 5 acres	5 to 10 acres	More than 10 acres
Paragraph 1: this indicator depends on the area of the geomorphologic site which is used for tourism and economicalexploitation. This area might include the whole geomorphologic site or just parts of it.					
Number of infrastructures	Zero	1	2 to 5	6 to 10	More than 10
Paragraph 2: it includes transportation, information, settlement, visits, and souvenir infrastructures in the geomorphologic site. The sidewalk path is not considered in this indicator.					
Seasonal habitation (days)	-	1 to 90 days (1 season)	91 to 180 days (2 seasons)	181 to 270 days (3 seasons)	271 to 360 days (4 seasons)
Paragraph 3: this paragraph is determined by the number of days and seasons that the geomorphologic site is used. If the geomorphologic site is not constantly used, annual average will be used to calculate the score.					
Daily habitation (hours)	Zero	Less than 3 hours	3 to 6 hours	6 to 9 hours	More than 9 hours
Paragraph 4: it discusses the number of hours the geomorphologic site is used every day. If the daily exploitation varies over year, annual average will be used to calculate the score.					

Table 6. Scoring scale and criteria in evaluating the exploitation quality alloy of geomorphologic sites

Score of paragraph 1 + score of paragraph 2 + (score of paragraph 3*0.5) + (score of paragraph 4*0.5) + score of paragraph 5+ score of paragraph 6 divided by 5 - total score					
Criteria / score	0	25%	50%	75%	1
Using external beauty	Without any ads	A supportive action and introducing a product	A supportive action and introducing several products	Several supportive actions and introducing a product	Several supportive actions and introducing several products
Paragraph 1: the notable phenomena of the geomorphic site are used to advertise product (preparing brochures, bill boards, websites, magazines, etc)					
Utilizing the scientific value	No education possibility	A supportive action and introducing a product	A supportive action and introducing several products	Several supportive actions and introducing a product	Several supportive actions and introducing several products
Paragraph 2: this paragraph emphasizes using the scientific attraction of geomorphologic site considering educational exploitation through supportive actions (holding exhibitions, educational tour, educational advertisements) of products considered					
Using cultural value	Without any educational possibility	A supportive action and introducing a product	A supportive action and introducing several actions	Several supportive actions and introducing a product	Several supportive actions and introducing several products
Paragraph 3: this paragraph emphasizes using the cultural attraction of geomorphologic site considering educational exploitation through supportive actions (holding exhibitions, educational tour, educational advertisements) of products considered					
Using the economical value	No visitors	Less than 500	5000 to 200000	200000 to 1000000	More than 1000000
Paragraph 4: this paragraph refers to using the economical potential facilities of the geomorphologic site based on the number of visitors over a year. This score does not imply the profitability of the desired geomorphologic site.					

2.2. Study area

Kerman province is located in the South east of Iran. Its elevated lands are an extension of the Central Iranian mountain chains beginning from the volcanic folds of Azerbaijan and continuing to Baloochestan. Climatic variations in Kerman due to especially climatic terrain are notable. As a result, Northern, Northwestern and Central areas are dry and the Southern and South eastern areas are humid. Precipitation regime is mostly in the form of rain and occurs from November to May. It is fed by the Western and North western winds which are seasonal and reduces relative moisture as they carry large amoungsof sand and dust. Maximum temperature of over 50°Coccurs in Shahdad. The evaporation level varies between 1500 to 4500 millimeters with maximum level observed in the periphery of the Loot desert (Shahdad plain, Bam plain and Normashir). Considering the precipitation, pluvial air masses enter the Province from the West and North-west. Their humidity decreases greatly as they move a long way over dry areas and pass Alborz and Zagros mountains. The central heights of the province reduce dryness and as height increases,e precipitation increases while temperature decreases. Kerman is under the influence of various local and extra-regional winds which cause various changes and modifications in the weather. These winds are mostly seasonal and dry winds which blow in March, April, and May from the South west to the North east and East. Western and North western winds cause rainfalls in winter and spring.

3. Results and discussion

Each value was given a score according to the Pralong approach based on the field view. Scoresgained by evaluating tourism alloy and the site's geomorphic landforms exploitation alloy of the area studied made their comparison possible. These comparisons help to understand the capabilities and abilities level of each landform. Thus, tourism planners and authorities can present special plans in Kerman Province's tourism area to improve touring and tourism in thisregion.

Given the values obtained from calculating the tourism value of geomorphologic landforms in Kerman province tourism area and comparing these landforms, Loot plain gains the highest score (39.53) in terms of tourism value and can be considered as the most attractive geomorphologic landform (Table 7). After Loot plain, Rayn waterfall (38.33), Torang cave (36.5), Meymand village (32.8), Shahdad desert (30.5) are ranked accordingly. However, Meymand village, Torang Cave and Rayn waterfall had the highest exploitation value.

Relative proximity to towns in Kerman province and relative availability of facilities helps increase their exploitation value. Loot plain and Shahdad desert come next. Evaluations show that tourism values of geomorphologic landforms in Kerman province tourism region are, respectively, due to high scientific value, external beauty value, historical and cultural value, and, finally, economical and social value of these landforms. Hence, attention must be paid to the relationship between these values.

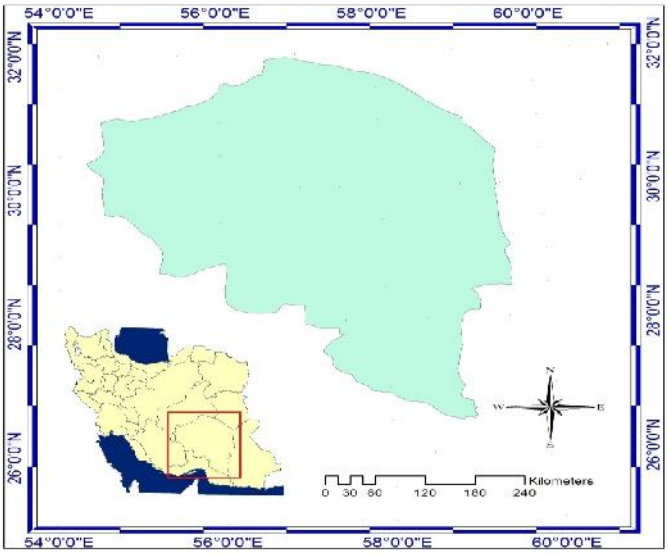

Fig. 1. Location of study area

Table 7. Evaluating the capabilities of geomorphosites

	Shahdad desert	Loot plain	Meymand village	Torang cave	Rayn waterfall
External beauty	40	42.2	49	39	58
Scientific value	48.83	40.83	35.66	22.83	36.66
Historical-cultural	22.83	35.33	26	29	32.66
Economical	50	56	65	59	40
Average tourism alloy	30.5	39.53	32.8	36.5	38.33
Exploitation level value	25.25	31.5	43.75	39.5	37.5
Exploitation quality value	18.75	13.5	13.5	13.5	8.25
Exploitation value average	28	26	30.45	29	31.87

4. Conclusion

Geotourism or tourism geology is a modern strategy for describing and explaining earth sciences and recognizing the natural capital of each region that developstourism and attracts geotourism researchers to area with geological attraction, in addition to fulfilling educational roles. In addition to creating economical geology and deposits, it motivates other researcher to visit the area to determine the scientific-economical axis of the region finally, paves way for social development once geological studies and other applied studies are combined. Areas like Kerman province as excellent tourism areas have particularly been popular with tourists in recent years. The majority of the visits to the area were for her external beauty, historical-cultural value and recreation and the area has hardly been studied in terms of geotourism. In addition to providing theoretical principles, the present research establishes a special relationship between geomorphologic phenomena of Kerman province and geotourism and studies the relationship between geomorphologic phenomena in various parts of the region. Results indicate that Kerman province tourism area with its infinite geomorphologic landforms is capable of becoming a geotop site where rare geomorphotouristic phenomena can be observed. According to results, infinite landforms were observedin the region and Shahdad desert, Loot plain, Meymand village, Torang cave, and Rayn waterfall were identified and studied in the area. Final evaluation showed that based on the Pralongapproach, Loot plain has the highest tourism value an Shahdad desert has the least capability to attract tourists among other landforms. Other landforms have average to high tourism values. Based on the comparison of

tourism values in the region, Shahdad desert with an average scientific value 48.83 has the highest score and other values in the region are more or less the same and do not show much difference. This fact indicates the high capability of Kerman province tourism region and shows the region's tourism potentials and values. Based on the calculations, Meymand village has the highest exploitation value and this has been made possible by the sufficient tourism facilities in the region. Shahdad desert has the least exploitation value and other landforms have average exploitation values. Considering the high potentials in these landforms, lack of integrated planning, infrastructures and facilities, shortage of national and international advertising, and paying no attention to profitability of tourism are among issues which have hindered the sustainable development of tourism. Given the high geomorphologic tourism attraction of Kerman province, this research can provide a new view into study inggeomorphotourism phenomena in Kerman province. Considering the potentials and capabilities available in the whole country, sites can be allocated with geomorphotourism potential and information provided about the essence of these phenomena and the relationship between geomorphologic sites in order todevelop tourism in this region.

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