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Assessment of Mayāmey Mountain Protection Suitability to Introduce It as a Prohibited Hunting Area by Analytical Hierarchy Process

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Abstract

Due to the rapid degradation of natural resources and biodiversity threat, analysing the status of protected areas and the need to promote the conservation level of such areas is of the challenges in the field of resources protection. This study aimed at investigating the possibility of promoting the Mayāmey area in the city of Mayāmey, Semnan province in order to promote it as one of the four areas of the environment. To this end, by studying the terms and conditions for the promotion of the regions, as well as considering the conditions in the area, it was recognized that the region studied has the potential to become a protected area and then a wildlife refuge. In addition, using hierarchical analysis process and criteria such as slope, altitude, density of vegetation, distance from the communication path, distance from the city, distance from sensitive habitats, distance from river and geology, the region was zoned for protection use. Expert-Choice software was used to weigh the criteria and ArcGIS software was used for overlaying of layers. The results suggested that about 45% of the area (17008 ha) is suitable for protection.

Key words: Suitability Assessment, Mayāmey, Hierarchical Analysis Process, Protected Area.

Introduction

In spite of speedy destruction of the country's biological resources, there are still notable areas of natural ecosystems that should be exploited in proportion to their suitability. If these areas are not identified, protected and managed, they will ultimately be exploited by occupied communities or will be over-exploited during the development process (Jozei et al., 2008).

To protect areas inside and outside, the main habitats of the living population is of the most effective ways of preserving biodiversity. The areas that are essential for wildlife, but the generation of important species are endangered, can be protected for a limited period of time under the authority given to the Department of Environment. If the requirements are provided, the prohibited hunting areas are suitable to be considered active natural ecosystems and be conserved as a protector of the country's reserves (Dehdar Darghahi, 2005).

The excessive deterioration of resources and the human's unreasonable use of the land has motivated the promisors to look for a framework to solve future problems and find various ways to make the best use of resources. Hence, the process of natural resources exploitation was implemented in a planned framework called the management plan, such as agricultural plans, rangeland, and so on. The first step in the implementation of each of these projects is to assess the ecological potential of the region to implement the plan. In recent years, studies have been conducted in different parts of the country, and based on the results, various plans have been implemented, but unfortunately there is still a wide range of areas which are exploited without proper assessment and planning. If the studies are developed, it will be possible to take an effective step towards proper utilization of existing resources, preservation and continuation of the land inventory (Makhdoom, 2010).

In this regard, studies have been conducted both inside and outside the country. Abaft (2016) evaluated the ecological potential of urban, industrial, and rural development in Dehdasht district using the AHP technique and concluded that most of the region consists of areas with inadequate potential for protection. Moazzeni and Shoeibi (2015) assessed the environmental suitability of the forbidden hunting area of Qom Province in order to develop ecotourism in a managed manner. Riyazi et al. (2015) evaluated the forbidden hunting area of

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Sefid Kuh in Damghan city to improve it to a protected area using the valuation method. According to the valuation principles, the prohibited hunting area was promoted to a protected one. Urak et al. (2014) investigated the environmental suitability of the forbidden hunting area of Khoramnaz to develop ecotourism using GIS. Yazdi and Zare'i Mahmoud Abadi (2011) analyzed the feasibility study of upgrading the protection level of forbidden hunting areas to protected areas in desert biomass (case study: Prohibited hunting area of Marv). Finally, by matching the results with the classification system of protected areas at the national and international levels, the conservation title of the area was determined. Using multi-criteria evaluation methods, Romano et al. (2015) evaluated the suitability of rural areas in southern Italy and realized that the OWA method has more potential in the implementation process and provides more details. Halil Ekinchi et al (2013) applied ICA and AHP techniques to evaluate the farming potential of Yusuflyh district in the city of Artvin, Turkey. After weighing, the factors were classified into five categories of proportions according to the FAO method. Abdelkader Mendas et al. (2012) used a multivariate decision making analysis in the GIS environment in order to assess the region's suitability to develop agricultural areas and wheat production.

Habitats with obvious indicators of declining the wildlife population are depleting because of over-hunting. Therefore, they need to be protected by becoming forbidden hunting for a limited time, typically three to five years. If the regional animal population is restored during this period, it can be determined as one of the four areas under management according to other criteria. The solution of identifying a region as the forbidden hunting area can be considered as the protector of the country's natural reserves and as the tester to check the suitability of protected areas. Due to the fast process of natural resource degradation and biodiversity threat, analyzing the status of protected areas and the need to promote the conservation level of such areas is of the challenges in the field of resources protection.

Methodology

Mayāmey is the area studied in this research. It is located at the north-east of Semnan province and in the city of Mayāmey with a total area of 37,364 hectares; distance of 55 degrees, 22 minutes, 38 seconds to 55 degrees, 47 minutes and 34 seconds in the east; and 36 degrees, 47 minutes, 36 seconds to 36 degrees, 24 minutes and 45 seconds in the north. Figure 1 displays the location of the Mayāmey area in the country and the province.

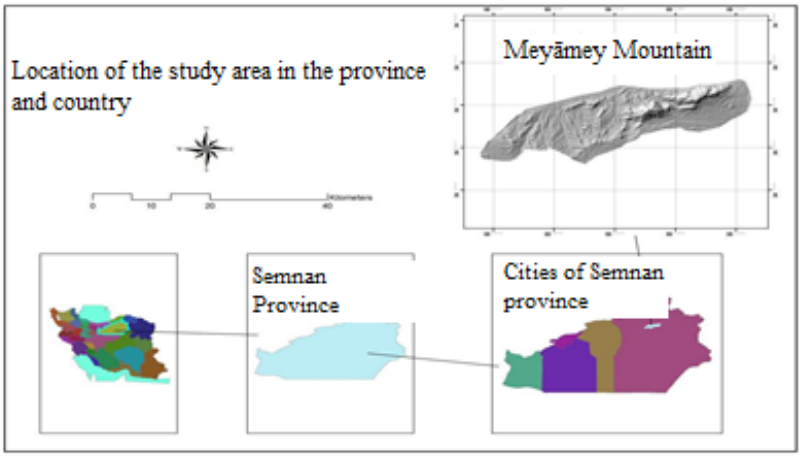

Figure 1: The location of the Mayāmey area in the country (Source: Authors)

In the present study, a topographic layer was used to prepare the Digital Elevation Model (DEM) of the region. The model was made using the digital layer in the ArcGIS environment as well as the elevation digits. Since the Mayāmey is located in the mountainous area, as well as due to its vast area (about 38,000 hectares), there are some species of wildlife including mammals, birds and reptiles in the region. Table 1 lists the species in Mayāmey Mountains.

Table 1: Mayāmey Mountain Species (Mayāmey Environment, 2016)

Row	Mammals		Birds			Reptiles		
	Big	Small	predators	Non-predators	Vultures	Lizards	Snakes	
1	Capra aegagrus	Pika	Eagle	Perdicinae	Vulture	Monitor lizard	Semi poisonous	poisonous
	-	-	***	-	**	***		
2	Urial	Jird	Hawk	See-see partridge	crows	Agamas	Schokari sand racer	Carpet vipers

	**	**	***	-	-	-	-	-
3	Panther	Gerbil	Kestrel	Sylvia warblers	Chough	Scincus	Spalerosophis diadema	Cobra
	**	-	***	-	-	-	-	*
4	Wolf	Rabbit	Barbary falcon	Wheatears	Magpie	Uromastycinae	Cat snake	Macrovipera lebetina
	-	-	***	-	-	*	-	***
5	Fox	Porcupine	Saker falcon	Lark			European cat snake	Gloydius intermedius
	-	-	***	-			-	-
6	Jackal			Eurasian hoopoe				Pseudocerastes
	-			-				-
7	Hyena			Sparrow				Horned Viper
	-			-				**
	Cheetah			Waxwing				
	***			-				

Layers and information used in the research were obtained from the relevant administrative centers, such as the environment and natural resources departments. Expert Choice 11 was used for weighing the criteria and sub-criteria, and ArcGIS 9.3 was used for analyzing the layers during the research process to weigh the criteria. The graphs were drawn in Excel.

Based on the review of relevant resources and local conditions in the region, the following factors were selected for zoning: The vegetation density of the area, the distance from the four areas of the adjacent environment, altitude, slope, distance from the habitats of endangered species of wildlife, distance from the habitats of protected species of wildlife, and geological layer-formations of the region.

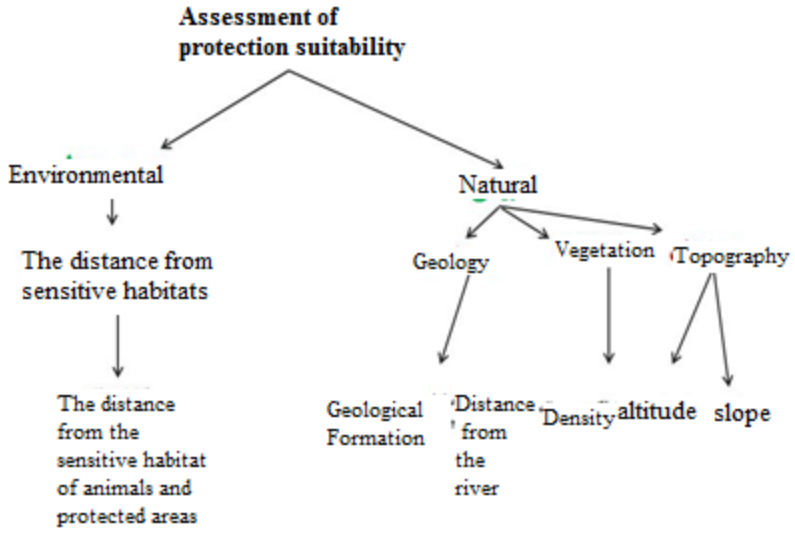

Figure 2: AHP tree of protection suitability

Results

Based on the requirements for converting a region to a forbidden hunting area, for the following reasons, the area studied is suitable to become a forbidden hunting area:

1. Capra aegagrus (wild goat) is one of the exploitable species considered by the Environment Department for hunting permission in the past years. It is one of significant species with the large bulk and horns. In the case of protecting the area, in addition to exploiting it by a hunting license, such a specie would be a unique gene bank.

2. If supported, the species of Capra aegagrus and Urial will be available in relatively heavy categories, while the proportion of heavy category in this area is greater than the four areas under the management of the organization.
3. At the moment, the habitat conditions of this area are similar to the mountainous habitats of Iran-Turan climate in the rest of the country. However, further and more detailed research would provide evidences for suitability of the region as a protected area with higher ratings.
4. This area is located 20 km away from Khoshyeylāq Wildlife Refuge, 85 km away from Golestan National Park, and 35 km away from Turan Persian Onager Refuge. It provides the appropriate corridor conditions for passing or immigrating the species of the areas.

1) Vegetation density

This layer was obtained using satellite imagery and NDVI index (Figure. 3)

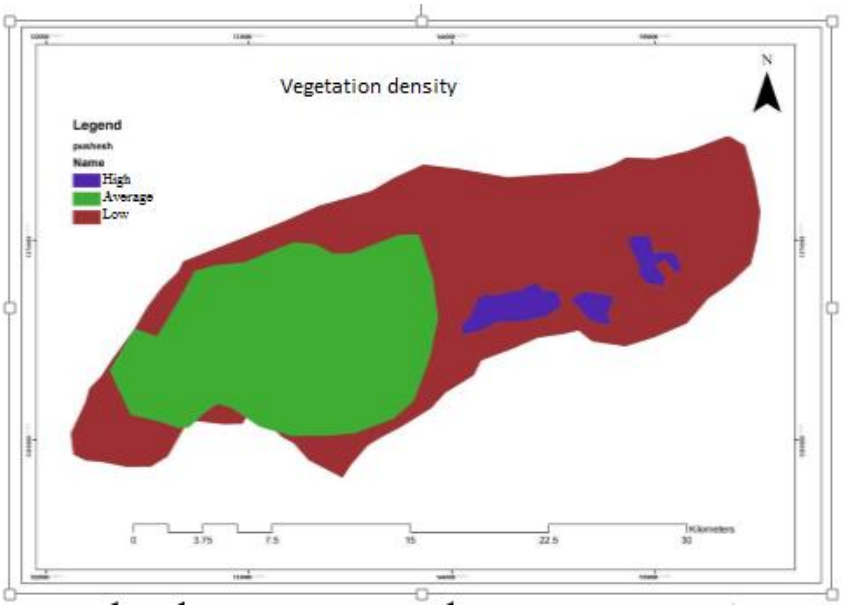

Figure 3. Vegetation density of the region (Source: Authors)

2) Altitude

Once the elevation layer was prepared, the map for altitude classes of the region was drawn (Figure. 4). The northern and eastern parts of the area are located at altitudes less than 1500 meters. Most of the central parts of the area are located at the altitudes between 1500 and 2000 meters. The highest elevations of the area are located in the center of the region with an altitude of more than 2,500 meters.

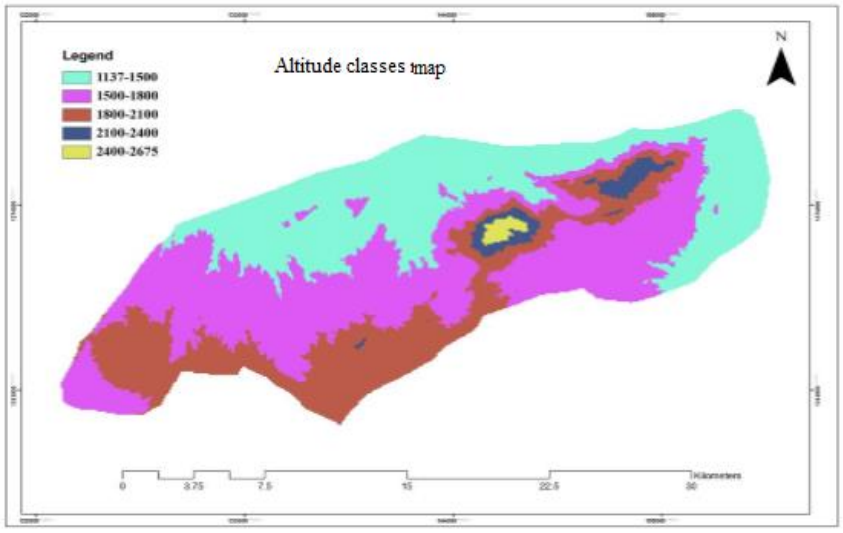

Figure 4. Altitude classes' map (Source: Authors)

3) Slope

The slope layer represents the ratio of the altitude of two points to the horizontal distance of them on the ground. Figure. 5 displays the map of the slope classes. As the figure indicates, the parts to the domain of the region have a slope of less than 10%. These parts are mostly located in the north and south of the region. This is while the central parts of the area mainly have a slope of over 30%.

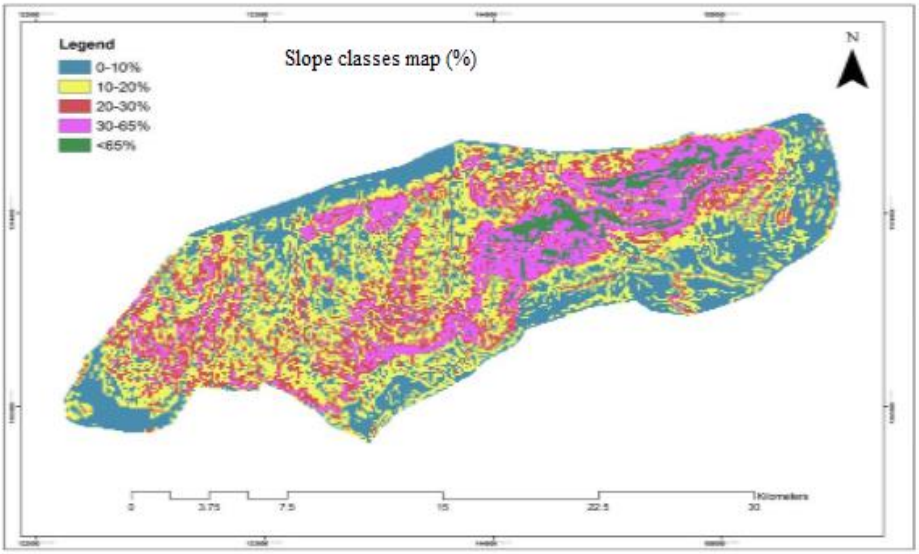

Figure 5. Slope classes' map (Source: Authors)

4) The distance from the habitat of endangered species of wildlife

Endangered species include panther and cheetah. The points where they live have been recorded by Mayāmey Environment Unit Forces based on field observations. Figure 6 shows the position of these points.

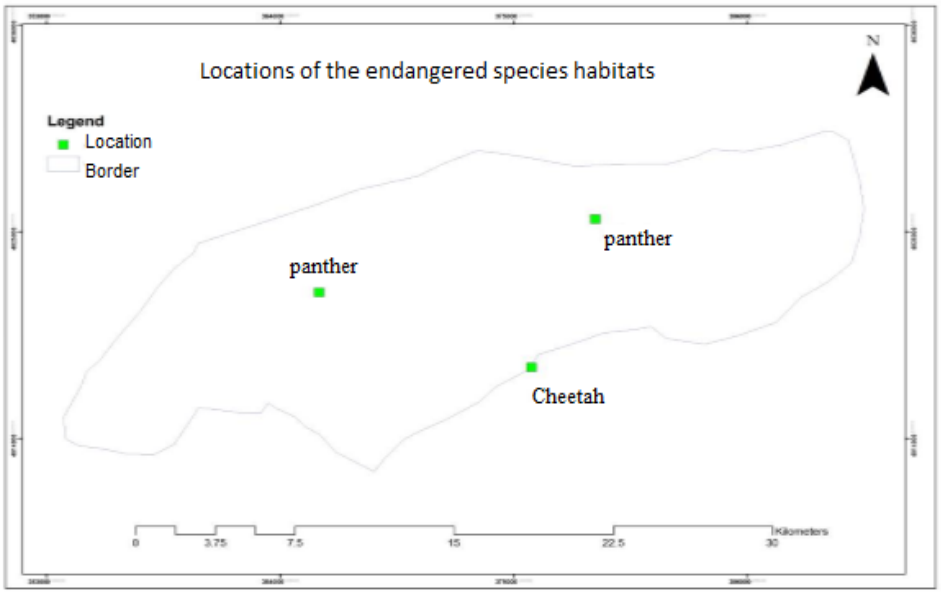

Figure 6. Locations of the endangered species habitat (Source: Authors)

5) The distance from the protected species habitats

Urials are the main protected species in the region. The points where they live have been recorded by Mayāmey Environment Unit forces based on field observations. Figure 7 presents the position of these points.

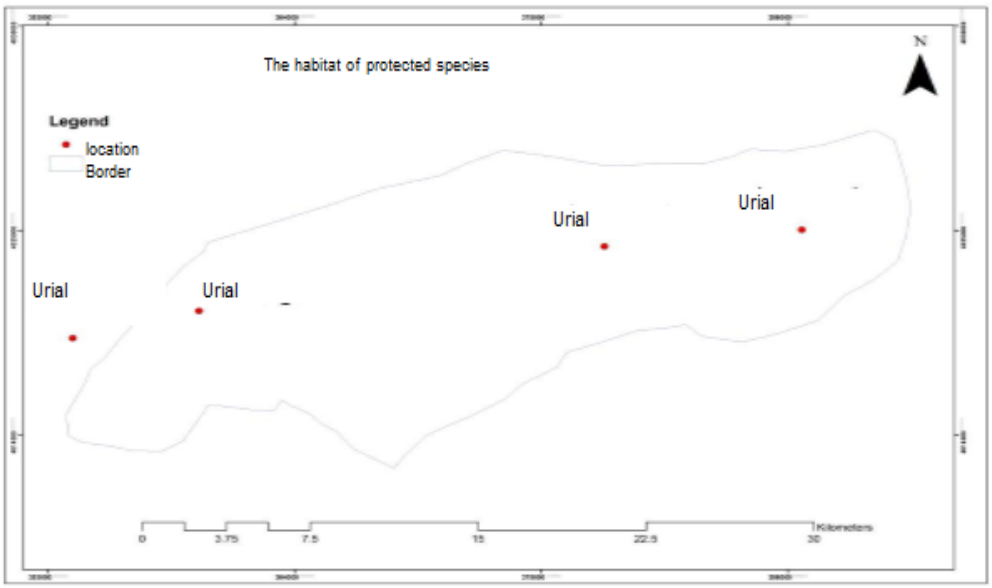

Figure 7: Map of the protected species habitats (Source: Authors)

6) The distance from the four areas of the environment

The study area is located in the vicinity of the Khoshyeylāq wildlife refuge (north) and Turan protected area (south). With the functions available in ArcGIS, the layer of distance from these areas was calculated for the study area (Figure. 8).

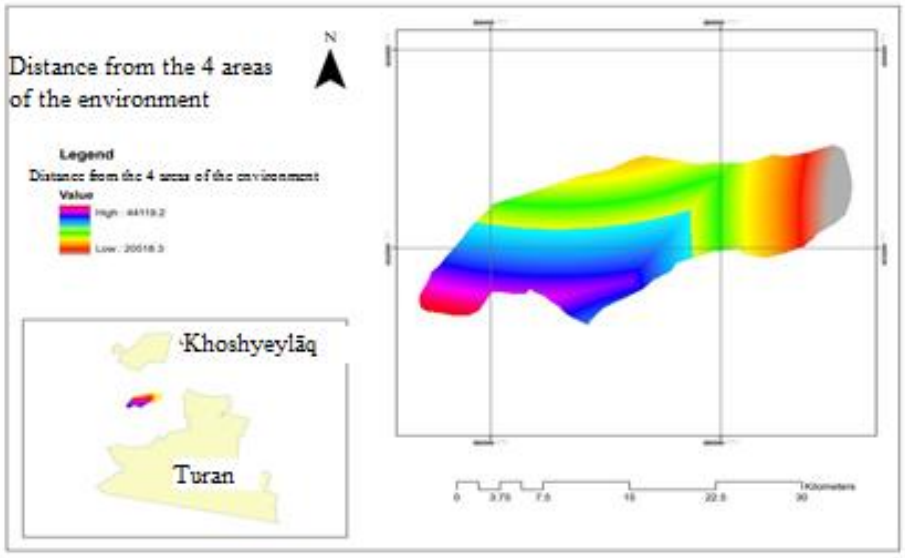

Figure 8: Distance from the four areas of the environment (Source: Authors)

Since the three factors of distance from the four areas of the environment, the distance from the habitats of the protected wildlife species and the distance from the habitats of the endangered species were used in the form of a factor called the distance from sensitive habitats, the map of distance from the sensitive habitat in the Mayāmey mountain range was prepared as follows:

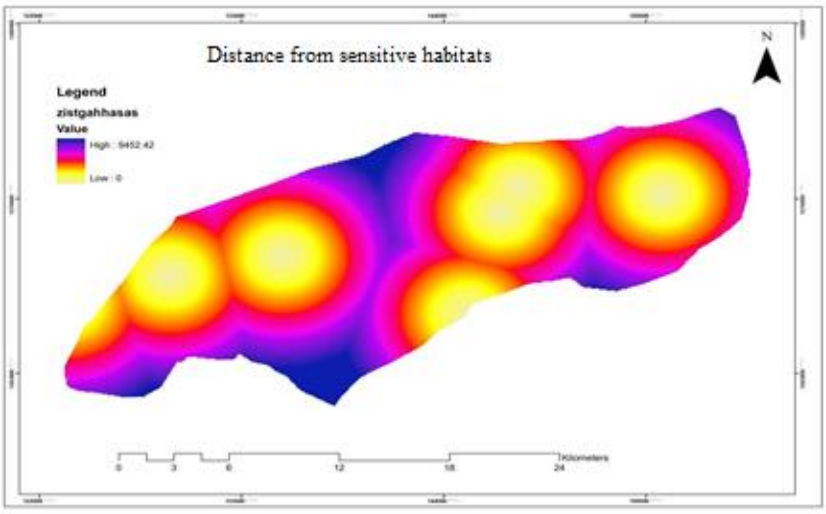

Figure 9: Distance from the sensitive habitat (Source: Authors)

7) Geological formation

The geological formation is one of the important layers for the detection of morphology, which indirectly affects the extent of erosion in the area. In the study area, there are geological formations of various geological periods, such as Quaternary (Figure. 10)

8) Distance from the stream

The stream existing in the region is a seasonal channel that flows during high water seasons. Figure (10) shows the region's stream map.

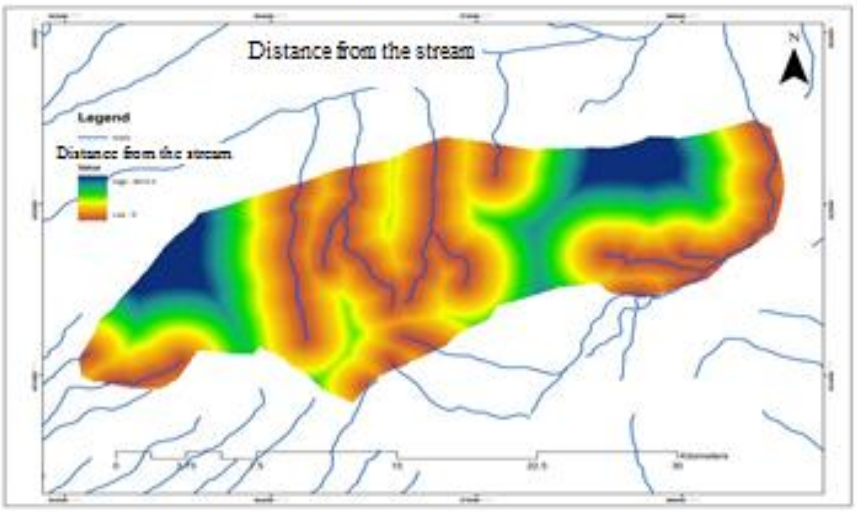

Figure 10: Distance from the stream

9) Distance from the communication path

The only way to access the asphalted road area is in the north of the region, passing in a stripped manner. Figure (11) presents the distance map of the communication path. The financial parts of the area are the closest regions connected to these routes.

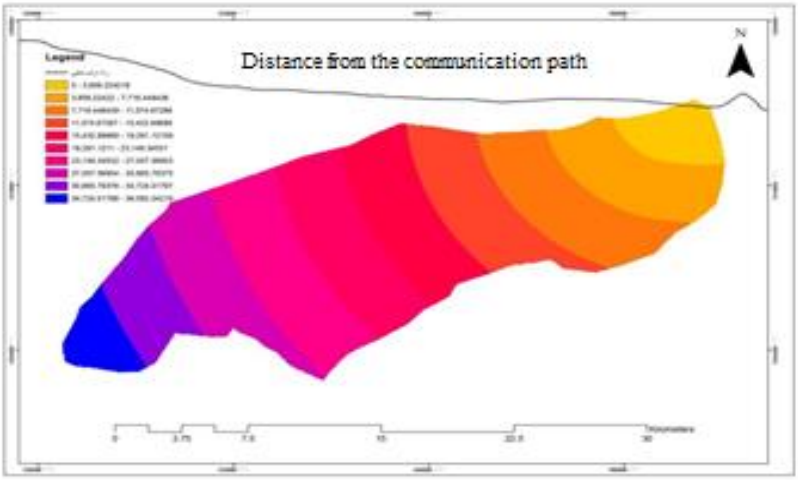

Figure 11: Distance from the communication path (Source: Authors)

10) Distance from the city

The closest city to the study area is Mayāmey, located in the north of the Mayāmey area. The least distance from this city is about 1700 meters and the most distance is about 30 kilometers (Figure. 12).

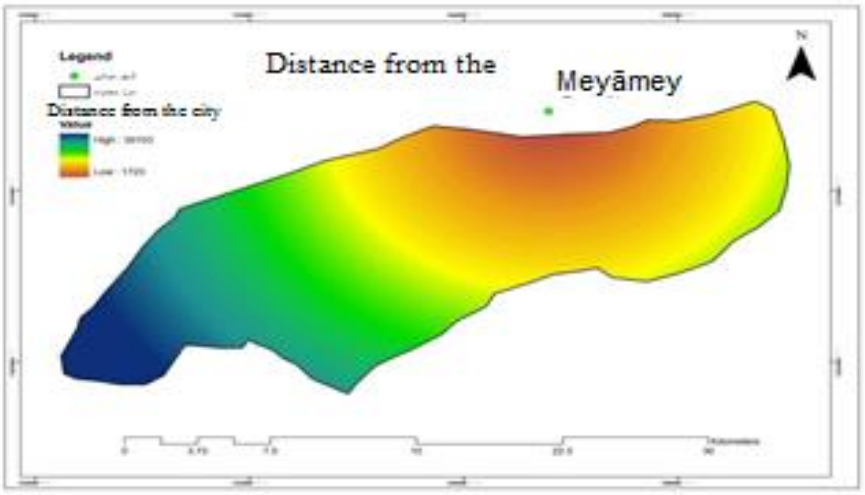

Figure 12: Distance from the city (Source: Authors)

Table 2 shows the weight of criteria and sub-criteria for assessing the conservation suitability of the Mayāmey area. The weights were calculated in the Expert Choice software, and because the incompatibility rate was less than 0.1 in all of the judgments, weighing was correct.

Table 2: Weight of criteria and sub-criteria for assessing conservation suitability in Mayāmey

The main criterion	Score	1st degree parameter	Score	2nd degree parameter	Score	3rd degree parameter	Score
Natural	0.27	Topography	0.59	slope (%)	0.80	0-20	0.07
						20-40	0.13
						40-65	0.31
						Higher than 65	0.48
				Altitude (m)	0.20	1500 Less than	0.08
						1500-1800	0.23
						1800-2100	0.63

						Higher than 2100	0.05
		Vegetation	0.24	Vegetation density	1	Low	0.09
						Moderate	0.25
						High	0.65
		Geology	0.17	Geological formation	1	Els	0.14
						Jbg, ktzl, trjs, pcmt2	0.08
						E2c, Eav, Ja.bv	0.44
						Jh	0.049
						Jugr and murc	0.19
						Murm	0.06
						Qcf, Qft1 and Qft2	0.03
Environmental	0.73	Distance from sensitive habitats	1	Distance from the habitat of Urial (m) , Distance from the habitat of panther and cheetah (m), Distance from protected areas	1	0-2	0.50
						2-4	0.21
						4-6	0.12
						6-8	0.08
						8-10	0.05
						10<	0.03

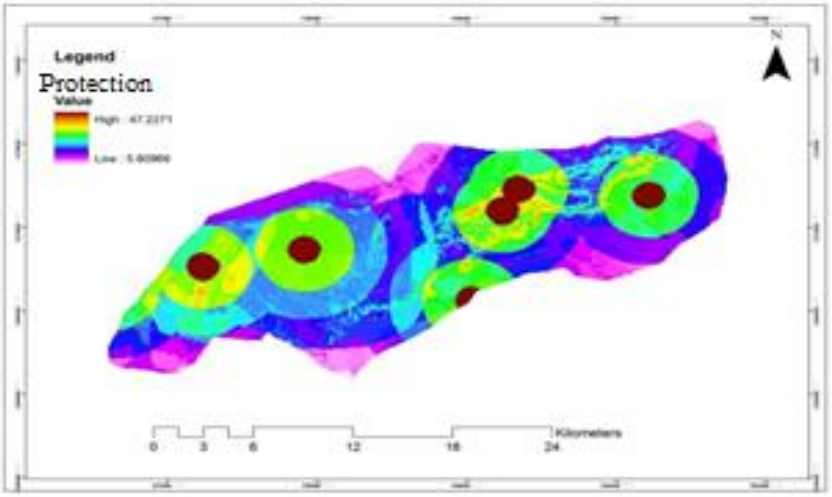

Figure 13: Zoning of the Mayāmey protected area (Source: Authors)

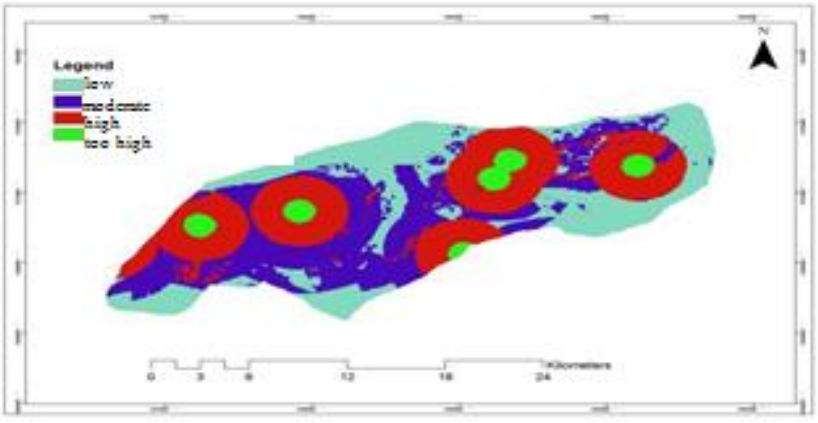

Figure 14: Zoning of the Mayāmey protected area (Source: Authors)

The figure shows better the Mayāmey area's protection potential classes. As it is evident from the figure, the greatest potential for protection can be seen in the green parts, which are in fact the habitat for protected or endangered species; these parts are more valuable for conservation purposes. Then, red areas on the margin of the green areas are worth more protection. Other parts of the area marked with blue are of moderate to low value for protection. Table (3) shows the area of each class.

Table 3: Area of potential protection classes

Row	Potential class	Area (ha)	Percentage of the area
1	poor	11619.48	31.29
2	moderate	11298.59	30.43
3	good	12520.51	33.72
4	Very good	1685.11	4.53

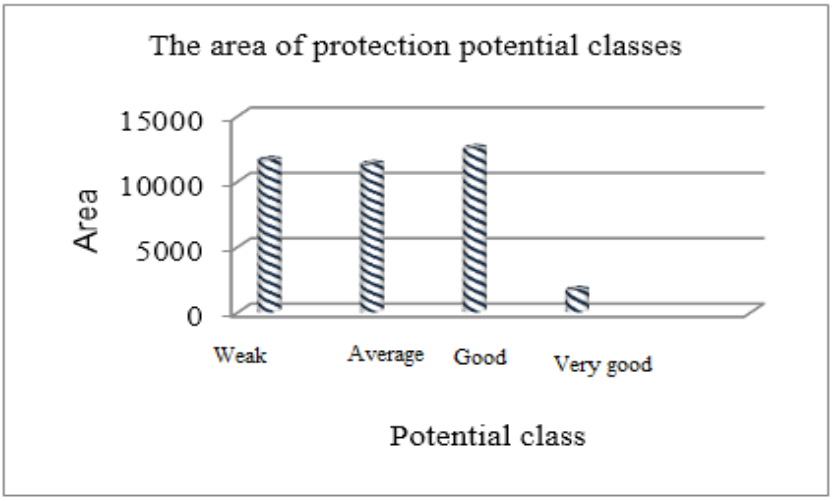

Figure 15: Area of protection potential classes in Mayāmey (Source: Authors)

As it is clear from the chart, most of the area is covered by lands of good, poor, moderate, and very good potential for protection, respectively.

Discussion and Conclusion

The present study focused on the possibility of upgrading the Mayāmey area to one of the four areas of the environment. By reviewing the available resources and rules (Majnonian, 2002) and by collecting information, it was found that the Mayāmey area has a suitable corridor for passing or immigrating the species of the area due to the following reasons: Existence of protected species such as Capra aegagrus, Urial, and most importantly the panther; as well as, locating at 20 km away from the Khoshyeylāq wildlife refuge border, 85 km from the Golestan National Park, and 35 km from Turan Persian Onager Refuge. Therefore, the region is suitable to become a protected area. Protected area refers to a range of natural resources of the country, including forests, rangelands, plains, water and mountains, which are of particular significance in terms of the necessity of preserving and reproducing the wildlife, or conserving or restoring vegetation, and its natural state. Hence, identification of it as a protected area can be effective in preserving the biodiversity of the area and the reproduction of protected and conserved species.

Wildlife refuge also refers to a range of natural resources of the country, including forests, rangelands and natural forests, forested lands, plains, water and mountains, which has a natural habitat and a particular climatic condition for wild animals, protected or restored in order to conserve these habitats. The study area is suitable for promotion to a protected area and a wildlife refuge. However, it lacks a good habitat conditions and also has poor food resources for the animals. Therefore, first, it needs to be upgraded as a protected area so that the habitat and nutrition status of the region are improved, animals and plants are reproduced in favorable conditions, and the rare animals are not endangered. Then, the area can be promoted to a wildlife refuge. It is worth noting that according to the guidelines of Journal 257 for the preparation of a plan for the management of the protected areas, the study area is eligible for promoting to a protected area. The layers used in this study are similar to those used in the studies by Jozei et al. (2008), Makhdoum (2000), Rashidi et al. (2009), and Valikhani et al. (2011). Based on the experts' opinions, the layers were classified into second and third degree criteria. Then, using AHP method, the layers were weighed and overlaid. This is similar to the studies conducted by Delbari, (2015), Naseri (2014), Kheiri (2015), Jalilvand et al (2012), and Eskandari (2013).

Other findings also indicated that large parts of the region (about 40%) is highly suitable for conservation. These lands are identified according to the weight of the criteria used and overlaying of the layers. Thus, the most potential for the conservation includes the lands close to the site where the protected and rare species of the area such as panther, capra aegagrus, and urial were observed. This, according to the environmental criterion weight (0.73) against the normal weight criterion (0.27), which includes criteria such as slope, altitude and vegetation, seems to be normal. However, it should be noted that in the process of zoning the area for protection by using the AHP method, the results are greatly influenced by the weighting process. That is why the opinions of experts were considered in this research.

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