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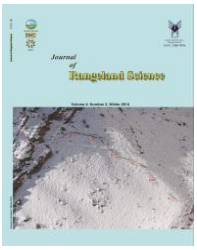

Full Length Article:

Analyzing Effective Factors on Rangeland Exploitation by Using A'WOT (Case Study: Aq Qala Rangelands, Golestan, Iran)

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Abstract. Rangelands are known as one of the main income resources for their exploiters. In the recent century, management of Iran rangeland has undergone vast transformations because of vulnerable socio-economic conditions of pastoralists. A study was done to provide a clear picture of the status and utilization of Aq Qala rangelands via assessing internal and external environmental factors affecting the utilization of rangelands. Thus a SWOT was adopted to identify and assess the positive and negative factors in internal and external environments. Data were collected through free and brainstorming interviews with an emphasis on the knowledge and experience of rangelands' exploiters. After content analyzing of primary collected data, Analytic Hierarchy Process (AHP) and spectral questionnaires were respectively used for range management technicians and exploiters to quantify gathered qualitative information. Based on the results, priority of the main factors of SWOT related to the rangelands utilization was respectively identified for opportunities, threats, weaknesses, and strengths. The results revealed that chance of income extension from livestock productions (weight= 0.102) had the first priority in the opportunities section. In the threats section, drought and its consequences in rangeland exploitations (0.095) had the highest threats from pastoralists and technicians views. Lack of water resources and their uneven distribution (0.028) and the importance of rangelands and their exploitation in the livelihood and economy (0.022) were respectively the main factors in the strengths and weaknesses sections.

Key words: Rangelands exploitation, SWOT, AHP, Pastoralists, Aq Qala

Introduction

Rangelands exploitation in Iran has a long-standing history and this exploitation is more dedicated to the pastoralism. In fact rangelands and their exploitations can be considered as an important source of income for pastoralists of the country (Janssen *et al.,* 2000). Unfortunately, in the half past century, due to the vulnerable social and economic status of pastoralists, rangelands had faced to substantial changes in their management (Barani, 2004; Heydari, 2010). Factors affecting rangeland exploitation dimensions can be studied from different perspectives.

Relevant studies has mostly been focused on analyzing individual and special factors in different ecological and socio-economical fields and the lack of comprehensive studies on this field is an obvious gap. Assessments of internal and external environmental factors have been extensively studied in various agricultural, environmental, financial and tourism topics (Kurttila *et al.,* 2000; Kajanus *et al.,* 2004; Shrestha *et al.,* 2004; Shinno *et al.,* 2006). Due to the importance of rangelands in the economy of the pastoralists community and country, such studies are necessary. In this context, a SWOT[1] analysis that originated by Albert S Humphrey in the 1960s, is a powerful tool for decision making and systematic analysis of the internal and external factors, are used to obtain a proper and systematic approach and to support an appropriate decision making (Kurttila *et al.,* 2000; Kangas *et al.,* 2003; Kotler, 1988; Wheelen and Hunger, 1995; Yuksel and Dagdeviren, 2007). Internal and external factors are often considered as strategic factors for the future of organizations. These factors in SWOT analysis are divided into four categories: strengths, weaknesses, opportunities and threats that are generally called as SWOT factors (Fig. 1).

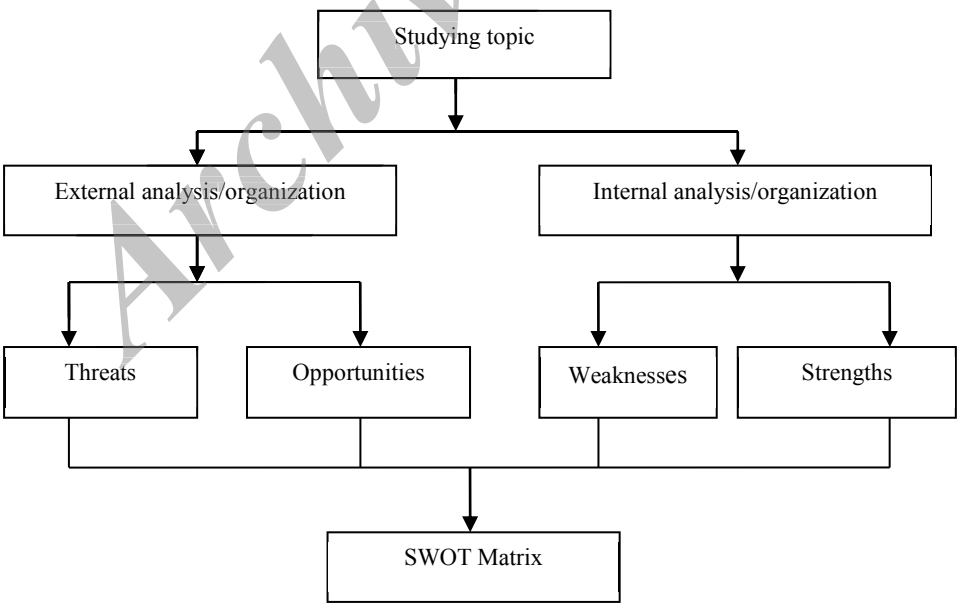

Fig. 1. Schematic view of strengths, weaknesses, opportunities and threats (SWOT), (Kahraman *et al.,* 2008)

[1]Strengths, Weaknesses, Opportunities and Threats

The SWOT analysis can be used to evaluate these factors, which include the strengths and weaknesses in the internal section and opportunities and threats in the external part. Through identifying opportunities and threats, strengths and weaknesses, organization can targeted its strategies by considering strengths and their strengthening, removing weaknesses, earning maximum profits by seizing opportunities and neutralizing threats (Kangas *et al.,* 2003). It should be noted that identifying the most preferred factors is an important issue in relation to affecting factors on any fields. Given the importance of economic resources and time constrains, prioritization can be done in conjunction with the considered factors. There are several methods to determine priorities. A common method is application of the AHP[2]. This method was presented by (Saaty, 1977 and 1996). The extensive features of AHP analysis are resulted from its simplicity, ease of use and high flexibility. Beside finance (Steuer and Na, 2003), AHP has been used in other different fields such as education, engineering, management, industry, government, manufacturing, private, political, social and sports (Vaidya and Kumar, 2006). This method use AHP matrix questionnaire to determine priorities based on experts views (Lee and Kim, 2000). One analysis that is jointly used with AHP analysis is SWOT analysis. The SWOT analysis is used because of its reputation, extensive application and high functionality in analyzing multi criteria decision making (HO, 2008). It can be claimed that combination of SWOT and AHP methods able specialists to decide on the raised issues about the subject and thereby to identify the influencing factors and evaluate them through SWOT-AHP method (Kurttila *et al.,* 2000; Ananda and Herath, 2003).

Identification of effective factors on rangelands exploitation can provide a general picture of the current status of rangelands and the influence of different managerial, ecological, climatic and socio-economic aspects. Most studies about the rangeland all around the worlds are just focused on examining an effective factor. However, the general understanding of different part of a subject is a needed initiate for all studies. This study with objectives of identifying key and priority factors from the pastoralists' and experts' points of view in relation to the rangelands exploitation aimed to meanwhile a knowledge oriented study, provide a good analysis of existing conditions based on the valuable experiences of pastoralists. Based on the results, the priority of each main factors of the SWOT was identified. In this study, the most important factors in different parts of the SWOT are discussed. This study sets out to assess and identify potentials and internal and external barriers to exploitation of Aq Qala rangelands based on the pastoralists and range management service technicians points of view; thus in this way,initial plans for management of these systems were designed by examining appropriate dimensions.

Materials and Methods

Study area

The study area is part of Aq Qala city. Rangelands are located at south-eastern part of Caspian and north of Aq Qala city, Golestan province, Iran (37°23'14"-37°09'41" N and 54°14'53"-54°39'12" E). These rangelands have a shared border with Turkmenistan in north. The area plants are mostly salt affected including dominant *Salsola turcamanica* and *Halocnemum strobilaceum* vegetation types. Total rangelands of studied area are about 56,670 hectare that are exploited by local pastoralists, who have been licensed by bureau of natural resources, during the months of November to late March. Husbandry practice in the area is based on

[2]Analytic Hierarchy Process

transhumance, which is one of the traditions of rangeland exploitation (Reid *et al.,* 2008). According to field assessments, there are two breeds of sheep in this area including Dalagh and Afshari that both of them considered as average weight breeds (51 kg) of Iran's sheep (Arzani *et al.,* 2007). Based on the local grazing system, the flocks are moved to rangeland by shepherds early in the day and returned to corrals forenoon. At remained hours of day, livestock rest around the corral and are fed by hand. It should be noted that over 70% of livestock requirements are met by hand feeding (grains). There are 8 rangelands with total 144 pastoralists that 93 of them were active during the study period.

Data collection

To identify the different factors of SWOT (Strengths, Weaknesses, Opportunities and Threats), brainstorming and individual interviews were conducted. Therefore, ten participants (representatives of region's pastoralists) were invited and interviewed in multiplayer and single-player sessions. The internal factors of SWOT i.e. strengths and weaknesses were determined by asking questions in the fields of limitations and potentials of exploitation of region's rangelands. PEST analysis was then used to identify external factors of SWOT i.e. opportunities and threat. By this analysis, various political and economic aspects and social and technological changes affecting rangelands exploitation were assessed. All the factors were assessed using content analysis and the factors of different sections of the SWOT were extracted and classified as key factors. Then questionnaire was prepared to determine the priority of the factors by pastoralists and technicians. For the pastoralists, the questionnaire has been set based on Liker spectrum items with a 5-point scale questions from very low to very high. For the technicians, AHP questionnaire including pair wise comparisons has been prepared to determine the weights of SWOT main factors i.e. strengths, weaknesses, opportunities and threats.

There are a lot of techniques to determine the number of samples e.g. Krejcie and Morgan (1970) and Cochran (1977). As the sample size resulted from two techniques were the same, Cochran (1977) method was presented here (Equation 1).

$$n = \frac{N(t.s)^2}{Nd^2 + (t.s)^2}$$ (Equation 1)

Where

n is sample size, s is standard deviation, N is population size, d is the desired level of precision, and t is t-value at 0.95 probability level. The population size was 91 pastoralists exploiting public rangelands of Aq Qala putting into the Cochran's equation gave the sample size 76.

The questionnaires were assessed after completion and 7 of them were rejected because of being incomplete and factors analysis was done through 69 remained questionnaires. Ten questionnaires were also filled by range management service and used to determine priorities. Resulted data from AHP questionnaires were analyzed using expert choice. In some cases, inconsistency ratio that is used to test consistency between judgments experts in the pair wise comparison was more than 0.1 so to improve it in these cases; the questionnaires were refilled by those technicians. After improving inconsistency ratio, prioritization of factors was performed.

Results

The results of identifying the strengths, weaknesses, opportunities and threats of rangelands exploitations were generally introduced 31 factors. There were 24 factors in internal section consisted of 11 strengths and 13 weaknesses (Table 1). There were 7 factors in the external section including 3 opportunity and 4 threats (Table 2).

Table 1. The results of content analysis of SWOT internal factors for Aq Qala rangelands exploiters

	SWOT factors	Factors
SWOT internal factors	Strengths (S)	S1: The possibility of prolonging grazing season (lengthening the time of departure from the rangeland)
		S2: Apparent potential for planting forage species
		S3: The possibility of hand feeding (use of cereal for animal diet)
		S4: Matching animal type and breed with rangelands vegetation
		S5: Health and organic products of rangelands
		S6: Favorable weather conditions in the exploitation season
		S7: Diversity of income sources (farming as second occupation)
		S8: Participation of pastoralists in range management plans and projects
		S9: The role of rangelands and their exploitation in the country livelihood and economy from pastoralists points of view
		S10: Rangelands potential for increasing stocking rate with relying on hand feeding
		S11: Acceptance of the cooperation and range Management cooperatives by pastoralists
	Weaknesses (W)	W1: Problems related to the lack of appropriate and specific roads
		W2: Inexperience of shepherds on distributing livestock grazing
		W3: Salty and marsh rangelands
		W4: The lack of coordination and lack of trust between technicians and pastoralists
		W5: Non-rangeland and Non-normative exploitations such as mining, military maneuvers
		W6: The presence of illegal pastoralists in the rangelands
		W7: Lack of rangelands insurance
		W8: Lack of extension-educative programs
		W9: Extreme obsession of experts regarding shrubs planting
		W10: Resignation of experienced pastoralists
		W11: Presence of lord-shepherd system in rangelands husbandry
		W12: Unavailability and inappropriate distribution of watering points and sources
		W13: Failure to take advantage of the knowledge and labor of pastoralists

The results of PEST analysis to identify external factors affecting the rangelands exploitations in different parts of the politics, economy, climate change and education are also summarized in Table 2.

Table 2. The results of content analysis of SWOT external factors for Aq Qala rangelands exploiters

	SWOT Factors	Factors
SWOT external factors	Opportunities (O)	Factors of each section
		O1: More use of the expertise capacity and specialized knowledge (including government forces, engineering organization and academic communities)
		O2: Chance of income generating from animal productions (e.g. animal fattening, development of agriculture)
		O3: Increasing scientific studies about rangelands in the research centers, academic institutes, and natural resources services
	Threats (T)	T1: Fluctuations in the animal market (such as the husbandry inputs costs)
		T2: Excessive governmental interventions in relation to pastures
		T3: Drought and the its consequences on the rangelands exploitation
		T4: Floods caused by seasonal rainfall in the region
		T5: Dual ownership of rangelands by Government (public) and pastoralists (private)

Determining the weight of SWOT factors for rangelands exploitation

The results of AHP pair wise comparison that was performed to determine weights of SWOT for main factors (strengths, weaknesses, opportunities and threats) revealed that priority of external factors affecting rangelands exploitation have higher weight than priority of internal factors. In external section, threats and opportunities had priority factors but Weaknesses had higher weight than strengths in internal section (Table 3).

Table 3. The weights assigned to each factor based on AHP pair wise comparison of experts

Factor Type	Internal		External	
	Strengths	Weaknesses	Opportunities	Threats
Factors weight	0.193	0.221	0.284	0.301

The relative weight of each factor in SWOT sections was determined through statistical analyses (SPSS Ver. 21) and the results of relative frequency of each factor to SWOT factors are presented in Tables 4-7. The final rank of each factor was determined after combination the weights assigned by pastoralists and technicians.

Table 4. The relative weights of SWOT factors for straights of rangelands exploitation

SWOT Factors	Factors of Each Section	Relative Weight of Factor in Each Section	Final Weight	Final Rank
Strengths (S)	S1: The possibility of prolonging grazing season (lengthening the time of departure from the rangeland)	0.092	0.017	5
	S2: Apparent potential for planting forage species	0.066	0.012	9
	S3: The possibility of hand feeding (use of cereal for animal diet)	0.102	0.019	3
	S4: Matching animal type and breed with rangelands vegetation	0.104	0.020	2
	S5: Health and organic products of rangelands	0.068	0.013	8
	S6: Favorable weather conditions in the exploitation season	0.085	0.016	6
	S7: Diversity of income sources (farming as second occupation)	0.092	0.017	5
	S8: Participation of pastoralists in range management plans and projects	0.096	0.018	4
	S9: The role of rangelands and their exploitation in the country livelihood and economy from pastoralists' points of view	0.114	0.022	1
	S10: Rangelands potential for increasing stocking rate with relying on hand feeding	0.099	0.019	3
	S11: Acceptance of the cooperation and range management cooperatives by pastoralists	0.082	0.015	7

Table 5. The relative weights of SWOT factors for weaknesses of rangelands exploitation

SWOT factors	Factors of each section	Relative weight of factor in each section	Final weight	Final rank
Weaknesses (W)	W1: Problems related to the lack of appropriate and specific roads	0.103	0.023	2
	W2: Inexperience of shepherds in distributing livestock grazing	0.051	0.011	10
	W3: Salty and marsh rangelands	0.063	0.014	7
	W4: The lack of coordination and lack of trust between technicians and pastoralists	0.062	0.014	7
	W5: Non-rangeland and Non-normative exploitations such as mining, military maneuvers	0.101	0.022	3
	W6: The presence of illegal pastoralists in the rangelands	0.060	0.013	8
	W7: Lack of rangelands insurance	0.090	0.020	5
	W8: Lack of extension-educative programs	0.085	0.019	6
	W9: Extreme obsession of experts regarding shrubs planting	0.054	0.012	9
	W10: Resignation of experienced pastoralists	0.097	0.021	4
	W11: Presence of lord-shepherd system in rangelands husbandry	0.048	0.011	10
	W12: Unavailability and inappropriate distribution of watering points	0.126	0.028	1
	W13: Failure to take advantage of the knowledge and labor of pastoralists	0.059	0.013	8

Table 6. The relative weights of SWOT factors for opportunities of rangelands exploitation

SWOT factors	Factors of Each Section	Relative weight of factor in each section	Final weight	Final rank
Opportunities (O)	O1: The More use of expertise capacity and specialized knowledge (including government forces, engineering organization and academic communities)	0.331	0.094	2
	O2: Chance of income generating from animal productions (e.g. animal fattening, development of agriculture)	0.358	0.102	1
	O3: Increasing scientific studies about rangelands in the research centers, academic institutes, and natural resources services	0.311	0.088	3

Table 7. The relative weights of SWOT factors for threats of rangelands exploitation

SWOT Factors	Factors of Each Section	Relative Weight of Factor in Each Section	Final Weight	Final Rank
Threats (T)	T1: Fluctuations in the animal market (such as the husbandry inputs costs)	0.265	0.080	2
	T2: Excessive governmental interventions in relation to pastures	0.186	0.056	3
	T3: Drought and the its consequences on the rangelands exploitation	0.315	0.095	1
	T4: Floods caused by seasonal rainfall in the region	0.147	0.044	4
	T5: Dual ownership of rangelands by Government (public) and pastoralists (private)	0.088	0.027	5

Discussion

The most important factor in the straights was the importance of rangelands in pastoralists view with a final weight of 0.022. The results showed that rangelands play a significant role in the daily life and livelihood of pastoralists that they are well aware of this. The rangelands are noteworthy from different economic, social and cultural aspects for pastoralists. Animal production generally consists of meat and livestock in the area. In some cases negligible production of milk and dairy products (e.g. cheese, butter, yogurt) for own pastoral household consumption can be added to the animal productions. Also in this area, pastoralism is considered as a valuable carrier with about high social class; so that the value of pastoralism relaying on rangelands is more related to social aspect than economic aspects. In this respect, based on the SCBD studies (2010) results, multiple values of rangelands from the pastoralists' hand can be assigned to direct values such as the livestock sale, animal productions (meat, milk and etc.) employment, transportation, and knowledge; and non-market values such as socio-cultural values, wildlife, ecosystem services, and compliance with agriculture.

Deficiencies and lack of proper distribution of watering points and resources were the most important identified factor in dealing with the weaknesses. The final weight of this factor was 0.028 (Table 4). It is one of the most important factors in rangelands exploitation (King, 1983). Due to salinity, the quality of water sources' region is not suitable for watering the animals and pastoralists are forced to transfer water through thousands liter capacity tankers. The daily water transfer imposes exorbitant costs over the living of pastoralists on the macro scale. It should be noted that allocation of water resources as watering points led to the formation of livestock biospheres and frequent traveling and its negative effects on soil properties (Brooks *et al.,* 2006; Kotze *et al.,* 2013). Such studies have a higher priority in rangelands with water resources limitations (Bruce and Mearns, 2002) .

In the Section of opportunities, the chance of income developing from animal production including fattening and increasing contribution of crop productions in animal productions was

specified as main opportunity with final weight that equals 0.102. Aq Qala pastoralists had their own traditions in relation to husbandry that one of them is livestock rising with emphasis on supplementary hand feeding (barley, concentrates, hay and in some cases corn). It takes on greater importance in this respect that the secondary job of the pastoral is agriculture, so raw materials of animal feed can be provided. Actually a typical cycle from production to consumption can be introduced for the system. Regarding sufficient capacity in this part of rangeland husbandry efficiency, governmental instructions and measures must be further directed towards strengthened this tradition. In this way by providing opportunities in agriculture and livestock fattening, the economy and welfare of pastoralists can be improved in an appropriate manner. Supporting the plan of livestock grazing management and storing forage can be recommended to improve economic conditions of rangeland exploiters. Such supports would also promote and develop the banking system and economic conditions (Coppock, 1993).

Drought and its consequences were the main threats for rangelands exploitation with final weight 0.095. According to questionnaire results, drought was the factor that intensified the problems of the pastoralists. Forage shortage caused by drought led to increment of hand feeding and related costs. Animal diseases that are probably caused by the poor dietary during drought, has been soaring in recent years. One of the serious threats that pastoralists are facing to is the climate change threat (SCBD, 2004). The results of SCBD (2004) showed that some diseases that led to livestock anemia, loss of weight and also death are derived from climatic changes such as drought. Among climatic factors, mean annual rainfall and its distribution have a significant impact on rangelands conditions and plants production (Williams and Albertson, 2006). Changes resulted from drought, directly affect on condition of rangelands that are essential for pastoralists' livelihoods and their animal productions (Fernandez-Gimenez and Febre, 2006). Zhang *et al.* (2013) showed that the main suffered problem in the time of drought, is the high cost of hand feeding which requires governmental policy change to protect natural resources and eliminate the problem of costs. In relation to Aq Qala rangelands, pastoralists' approach is focused on greater use of hand feeding instead of reducing the number of livestock to put less pressure on rangelands. However the governmental facilities in drought periods were among the strategies mentioned by the rangeland exploiters.

According to the results of this study, decision making for Aq Qala rangelands that are salt affected and seasonally marsh ecosystems, is required the revisement and case-based considerations. Regard to the capabilities and limitations associated with Aq Qala rangelands and exploitations, and their utilization in there, providing strategic plans (planning to achieve long-term goals) can have a significant impact on the future of rangelands and life of future generations.

Decision making for rangelands requires considering both ecological and socio-economic contexts (Lynam and Smith, 2003; Nathan, 2004) especially for marsh and salt affected ecosystems such as Aq Qala rangelands. According to the results, the highest rank of strengths factors was related to the role of rangelands and their exploitation in the pastoralist's livelihood and economy which is one of the social factors. Among opportunities factors, chance of income extension from animal productions had the highest rank which is an economic factor. So by considering these two main factors as straights and opportunities of Aq Qala rangelands exploitation, it will

be possible to dump the effectiveness of weaknesses and threats factors. To reach this goal, planning based on sustainable livelihood can be recommended for the area. A livelihood is sustainable when it can adapt to shocks and pressures and improve, fortifies or keeps its capabilities and properties, provides opportunity of sustainable livelihood for beyond generations and makes pure profits for other's livelihood in local or national levels or in short term or long term as well (Chambers and Conway, 1992). However, by providing the appropriate economic conditions for exploiters based on existing opportunities in rangelands, it is possible to reduce the stocking rate during drought and rely more on the hand feeding. In this regard, problems related to the improper distribution of water resources as one of the affecting factors on the rangelands degradation can be improved by pastoralists participation because of the increased fixation. In consideration of the services, while strengthening the sense of belonging and ownership in the pastoralists and technicians, their active participation in the soil and water conservation projects will also improve and field of mutual respect and trust will be generated (Guy, 2006).

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چکیده. مرتع و بهره‌برداری از آن به عنوان یک منبع درآمدی مهم برای بهره‌برداران از آن شناخته می‌شود. در نیم قرن اخیر، به دلیل شرایط شکنندهٔ اجتماعی و اقتصادیِ بهره‌برداران، بهره‌برداری و مدیریت مراتع کشور ایران دستخوش دگرگونی و تغییرات زیادی شده است. این مطالعه در نظر دارد با بررسی عوامل درون و برون محیطی موثر بر بهره‌برداری مراتع، تصویری شفاف از وضعیت مراتع منطقه آق‌قلا و بهره‌برداری از آن نمایش دهد. بدین منظور از آنالیز SWOT که یک روش مناسب برای شناخت و ارزیابی فاکتورهای مثبت و منفی در محیط‌های داخلی و خارجی است، استفاده شد. برای گردآوری اطلاعات از مصاحبه به روش‌های آزاد و طوفان فکری با تکیه بر دانش و تجربه بهره‌برداران استفاده شد. بعد از این مرحله تحلیل محتوا در مورد اطلاعات گردآوری شده صورت گرفت و پرسشنامه‌های طیفی و AHP به ترتیب برای بهره‌برداران و کارشناسان منابع طبیعی برای کمی‌کردن اطلاعات کیفی گردآوری شده، مورد استفاده قرار گرفت. در نهایت تجزیه و تحلیل داده‌ها در نرم افزارهای آماری و EXPERT CHOICE صورت پذیرفت. بر اساس نتایج اولویت فاکتورهای اصلی SWOT (قوت، ضعف، فرصت و تهدید) در رابطه با بهره‌برداری از مراتع منطقه آق‌قلا به ترتیب برای فرصت‌ها، تهدیدها، ضعف‌ها و قوت‌ها مشخص گردید. نتایج نشان داد برای فاکتور فرصت عامل فرصت گسترش درآمد از تولیدات دامی (مانند پرواربندی، گسترش نقش کشاورزی بهره‌برداران در دامداری مرتع) با وزن ۰/۱۰۲ دارای اولویت اول می‌باشد. همچنین در بخش تهدیدها عامل خشکسالی و پیامدهای ناشی از آن در بهره‌برداری مراتع با وزن ۰/۰۹۵ دارای بیشترین میزان بار تهدیدی از منظر بهره‌برداران و کارشناسان می‌باشد. این نتایج همچنین عامل عدم دسترسی و پراکنش مناسب منابع آب را با وزن نهایی ۰/۰۲۸ در بخش ضعف‌ها و عامل اهمیت مرتع و بهره‌برداری از آن در معیشت و اقتصاد کشوری از دیدگاه بهره‌برداران با وزن ۰/۰۲۲ در بخش قوت‌ها نشان داد.

کلمات کلیدی: بهره‌برداری مرتع، SWOT، AHP، دامداران، آق‌قلا