



Research Article

Vol. 39, No. 4, Winter 2025, p. 345-358

Factors Contributing to Rangeland Degradation in East Azerbaijan, Iran: Experts' Perspectives

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Received: 04 February 2025

Revised: 02 June 2025

Accepted: 11 June 2025

Available Online: 11 June 2025

How to cite this article:

Rouhi, E., & Falsafian, A. (2025). Factors contributing to rangeland degradation in east Azerbaijan, Iran: experts' perspectives. *Journal of Agricultural Economics & Development*, 39(4), 345-358. <https://doi.org/10.22067/jead.2025.92035.1332>

Abstract

Livestock grazing pressure in East Azerbaijan province, located in the northwest of Iran, is 2.5 times higher than the capacity of rangelands. This study employed a two-stage Delphi technique to identify and rank supervisory, natural, economic, cultural, legal, administrative, and infrastructure factors. The second Delphi round results indicated that, from the experts' point of view, poverty among rural residents on the outskirts of rangelands (scoring 4.7), insufficient support of the *Agriculture Organization* in providing livestock feed and allocation of loans to livestock farmers (scoring 4.53), conversion of rangelands into agricultural and horticultural lands to gain higher profits (scoring 4.43), overgrazing and long term grazing (scoring 4.4), were the important factors contributing to rangeland degradation. Comprehensive legal, legislative, executive, and monitoring measures to prevent overgrazing and premature grazing were identified as key solutions to reduce rangeland degradation. Among economic factors, poverty among rural residents on the outskirts of rangelands and their livelihood dependence on rangelands were recognized as the most significant factors in the destruction of rangelands and forests. Additionally, collaboration with the *Agriculture Organization* in providing alternative forage for livestock, strengthening the monitoring mechanisms of relevant organizations, and enhancing education and awareness levels among the public, regarding the protection of natural resources have been highlighted as other important strategies in reducing the level of rangeland degradation.

Keywords: Delphi technique, Overgrazing, Rangeland degradation, Sustainable land management



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<https://doi.org/10.22067/jead.2025.92035.1332>

Introduction

Although rangeland degradation is not limited to Iran, environmental data indicate that rangelands are declining in most parts of the country. The total rangeland area in Iran decreased from 84.8 million hectares in 2011 to 83.3 million hectares in 2021. Out of this total, only 6.5% is classified as good condition rangeland, 68.4% as poor, and 25.1% as moderate. According to the reported data, the share of good, moderate, and poor rangelands from the total rangeland area in 2011 was 8.5%, 25.2%, and 66.3%, respectively (Ministry of Agriculture-Jahad, 2022). Although Iran's rangelands are similar to rangelands worldwide, they also have distinct characteristics that require adjustments to traditional management practices. Scholars have identified various factors contributing to the growing trend of rangeland degradation, including natural and human factors (Ansari *et al.*, 2009; Saeedi Geraghani *et al.*, 2014; Zohdi *et al.*, 2004). The current policy framework for agroecological zones lacks robust evaluations of grassland degradation's impact on livelihoods. Adoption of sustainable land management is hampered by a lack of knowledge and experience (Flintan *et al.*, 2011). This deterioration is attributed to a combination of factors, including overgrazing, climate change, and unsustainable land-use practices. Livestock grazing, which is a primary livelihood for many rural communities, often exceeds the rangelands' capacity, leading to soil erosion and loss of vegetation cover. Identifying these factors can be necessary for developing appropriate policies to preserve rangelands and prevent their degradation.

The rangelands in East Azerbaijan Province, located in the northwest of Iran, represent approximately 2.8% of the country's total rangeland area. Despite their relatively small share in terms of land coverage, these rangelands play a disproportionately significant role in the nation's forage production, contributing 5.4% of the total dry forage output. This remarkable productivity

highlights the high ecological and economic potential of the province's rangelands, which serve as vital resources for livestock grazing and rural livelihoods. However, the current level of forage production supports a carrying capacity of about 1,561,600 livestock units. Alarming, the actual number of livestock grazing in the region far exceeds this figure, exerting a grazing pressure that is approximately 2.5 times higher than the sustainable capacity of the land (Agriculture-Jihad Organization of East Azerbaijan Province, 2022). This overgrazing leads to serious ecological consequences, including soil erosion, loss of vegetation cover, reduced biodiversity, and long-term land degradation. Given the critical role of rangelands in supporting both ecological balance and rural economies, it is imperative to identify the underlying causes of their degradation. Understanding these factors is essential for the development of targeted, evidence-based policies aimed at conserving rangeland resources and promoting sustainable management practices. In this context, the present research seeks to explore and analyze the key drivers of rangeland degradation in East Azerbaijan Province. To achieve this, the study employs the Delphi method, a structured expert-based approach designed to gather, refine, and prioritize expert opinions through multiple rounds of consultation. The findings are expected to provide valuable insights for decision-makers and contribute to the formulation of effective strategies to reduce grazing pressure and preserve the long-term health of the province's rangelands.

Numerous studies have extensively examined the multifaceted phenomenon of rangeland degradation, emphasizing a wide array of contributing factors. Several researchers have highlighted the role of rangeland management practices, such as overgrazing, mismanagement of grazing schedules, and insufficient rehabilitation efforts, as critical drivers of degradation (Ghasemi *et al.*, 2016; Fenetahun *et al.*, 2018; Gokkus, 2020). In addition to technical and

managerial aspects, a growing body of literature has emphasized the livelihood strategies of livestock-dependent communities as a major contributing factor. These studies suggest that socioeconomic vulnerabilities, dependence on natural resources for income, and limited livelihood diversification significantly influence rangeland conditions (Amiri Lemar, 2012; Ansari *et al.*, 2009; Ghasemi *et al.*, 2016; Gheitury *et al.*, 2007; Gholampour *et al.*, 2012; Sharifiyan *et al.*, 2014; Belay *et al.*, 2014; Amare, 2015; Gokkus, 2020). Furthermore, social, cultural, and economic dimensions, including land tenure systems, traditional grazing rights, population pressure, and market dynamics, have been recognized as pivotal in shaping the intensity and trajectory of rangeland degradation (Fenetahun *et al.*, 2018; Malekmohamadi *et al.*, 2021; Moyo *et al.*, 2013; Saberi, 2021; Daba & Mammo, 2024). The influence of legal and institutional frameworks has also been acknowledged, particularly in relation to the enforcement of rangeland management policies and property rights, where the absence of coherent legislation or weak implementation mechanisms exacerbates degradation risks (Han *et al.*, 2008; Gheitury *et al.*, 2007; Daba & Mammo, 2024). Lastly, the role of natural and climatic variables, including precipitation variability, soil erosion, and ecological fragility, has been widely reported as an underlying stressor that interacts with anthropogenic drivers to accelerate land degradation (Aryal *et al.*, 2014; Fenetahun *et al.*, 2018; Malekmohamadi *et al.*, 2021; Mussa *et al.*, 2016). These findings collectively underscore the complex and interlinked nature of rangeland degradation, necessitating integrated and context-specific solutions that consider both human and environmental dimensions. Based on the literature review, no comprehensive study has yet examined rangeland degradation in East Azerbaijan Province, Iran. Therefore, the present study aims to identify and prioritize the key factors contributing to rangeland degradation in this region from the perspectives of experts and

experienced specialists, and to propose practical mitigation strategies. By employing expert consensus to systematically assess degradation drivers, this research represents the first comprehensive evaluation of rangeland degradation factors in East Azerbaijan Province, highlighting the study's originality and scientific significance.

Materials and Methods

The total area of rangelands in East Azerbaijan Province is 2,340,200 hectares. According to expert estimates, 36% of the rangelands are classified as good, 49% moderate, and 15% poor. In terms of vegetation cover, the rangelands are divided into three distinct groups: mountain rangelands utilized during the warm season, mostly located in highlands and cold regions. Steppe rangelands are dispersed in low-lying and warm regions and are utilized during the winter season. Transitional pastures are mainly located around villages and serve as permanent grazing grounds. Data show that approximately 6% of the total rangeland area has been degraded over the last ten years (Ministry of Agriculture-Jahad, 2022). Additionally, there were 340 nomadic villages with a population of 44,640 rangeland owners in the province. In 2022, there were 4,845,654 heads of existing livestock and 1,778,145 heads of authorized livestock (Agriculture-Jihad Organization of East Azerbaijan Province, 2022).

This study employed the Delphi technique, in which experts are referred to as Delphi panel members. A critical aspect of the Delphi method is the identification of qualified experts, as the success of the process largely depends on the careful selection of participants. To ensure methodological validity, experts were selected based on four key criteria: expertise and experience in rangeland management, willingness to participate, sufficient availability of time, and effective communication skills (Ahmadi *et al.*, 2008). A pool of potential candidates was compiled from the Agriculture-Jihad Organization, the Department of Natural

Resources, and the Department of Tribal Affairs in East Azerbaijan Province. Through purposive sampling, 58 key experts with demonstrated competence in rangeland-related issues were identified as Delphi panel members. In support of this sampling method, factors such as years of experience, academic credentials, professional roles, and employment history were taken into account.

Required data were extracted from a researcher-developed questionnaire which consisted of four major sections. In the first, questions were designed to investigate the personal and professional characteristics of experts. The second included closed-ended questions about the most important causes of rangeland degradation. The third section covered indicators of rangeland degradation, and the final section included the reduction and control-based strategies for rangeland degradation from their perspective. The initial questionnaire using the Delphi method aimed to screen the primary factors and reach a consensus among experts regarding the influential factors and necessary strategies for reducing rangeland degradation. The average age of the experts was 45 years, with a minimum and maximum of 27 and 57 years, respectively. Most (67%) had a postgraduate education and an average of 12 years of experience, with a minimum and a maximum of 4 and 34 years, respectively. Moreover, 60 experts (approximately 69%) were engaged in agriculture and livestock farming alongside

their main occupation. There were 7 experts involved in cropping, 15 in livestock, and 5 worked in both sectors.

Factors contributing to rangeland degradation were identified through a literature review and preliminary interviews with stakeholders and experts, as detailed later in this section. A total of 46 items were categorized into nine groups, each representing a specific dimension influencing rangeland degradation. These categories included: supervisory (4 items), livestock farming (4 items), cultural and social (8 items), economic (8 items), natural (4 items), supportive (2 items), organizational (5 items), infrastructure (6 items), and legal (5 items) factors. In the Delphi method, a Likert scale was used to assess the perceived importance of each item. The responses from Delphi panel members were analyzed to determine the significance of each factor in contributing to degradation. To evaluate the internal consistency of the questionnaire, Cronbach's alpha coefficient was calculated using SPSS software (Table 1). In all cases, Cronbach's alpha coefficient was above or equal to 0.70, ensuring the reliability of Delphi. After collection, based on Delphi method guidelines data comparison and prioritization were conducted. In the second stage, considering the results from the first stage, the second questionnaire was distributed among the same experts. Responses were then analyzed within the framework of the Delphi method.

Table 1- Cronbach's Alpha coefficient values

Variables	Scale	Item count	Cronbach's Alpha	Reliability level
Rangeland degradation effects	Supervisory factors	4	0.75	Acceptable
	Livestock farming factors	4	0.87	Good
	Cultural-social factors	8	0.72	Acceptable
	Economic factors	8	0.95	Excellent
	Natural factors	4	0.8	Good
	Supportive factors	2	0.97	Excellent
	Administrative factors	5	0.73	Acceptable
	Infrastructure factors	6	0.701	Acceptable
	Legal factors	5	0.81	Good
Degradation indicators	-	24	0.79	Acceptable
Destruction reduction and control strategies	-	16	0.86	Good

Ten steps were utilized to implement the Delphi method.

1-Formation of an execution and supervision

team.

2-Selection an expert panel.

3-Preparation of first-round Delphi

questionnaires.

- 4-Testing the questionnaires for sentence construction accuracy.
- 5-Transfer the initial questionnaires to the members of the expert panel.
- 6-Analysis of first-round responses.
- 7-Preparation and arrangement of second-round questionnaires and their testing.
- 8-Distributing the second set of questionnaires to the members of the expert panel.
- 9-Analysis of second-round responses. Steps 7 to 9 are repeated until reliable and appropriate results.
- 10-Preparation and compilation of a report on the analysis of the team's findings to conclude the conducted method.

Then, interviews were conducted with members of the target community. The interview discussion topics were categorized based on the general classification of influential factors derived from the literature review. After the interviews, some group members mentioned points outside the scope of the findings from the initial stage, prompting the researcher to review additional sources and identify scientific references for these mentioned factors to be used and referenced by experts. The findings of the two initial stages were combined. Two rounds were sufficient due to the strong consensus achieved (Kendall's $W = 0.91$ in Table 2). A general categorization, consisting of 9 categories (supervisory factors, livestock farming factors, cultural-social factors, economic factors, natural factors, supportive factors, administrative factors, infrastructure factors, and legal factors), was made of 46

factors. This categorization formed the basis of the Delphi questionnaire.

Kendall's Coefficient of Concordance

Kendall's coefficient of concordance indicates that individuals who have ranked multiple variables based on their importance have utilized similar criteria for judging the importance of each variable and, therefore, agree with each other. It has been used to determine agreement among group members, and measure agreement in several categories related to N objects or individuals. By applying this scale, it is possible to obtain the rank correlation among K sets of ranks. Such a scale is particularly useful in studies related to the validity among judges or achieving desirable consensus for completing Delphi rounds. Kendall's coefficient is calculated by equation (1), (Kendall & Smith, 1939).

$$W = \frac{S}{\frac{1}{12} k^2 (N^3 - N)} \quad (1)$$

where $S = \sum (R_j - \frac{\sum R_j}{N})^2$ represents the sum of squared deviations from the means, which is the sum of ranks corresponding to a factor, K is the number of sets of ranks (number of judges), and N the number of ranked factors. The value is 1 when there is perfect agreement or complete concordance, and is 0 when there is no agreement or complete discordance. If such a consensus does not exist, a constant value or minimal growth of this coefficient in two consecutive rounds indicates a lack of increase in member agreement, and the survey process should be halted.

Table 2- Interpretation of various values of Kendall's coefficient of concordance

Confidence in the order of factors	Interpretation	The value of W
Nonexistent	Very weak consensus	0.1
Low	Weak consensus	0.3
Average	Moderate consensus	0.5
High	Strong consensus	0.7
Very high	Very strong consensus	0.9

Results

Results of Identifying Factors Influencing Rangeland Degradation

The results from the Delphi technique are

presented in Table 3. In the first round of Delphi, the Kendall coefficient was 0.8322. According to the ranking results from the first round of Delphi, experts considered the

following factors to have the greatest impact on rangeland degradation: inadequate support by the Agriculture-Jihad Organization in providing forage and allocating loans to livestock farmers, rural poverty and their dependence on rangelands, and long-term grazing. In the second round, panel members were provided with a second questionnaire, but the scores for each factor from the first round were included so that individuals could reconsider their opinions based on their collective views. The results collected in the second round showed an increased Kendall coefficient of 0.91. A coefficient of concordance 0.9 suggested further Delphi rounds may have been unnecessary.

The drivers influencing rangeland degradation were ranked. Factors such as poverty among rural rangeland communities, insufficient support from Agriculture-Jihad Organization in providing forage and allocating loans to livestock farmers, conversion of rangelands into agricultural and horticultural lands for higher profits, early grazing, and long-term grazing are ranked as the first to fifth priorities, respectively, with values of 4.7, 4.53, 4.43, 4/4, and 4.29 according to experts' perspectives on rangeland degradation. These factors fall under the subsets of economic, supportive, and livestock farming factors, suggesting economic, supportive, and livestock farming factors had the greatest impact on rangeland degradation. Those factors with a score above 3 in the second round of Delphi were identified as influential in rangeland degradation (Table 3).

Results of Identifying Indicators of Rangeland Degradation

The average numerical value was used to determine the importance and prioritization of indicators of rangeland degradation from the experts' perspective. In the first round of the process, the standard deviation and Kendall's coefficient of concordance for identifying indicators of degradation from the experts' viewpoint were 1.08 and 0.63, respectively. It was therefore necessary to continue the

process for another round to minimize differences of opinion between the two stages. In the second stage, the value of Kendall's coefficient was 0.78, indicating strong agreement among experts. From the experts' perspective, the reduction in vegetation cover, sheet and gully erosion of soil, and reduction in vegetation diversity placed first, second, and third priorities, respectively (Table 4).

Results of Identifying Solutions for Reducing and Controlling Rangeland Degradation

Experts were asked to express their views on the solutions for the reduction and control of degradation. Initially, the Delphi method was used to identify solutions to reduce and control rangeland degradation, resulting in a standard deviation of 0.95 and Kendall's coefficient of concordance of 0.87. To increase expert consensus on control solutions, the second stage of the Delphi method was conducted, resulting in a Kendall coefficient of 0.93 (Table 5).

Discussion and Conclusion

The results of prioritizing the identified factors affecting rangeland degradation indicated that the lack of a proper grazing management system, from the supervisory factors; inadequate support from the Agriculture-Jihad Organization in forage supply and the allocation of loans to livestock farmers, from the supportive factors; negligence towards environmental projects and initiatives in national research projects among, from administrative factors; are identified to be as significant contributors to rangeland degradation in the province. Dehghanian & Sarafriz (1998), Stenborg (2008), Han *et al.* (2008), Saberi (2021), and Daba & Mammo (2024) indicated that the government's neglect of rangelands is one of the most significant causes of rangeland degradation. Proper management of rotational grazing and effective supervision by natural resource agencies and other relevant authorities, along with appropriate administrative practices, are among the main proposed solutions presented by experts.

Table 3- First and second Delphi rounds for identifying factors affecting rangeland degradation

Table 3- First and second Delphi rounds for identifying factors affecting rangeland degradation					
Factors affecting rangeland degradation		First round		Second round	
		Score	Standard deviation	Score	Standard deviation
Supervisory factors	Inadequate supervision over the entry and exit of tribes to the pastures	3.43	0.86	3.54	0.83
	Lack of sufficient supervision over livestock grazing	3.82	0.8	3.97	0.74
	Inadequate supervision of the entry and exit of local and non-local visitors	2.68	1.04	2.54	0.94
	Poor rangeland enclosure management	3.8	0.86	4.02	0.876
Livestock farming factors	Premature grazing	4.07	0.75	4.4	0.71
	Long-term grazing	4.21	0.67	4.29	0.63
	Excessive grazing pressure	3.54	0.78	3.38	0.71
	A large number of beneficiaries	4	1.04	4.13	0.89
Cultural-Social factors	Lack of training courses on the importance and conservation of rangelands	3.86	0.87	4.2	0.81
	Weak cultural awareness within the community regarding the importance of conserving rangelands	3.96	1.05	4	1
	Inadequate communication by officials regarding the organization of training courses on rangeland conservation	3.61	1.01	3.83	0.9
	Population growth	3.64	1.14	3.4	1.02
	Lack of appropriate advertising to promote rangeland conservation, such as using advertising and promotional materials	3.18	0.89	3.2	0.81
	Ethnic conflicts among stakeholders	2.96	1.15	2.98	1.03
	Insufficient water availability in rangelands and its improper distribution	3.21	1.21	3.3	0.97
	Lack of ownership regarding rangelands	3.46	1.27	3.78	1.25
	poverty among rural rangeland communities and their economic dependency on rangeland resources	4.33	0.8	4.7	0.81
Economic factors	Conversion of rangelands into agricultural and horticultural lands by local people to seek higher profits	4.04	0.87	4.43	0.82
	Harvesting and using shrubs as fuel	3.71	1.03	3.9	0.95
	Budgetary constraints and lack of funding for necessary actions to conserve and restore natural resources	3.54	0.91	3.69	0.93
	Livestock farming as the primary livelihood	3.21	0.86	3.29	0.82
	Lack of investment and economic participation by rangeland beneficiaries	3.46	0.94	3.7	0.91
	Lack of rangeland cooperatives	3.04	0.94	3.15	0.90
	Bush clearing to create a livestock enclosure	2.82	1.2	2.92	1.03
	Natural factors	Drought	3.82	1	3.92
Wildfire		4.14	1.5	4.16	1.6
Flood		3.18	1	3.2	1
Soil erosion		3.79	0.9	3.87	0.92
Supportive factors	Insufficient support from the Agriculture-Jihad Organization in providing livestock feed and allocating loans to livestock farmers	4.43	0.98	4.53	0.95
	Allocation of a low budget by the government, including insufficient funding and limited access to bank credits and facilities, for rangeland conservation	3.29	0.99	3.67	0.91
Administrative (Organizational) factors	Limited use of specialized personnel in administrative and executive bodies	3.64	0.89	3.8	0.74
	Increased pressure from other executive bodies to utilization natural resource lands	3.54	1.02	3.59	0.92
	Neglect of environmental initiatives and projects in national research projects	3.71	0.88	3.83	0.81

	Administrative corruption and bribery by natural resources officials from offenders	2.86	1.33	2.93	1.25
	Weak collaboration between the government (natural resource management and Agriculture-Jihad Organization) and the people	3.43	1.02	3.46	0.78
Infrastructure factors	Road construction	3.25	0.95	3.27	0.85
	Water and gas pipeline installation	2.96	1.09	2.95	0.94
	Development of urban and rural areas	3.29	1.22	3.4	1.13
	Implementation of rural development projects	2.75	1.09	2.86	0.89
	Establishment of power plants	2.32	1.31	2.35	1.21
	Agricultural development through Agriculture-Jihad programs, such as increasing cultivated land area by utilizing rangelands	3.11	1.05	3.17	1.15
Legal factors	Official and legal actions of other institutions, such as conducting military maneuvers	2.32	1.23	2.42	1.06
	Lack of appropriate and timely legal actions in dealing with illegal encroachments	3.39	0.9	3.8	0.87
	Weak performance and prolonged process of law enforcement in pursuing offenders in the field of natural resources	3.95	0.75	4	0.71
	Negligence of local officials in matters related to land-grabbing	3	0.93	2.95	0.85
	Weakness or absence of proper laws for the conservation of rangelands	3.29	1.13	3.76	1.08

Table 4- Indicators of rangeland degradation in the first and second Delphi rounds and their prioritization from the perspective of experts

Row	Indicators of rangeland degradation	First-stage score	Second-stage score	Second-stage standard deviation	Ranking
1	Decrease in percentage of vegetation cover	4.14	4.58	0.55	1
2	Surface and gully erosion of soil	4.14	4.22	0.85	2
3	Reduction in vegetation diversity	4.14	4.2	0.75	3
4	Drying of vegetation cover	3.93	4.12	0.87	4
5	Reduction in dominant and palatable plants	3.93	3.96	0.8	5
6	Decline in the quality of rangeland forage	3.68	3.95	1.05	6
7	Decrease in soil fertility	3.86	3.88	0.89	7
8	The appearance of plant roots	3.75	3.84	1.02	8
9	Weakening of plants	3.46	3.8	0.97	9
10	Long-distance livestock for forage consumption	3.57	3.8	1.12	9
11	Reduction in soil properties	3.82	3.77	0.69	10
12	Litter reduction	3.64	3.76	0.76	11
13	Increase in forage grazing time for livestock	3.5	3.65	1.07	12
14	Reduction in primary plant productivity	3.54	3.63	0.86	13
15	Change in plant composition	3.57	3.55	0.84	14
16	Reduction in shrub size	3.39	3.44	0.88	15
17	Change in soil color	3.07	3.1	1.06	16
18	Reduction in height of shrubs	3	3.04	1.03	17
19	Soil salinization	2.82	2.99	1.11	-
20	Livestock emaciation	2.79	2.81	1.05	-
21	Wool shedding of livestock	2.43	2.58	0.97	-
22	Increased incidence of livestock diseases	2.68	2.55	1.2	-
23	Increase in unwanted and non-palatable plant growth	2.64	2.44	0.99	-
24	Reduction in milk and meat production of livestock	2.36	2.4	0.99	-

Table 5- Strategies for reducing rangeland degradation at the end of the first and second Delphi rounds and their ranking

Strategies for reducing rangeland degradation	First-stage score	Second-stage score	Second-stage standard deviation	Ranking
Prevent early grazing	4.43	4.53	0.68	1
Prevent overgrazing	4.46	4.5	0.5	2
Providing alternative forage sources	3.23	4.43	0.8	3
Proper management and effective monitoring by natural resource agencies and other relevant authorities	4.25	4.34	0.91	4
Educating and raising awareness among the public to prevent rangeland degradation	4.25	4.33	0.69	5
Enforcement of laws prohibiting land and rangeland degradation	4.29	4.32	0.8	6
Enclosure management based on rangeland condition	4.11	4.28	0.67	7
Providing facilities for alternative jobs	4	4.23	0.8	8
Maintaining and improving rangelands	4.11	4.12	0.72	9
Implementation of management programs to reduce the dependence of stakeholders on rangeland	4.07	4.11	0.75	10
Providing low-interest loans to stakeholders for the purchase of surplus forage	3.86	4.1	1.12	11
Proper training and conducting promotional classes	3.96	4.05	0.87	12
Limiting the expansion of agricultural lands	3.82	4	0.93	13
Substituting heavy livestock and reducing surplus light livestock beyond the carrying capacity of the rangeland	3.86	3.92	0.99	14
Substituting fossil fuels with charcoal	3.75	3.76	0.91	15
Implementation of rangeland management plans to engage local communities in preventing rangeland degradation	3.07	3.13	0.88	16

Among the infrastructure factors, the development of urban and rural facilities was given top priority in terms of its impact on degradation. Observations also indicate that the development of urban and rural areas has not been carried out with sufficient care, resulting in the destruction of some portions of rangelands for the sake of development. To better manage rangelands, it is recommended to involve local people, who have a comprehensive understanding of the region, native plant species, and their various needs (water, soil, nutrition, etc.), as well as their times of flowering and pollination, in activities such as rangeland enclosure management and protection of rangelands.

Among the socio-cultural factors, the lack of educational courses on the protection of rangelands was ranked as the most important factor. Therefore, it is recommended that an adequate budget be allocated to relevant organizations for conducting promotional classes aimed at educating beneficiaries and livestock farmers about the culture of protecting rangelands. Additionally, the use of billboards and promotional materials in urban and rural areas, near the edge of the

rangelands, utilizing advertising messages with positive concepts related to rangeland conservation, and broadcasting targeted radio and television programs, especially during travel seasons, are all parts of cultural initiatives. If these initiatives are carried out in a specialized and continuous manner, it can be expected that they will have a positive long-term impact on reducing the intensity of rangeland degradation. Sharifian *et al.* (2018) identified the lack of culture regarding the protection of natural resources as one of the most important factors contributing to rangeland degradation. Malekmohammadi *et al.* (2021) also highlighted education and cultural awareness as important solutions and corrective measures in addressing rangeland issues.

Among the legal factors, poor performance and the long and time-consuming process of law enforcement in pursuing offenders in the field of natural resources have been recognized as the most significant factors in range factors degradation. Legal actions against illegal encroachments are not taken promptly or, are not fully implemented. Accordingly, the legal instrument sometimes does not function

effectively in Iran. [Han et al. \(2008\)](#), [Ghaytouri et al. \(2007\)](#), and [Gholampour et al. \(2012\)](#) have also identified land use change as influential factors in the destruction of pastures and forests. [Moradi et al. \(2016\)](#) stated that the lack of decisive and legal action against offenders and the absence of deterrent punishments are among the main reasons for the failure of rangeland management plans. [Mirdilami & Moradi \(2018\)](#) also evaluated the actions and programs of responsible organizations as ineffective in the rangeland management system.

Among economic factors, poverty among rural residents on the outskirts of rangelands and their livelihood dependence on rangelands were recognized as the most significant factor in the destruction of rangelands and forests. The lack of job diversity in rural areas and the reliance on livestock farming as the main occupation have further tied the inhabitants of these areas to the rangelands. [Gheitouri et al. \(2007\)](#), [Al-Bakri et al. \(2001\)](#), [Gholampour et al. \(2012\)](#), [Rouhi et al. \(2012\)](#), [Aryal et al. \(2014\)](#), [Ghasemi et al. \(2016\)](#), [Sharifian et al. \(2018\)](#), [Saloupour et al. \(2018\)](#), [Farajillahi & Ghasemi Aryan \(2020\)](#), [Saber \(2021\)](#), [Malekmohammadi et al. \(2021\)](#), and [Dada & Mammo \(2024\)](#) have identified income and livelihood factors as influential factors in the degradation of rangelands. Creating non-agricultural employment opportunities and income diversification can play a crucial role in this regard.

Wildfires were identified as a more significant natural factor in rangeland degradation compared to others in East Azerbaijan province. Increasing public awareness by providing necessary information to those visiting natural areas and issuing necessary warnings could prevent unintentional fires caused by 'carelessness or lack of information. [Mussa et al. \(2016\)](#) and [Gheitouri et al. \(2007\)](#) both highlighted fire as an influential factor in rangeland degradation. The results also indicate that major factors in rangeland degradation were overgrazing, out-of-season, or premature grazing, largely related to economic, social, and cultural issues

within the community since livestock farming is often the sole or primary source of income for many rural households. The increased costs of acquiring animal feed and the associated difficulties in its supply, especially in recent years, have further intensified the pressure on rangelands by livestock farmers for feed provisioning. The findings of [Gheitouri et al. \(2007\)](#), [Han et al. \(2008\)](#), [Ansari et al. \(2009\)](#), [Jamshidi & Amini \(2013\)](#), [Fenetahun et al. \(2018\)](#), [Gokkush \(2020\)](#), [Farajillahi & Ghasemi Aryan \(2020\)](#), and [Mohammadi et al. \(2022\)](#) support the results of this section of the research. It seems that implementing appropriate mechanisms for livestock feed provision and offering it to livestock farmers at a reasonable price can significantly reduce premature grazing and the excessive grazing pressure in rangelands. Providing alternative fodder is one of the three main strategies proposed by the experts to reduce rangeland degradation. Since a cause of degradation is cutting shrubs and branches for fuel, increasing supervision through increasing environmental monitoring and patrols and providing sufficient facilities and human resources can help prevent further damage to the rangelands of the province. [Malekmohammadi et al. \(2021\)](#) have identified strengthening supervisory and executive mechanisms and enhancing monitoring of rangeland as effective measures for improving rangeland management efficiency, as has [Gheitouri et al. \(2007\)](#). Ultimately, increasing public awareness and fostering a commitment to protecting national assets and natural resources will undoubtedly have a significant impact.

A further factor contributing to rangeland destruction was the construction of rural roads, water, and power networks, as well as oil and gas pipelines by government agencies. It is suggested that comprehensive studies be conducted in the province regarding ongoing construction projects and future projects, with the presence of civil engineers, infrastructure experts, and rural development specialists. This is to minimize the negative side effects of government plans through a multidimensional

approach and sustainable development. In addition to all of the above, implementing short-term, medium-term, and long-term planning for investment in rangeland restoration and rehabilitation by the government is essential to prevent further degradation of the rangelands. Sharifian *et al.* (2018) have also identified the lack of development programs and infrastructure deficiencies as important and influential factors in rangeland degradation.

Based on the perspectives of experts from various relevant organizations in East Azerbaijan province, this study identified a range of different factors as influential variables in rangeland degradation, including supervisory, livestock farming, cultural and social, economic, natural, supportive,

administrative and organizational, infrastructural, and legal factors. Among all of them, the shortcomings of the government are evident in various aspects. The government has not been able to have positive activities in this field either from the economic, infrastructural, or even educational aspects. The process of destruction shows itself at a slow but steady pace in rangelands, which emphasizes the lack of priority of natural resources in the government's long-term policies and plans.

Availability of Data: The datasets analyzed during the current study are available from the corresponding author upon reasonable request.

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شناسایی عوامل مؤثر بر تخریب مراتع از استان آذربایجان شرقی، ایران: از دیدگاه کارشناسان

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تاریخ دریافت: ۱۴۰۳/۱۱/۱۶

تاریخ پذیرش: ۱۴۰۴/۰۳/۲۱

چکیده

در استان آذربایجان شرقی با توجه به تعداد دام موجود در عرصه مراتع، فشار چرای دام بیش از ۲/۵ برابر ظرفیت مراتع می‌باشد. شناسایی عوامل مؤثر بر تخریب مراتع می‌تواند به تدوین سیاست‌های مناسب برای کاهش تخریب آن کمک نماید. بدین منظور، در مطالعه حاضر با استفاده از تکنیک دو مرحله‌ای دلفی اقدام به شناسایی و اولویت‌بندی عوامل نظارتی، طبیعی، اقتصادی، فرهنگی، قانونی، اداری و زیرساختی مؤثر بر تخریب مراتع از دیدگاه کارشناسان سازمان‌های منابع طبیعی، امور عشایر و جهاد کشاورزی استان گردید. یافته‌های مرحله دوم دلفی نشان داد که کارشناسان به ترتیب وجود فقر در بین روستائیان حاشیه مراتع (با امتیاز ۴/۷)، حمایت کم جهاد کشاورزی در تأمین علوفه و تخصیص وام برای دامداران (با امتیاز ۴/۵۳)، تبدیل مراتع به زمین‌های زراعی و باغی با هدف کسب سود بیشتر (با امتیاز ۴/۴۳)، چرای زودرس (با امتیاز ۴/۴) و چرای طولانی‌مدت (با امتیاز ۴/۲۹) را به عنوان مهم‌ترین عوامل تخریب مراتع شناسایی نمودند. براساس نتایج مطالعه، اقدامات جامع قانونی، اجرایی و نظارتی برای جلوگیری از چرای زودرس و بی‌رویه از مراتع به منظور تغذیه دام به عنوان راهکار کلیدی برای کاهش و کنترل تخریب مراتع شناخته شد. در میان عوامل اقتصادی، وجود فقر در بین روستائیان حاشیه مراتع و وابستگی معیشت آنان به مراتع مهم‌ترین عامل تخریب مراتع و جنگل‌ها شناخته شده است. همچنین، همکاری با سازمان جهاد کشاورزی در تأمین علوفه جایگزین برای دام، تقویت سازوکارهای نظارتی سازمان‌های ذیربط و افزایش سطح آموزش و آگاهی عمومی در مورد حفاظت از منابع طبیعی به عنوان سایر راهکارهای مهم در کاهش سطح تخریب مراتع مورد تأکید قرار گرفت.

واژه‌های کلیدی: تخریب مرتع، تکنیک دلفی، چرای بیش از حد، مدیریت پایدار زمین

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