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Factors Affecting Degradation of Natural Rangelands in Bamyan Center: A Community-Based Investigation

Ghulam Hazrat Ghulami✉

Bamyan University
✉Email: ghulamih30@gmail.com (corresponding author)

ABSTRACT

Sustainable rangeland management requires the active participation of all stakeholders to develop comprehensive management strategies. However, the role of these players in sustainable natural resource management is poorly understood. This study aims to (i) investigate the factors contributing to the degradation of natural rangelands based on community knowledge perception and (ii) document valuable information to identify urgent needs for effective administration and strategic planning. The study conducted interviews with 150 beneficiaries, the majority of whom lived in long-term agrosilvopastoral systems. The target groups for this study were local farmers and experts' groups, with 110 farmers and 40 governmental and non-governmental experts interviewed using a semi-structured questionnaire. The findings revealed that the most significant priorities for anthropogenic degradation factors include converting natural rangeland to agricultural land, collecting and uprooting plants for fire fuel, animal feed, and medicine; farmers' financial poverty; lack of design and adjustment of grazing systems, lack of information about the importance of rangeland, shortage of technical personnel, lack of clarity in rangeland ownership, and overuse of plant cover. Additionally, drought years, deficient snowfall, and floods were identified as contributors to rangeland degradation. This study emphasizes the urgent need for specific data and community-based rangeland management through cooperation between Indigenous communities and improvements in their traditional institutions, which are vital for responsible rangeland management and the well-being of the people dependent on these resources. Also, it helps policymakers consider this prioritization to solve this problem.

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Introduction

Afghanistan's rangelands are a vital provider of imperative ecosystem goods and facilities. They give fuelwood and restorative plants for individuals and territories for natural life, protect soil and water, and assist in climate control. This different usefulness of rangelands is

picking up expanding acknowledgment by clients. Appropriate administration of the rangeland assets in Afghanistan will be critical for feasible advancement, making strides in the quality of life, and guaranteeing nourishment security (Aziz Ali and Yi Shaoliang, 2013).

About 30 million hectares, or roughly 45% of Afghanistan's total land area, are covered by rangelands (UNEP, 2008). However, large tracts of "wasteland" or "barren land" are also utilized for grazing, particularly during the winter. Because of this, there is a significant increase in the total grazeable area, which makes up 70–85% of the land area and serves as a home and food source for over 35 million livestock and various wild species. (Robinson, 2012). Rangelands provide a supplementary source of revenue for rural communities through tourism, medicinal plants, and livestock byproducts like wool, carpets, and rugs (UNEP, 2009; Clark, 2015).

The nation's backbone, rangeland watersheds, sustains more than 4,000,000 hectares of irrigated land and provides water for springs, streams, and rivers. Most of Afghanistan comprises rangelands, deserts, semi-deserts, high altitudes, and mountains (Robinett et al., 2008). Afghanistan is a mix of flora types, including Mediterranean, Tibetan, and Himalayan, with the monsoon influencing the eastern border region (UNEP, 2008; Shank and Larsson, 1977). Artemisia steppe is the principal grazing vegetation type, and the country's high elevation adds to the diversity of plants (Thieme and Suttie, 2006; Breckle, 1983).

For instance, most of the country's inhabitants rely on rangelands for their food, housing, energy, income, and cultural legacy (Bedunah et al. 2010). To demonstrate the financial importance of these normal assets, consider that three decades back, Karakul, fleece, cotton, natural products, nuts, raisins, grapes, and woodland products accounted for 80 percent of Afghan trade (UNEP, 2008).

Alpine shrubland, subalpine, alpine heaths, and meadows are found above the tree line at around 3,300 meters. These areas comprise a larger proportion of the cover and, as a result, offer domestic animals a good variety of food sources. This implies that natural and semi-natural ecosystems in the area have been impacted by human activity. (Breckle, 2007; Ostrowski et al., 2007; Holdschlag et al., 2012).

Conversely, higher plateaus, historically utilized as rangelands and a source of wild products, are under more and more strain (Behnke et al. 2006; Moghaddam et al. 2016). Due to shifts in productivity and flora, farmers have been forced to move grazing from low-lying areas to higher-lying areas (as well as modifications to the duration of the vegetative season and variations in weather patterns like rain and snow) (MAIL., 2008).

Afghanistan's Central Highlands are vital to the nation's farming system, which relies on a mix of nomadic livestock husbandry and sedentary farming, as they serve as many animals' main summer pastures. Numerous significant rivers in the area, such as the Amu, Kabul, and Helmand, have their source in them. Moreover, the highland rangelands of Afghanistan are essential to the country's rich biodiversity (Bourrouilh et al., 2007). Ethnic and communal disputes have often occurred in the rangelands because of their vital role in the nation's

farming system and other historical and modern factors. Ecological and social problems exist when rangelands are converted to rain-fed crop production since less rangeland is available and pasture connectivity is decreased (Breckle and Wucherer, 2006).

Rangelands comprised 92.4 percent of Bamyan province, spanning 1.3 million hectares. They are widely utilized for two purposes: first, to graze livestock and second, to harvest essential plant resources for fuel. However, because of rising temperatures, high pastures are now used 10–20 days a year more frequently than in the past, which puts additional stress on the rangeland ecosystem (NEPA and MAIL 2014). Most of the population are subsistence agro-pastoralists, and they have been extensively cultivating the few productive alluvial regions in the valley bottoms for many generations at a largely sustainable level (Hoeck et al., 2007). Intensive cattle grazing, plant resource collection for fuel wood, animal feed, and medicines, the growth of rain-fed field cultivations in arid regions (known as lalmi), and wildlife hunting are currently the main environmental concerns (Bedunah et al., 2010).

The rangeland in Central Bamyan is threatened by overgrazing and over foraging. The issue is that there is nothing left in the earth for the plants to regenerate because their roots are ripping them out for fuel. This damages rangeland and has catastrophic long-term effects on the existence of the surrounding people, increasing its susceptibility to flooding (Clark, 2015; CSO and UNFPA, 2006).

The absence of resource-protecting range management appears to be caused by several factors, including population pressure, a lack of effective traditional communal management techniques, and a lack of government technical support capacity. It doesn't seem like land tenure—or lack thereof—is a significant factor. Additionally, since the loss of Afghanistan's rangeland vegetation is a centuries-old process, it is unlikely that previously operational communal rangeland management systems were destroyed by the effects of the conflict (Pittroff, 2011). According to Ggeitury et al. (2007), In Kermanshah rangelands, alterations in land use, a rise in animal population, and early grazing are the most frequent sources of damage.

The study's findings demonstrated that other fundamentally important issues in this region include the scarcity of substitute energy resources for fire fuel collection, the growing conversion of rangeland into cropland, excessive grazing pressure, recurrent droughts, and the inaccessibility of water for grazing animals. Other significant issues include rural poverty, unequal access to rangeland, particularly for pastoral groups, and the government's limited ability to lessen the effects of natural disasters (Ghoryar and Paolo, 2019).

Both sets of respondents in the Central Bamyan region provided the following explanations for rangeland degradation: removal of vegetative cover, excessive grazing and overreliance on natural resources, gathering fodder, and farming on steep slopes (Mohibbi et al., 2018). Because of heavy cattle grazing, dry land cultivation, and shrub gathering, the fauna is now in poor condition, and the vegetation, primarily mountain steppe, is deteriorating ((Mohibbi and Cochard, 2014).

In this case, the important goal of this study is to explore the causes contributing to the degradation of natural rangelands based on community knowledge and perception to help the related administration make a strategic plan by documenting valuable information to identify urgent needs in our country.

Methods and Materials

Study area

Bamyan Center is located in the center of Afghanistan, between the Hindu Kush and Baba mountains, at an altitude of 2,000 to 5000 meters above sea level (Fig. 1). The area is characterized by high elevation, cold temperatures and a poor population living in long, narrow valleys with limited possibilities for irrigated agriculture and long winters of six to seven months in the higher zones. Cold periods occur in winter, with air temperatures commonly not exceeding - 5°C during the day, and minimum air temperatures below - 20°C are common. Additionally, large daytime temperature variations are recorded in the summer, with daily temperatures sometimes exceeding 20°C. Mean annual precipitation in Bamyan is less than 165 mm, with much of this falling as snow (Cook 2011).

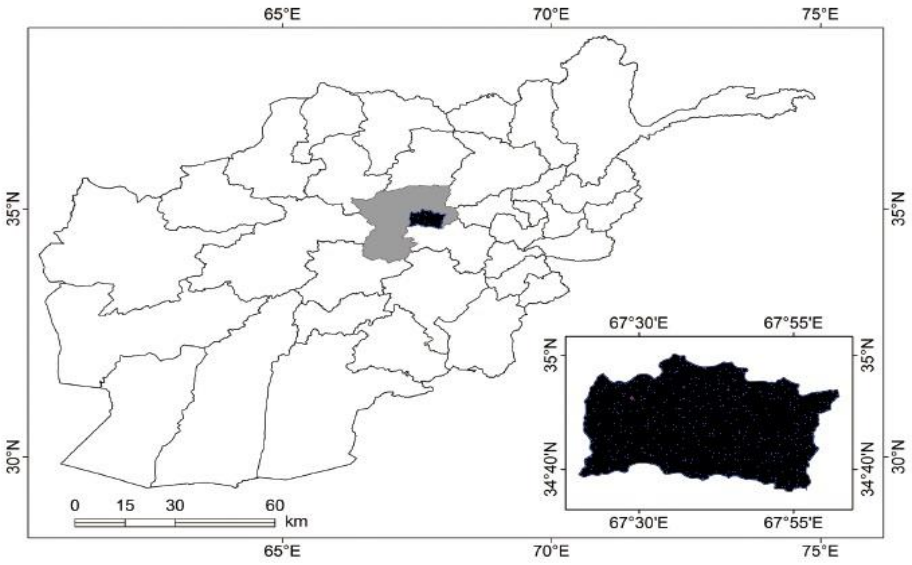

Figure 1*: Study area boundary. The gray area shows Bamyan province, and the black area shows the study area in the Bamyan Center.*

Data collection and analysis

This research employs both quantitative and qualitative research designs. The quantitative design collects data through surveys and questionnaires and analyzes the data through descriptive and inferential statistics. The qualitative method aims to understand the effective degradation factors of rangelands in the Bamyan Center. For this research, both primary and secondary data were collected. The data were gathered through different methods like household questionnaire surveys, Focus Group Discussions (FGD) with local people, councils, and related experts from different relevant organizations (governmental and non-

governmental) dealing with biodiversity conservation, rangeland management, land management, and field observation.

The author conducted four Focus Group Discussions (FGDs) with 7–10 participants in each group. The purpose of the FGDs was to collect detailed information and discuss the effective degradation factors of the Central Bamyan rangelands, their importance, and the prevention of degradation. A prepared questionnaire was used to guide the discussions. The FGDs also helped validate and confirm important information collected during the household survey. In two of the FGDs, the participation of women was 40 percent. The FGDs were conducted in various locations, including villagers' homes, mosques, and a community development council's room. The initial respondents were identified through a focus group discussion with the village chief. They were informed about the purpose of the study and assured that any information would only be used for research anonymously. After obtaining the participants' consent, an appointment was made, and a semi-structured questionnaire was administered according to the status of the respondents as defined by their use of communal rangelands.

Technical and socio-economic standard questionnaires were developed using a five-point Likert scale (much less = 1, less = 2, average = 3, much = 4, and very much = 5) with the assistance and discussion of experts and colleagues from two groups (local farmers and local experts). The questionnaires were divided into two parts (artificial and natural degradation) and administered to 150 people, including 110 local farmers and 40 experts, both men and women, aged 18 or older, who were personally interviewed during the summer of 2020 (Jun–August).

The survey questions and the data variables derived from them are offered in Tables 1–4. Material was collected on (1) the personal features of the respondents, (2) respondents' revenue sources and, (3) agricultural production and resources, (4) effective anthropogenic destruction factors, (5) effective natural demolition factors with priority. A face-to-face household survey was conducted using a structured questionnaire to collect data on personal features, socio-economic profiles, agriculture practices, and effective anthropogenic and natural destruction factors. Respondents were randomly selected; the survey included 150 respondents and used both open-ended and closed-ended questions for qualitative and quantitative data collection. The data were collected quantitatively before the survey; a pre-survey was conducted to test the questionnaire for clarity and relevance. Questionnaires were coded and grouped for data analysis. Then descriptive census methods, including frequency, percentage, average, standard deviation, coefficient of variation, and inferential and factor analysis, were conducted using the SPSS version 24 program.

Result and Discussion

Effective Anthropogenic Destruction Factors Priority According to Farmers

Local people characterize artificial demolition factors in Bamyan Center, and the results of 110 farmers' questionnaires are represented in Table 1. These variables result from local and outside people affecting the natural resources.

Table 1: *Effective anthropogenic demolition factors priority according to farmers (n=110)*

Effective artificial factors in rangeland demolition	Standard deviation	Average	CV	Priority
Transforming natural rangeland to agricultural land	0.763	4.31	0.177	1
Collecting and uprooting of plant cover	0.760	4.28	0.182	2
Farmers financial poverty	0.750	4.13	0.206	3
Severe and long grazing	0.715	4.12	0.173	4
lack of design and adjustment of grazing systems	0.875	4.07	0.215	5
Lake of information about rangeland importance	0.875	4.07	0.214	6
Shortage of technical persons	0.928	3.96	0.234	7
Lake of Clarity in rangeland ownership	1.066	3.73	0.285	8
Overuse of plant cover	0.947	3.73	0.254	9
Imperfect management of natural resources	0.900	3.72	0.242	10
Income increasing	0.891	3.59	0.248	11
Rivalry in grazing	0.967	3.32	0.291	12
Collecting of secondary production	0.814	3.21	0.253	13
Development of profit-seeking individuals	0.938	2.96	0.316	14
External contention	0.812	2.04	0.398	15
Poor culture	0.691	2.02	0.345	16
Changing rangelands to construction area	0.851	1.97	0.431	17
Catching fire	0.872	1.97	0.442	18
A contest between nomadic and local	0.880	1.80	0.488	19
Local contention	0.637	1.79	0.355	20
Military basis	0.774	1.54	0.504	21
Constructional projects	0.787	1.51	0.521	22
Increase in land price and productivity	0.505	1.27	0.396	23
Mine extraction	0.789	1.15	0.686	24

Rangelands' priority destruction factors are found by calculating the average, which comes by dividing the sum of the values in the set by their number. Table 1 shows 24 effective destruction factors with priorities, which include transforming natural rangeland to agricultural land; collecting and uprooting plant cover; farmers' financial poverty; severe and long grazing; early grazing; a lack of information about rangeland importance; a shortage of technical personnel; imperfect management of natural resources; a lack of clarity in rangeland ownership; and overuse of plant cover.

Effective natural destruction factors priority according to farmers

The resulting survey of 110 farmer's questionnaires in the case of effective natural demolition factors determined priority according to local beneficiaries listed in Figure 2.

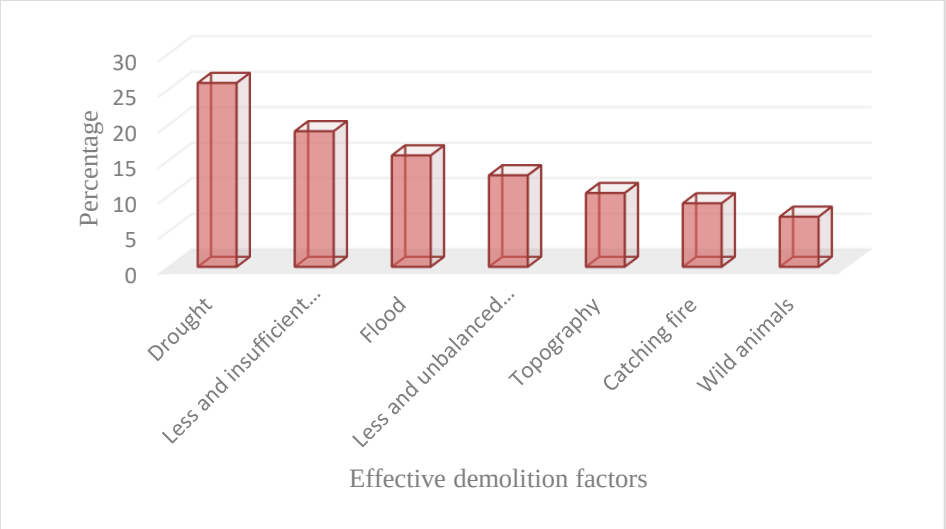

***Figure 2**: Effective natural demolition factors priority according to farmers (n=110)*

Figure 2 shows the farmers in Central Bamyan province knew 7 natural destruction factors: drought, less and insufficient snowfall, climate change, less unbalanced spring season rainfall, topography, catching fire, and wild animals had, on average, meant very much and much, or in percentage order, 25.9, 19.1, 15.7, 12.9, 10.4, 8.97and 7.06.

Effective anthropogenic destruction factors priority according to specialist

The local experts identified 27 anthropogenic destruction factors in Table 2; the priorities are calculated using the average, with a five-point Likert-scale; the experts mentioned in the ten priorities—collection and uprooting of plant cover for fuel, animal feed, and home cover; and converting natural rangeland into agricultural land, less extension activity and professional people, farmers' financial poverty, severe and long grazing, common tragedy, lack of design and adjustment of grazing systems, lacking awareness about the importance of rangeland, lack of basic data to create a strategic plan and waste in the use of vegetable cover through governmental and nongovernmental organizations with the assistance of people, that is, by considering participatory management policy in the short and medium term, will not be solved; plant cover will complete its regression.

***Table 2:** Effective anthropogenic demolition factors priority according to a specialist (40)*

Effective human demolition factors are a priority	Very much	Much	Average	Less	Very less	Middle	Standard deviation	Average	CV	Priority

Collecting and uprooting of plant cover for fuel, animal feed, and home cover	55%	22.5 %	22.5%	0	0	5	0.73	4.50	0.162	1
Transforming natural rangeland to agricultural land	53%	21.5 %	25.5%	0	0	4.5	0.70	4.23	0.165	2
Less extension activity & professional propel	50%	25%	25%	0	0	4.5	0.71	4.18	0.170	3
Farmers financial poverty	42.5 %	40%	17.5%	0	0	4	0.74	4.25	0.174	4
Severe and long grazing	42.5 %	30%	22.5%	5	0	4	0.83	4.33	0.191	5
Common tragedy	35%	47.5 %	17.7%	0	0	4	0.84	4.25	0.197	6
Lake of design & adjustment of grazing system	35%	55%	7.5%	2.5	0	4	0.84	4.03	0.208	7
Lake of awareness about the importance of rangeland	32.5 %	42.5 %	22.5%	2.5	0	4	0.85	4.01	0.209	8
Lake of basic data to create a	30%	47.5 %	15%	7.5	0	4	0.88	4	0.211	9

strategy plan										
Waste in the use of vegetable cover	27.5 %	40%	30%	2.5	0	4	0.829	3.93	0.220	10
Mismanagement of natural resources	20%	37.5 %	35%	5	2.5	4	0.93	4.10	0.226	11
Duality in rangeland management	10%	30%	40%	12.5	7.5	3	0.94	3.86	0.243	12
Lake of Transparency Rangeland ownership	10%	15%	45%	27.5	2.5	3	0.97	3.03	0.250	13
Compete on grazing	5%	17.5 %	27.5%	25	25	2.50	0.98	2.53	0.300	14
Development of profit-seeking individuals	5%	5%	30%	45%	15%	2	0.98	2.4	0.302	15
Competition between locals and nomads	2.5 %	5%	7.5%	10%	75%	1	0.97	1.5	0.303	16
Cultural poverty	0	12.5 %	37.5%	45%	5%	2.5	0.78	2.58	0.320	17
Catching fire	0	0	0	7.5 %	92.5 %	1	0.27	1.08	0.366	18
Turning rangeland into residential areas	0	2.5 %	12.5%	27.5 %	57.5 %	1	0.75	1.5	0.373	19

Conquest of rangeland by mines	0	0	0	2.5 %	97.5 %	1	0.16	1.03	0.378	20
Harvesting byproducts	0	0	25%	60%	15%	2	0.63	2.10	0.387	21
Rising prices for lands and crops	0	0	20%	50%	30%	2	0.71	1.9	0.408	22
Increasing revenue	0	2.5	7.5%	60%	30%	2	0.67	1.83	0.468	23
Military basis and activities	0	0	0	5%	95%	1	0.64	1	0.640	24
Development projects	0	0	0	4	96	1	0.22	1.05	0.650	25
Regional quarrel and dispute	0	2.5	2.5	32.5	62.5	1	0.68	1.45	0.655	26
External quarrels and dispute	0	0	15	17.5	67.5	1	0.56	1.48	0.660	27

Effective natural demolition factors, according to experts

The resulting survey of 40 expert questionnaires on effective natural demolition factors given priority according to local scientists is listed.

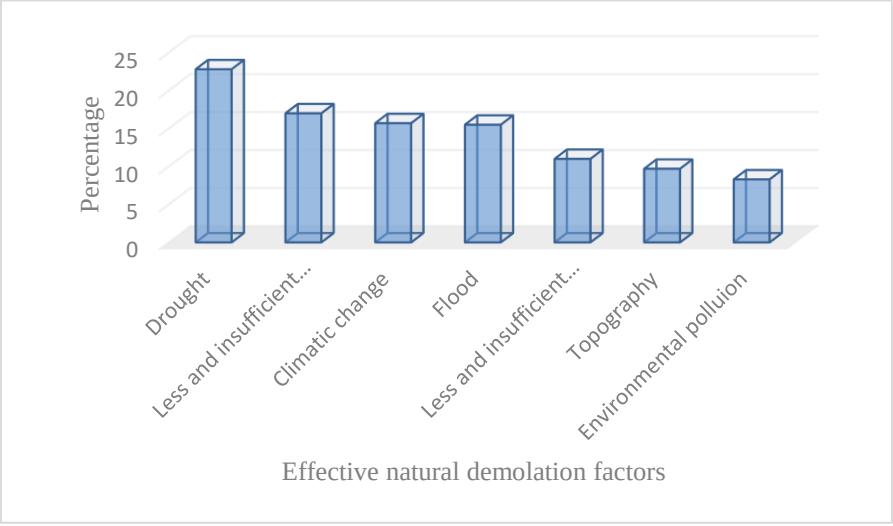

***Figure 3**: Effective natural demolition factors according to experts (n=40)*

Local experts in Figure 3 expressed 7 natural destruction factors are known over the average (drought, less and insufficient snowfall, climatic change, flood, less unbalanced spring season rainfall, topography, and environmental pollution) or in percentage order: 22.8, 17, 15.7, 15.5, 11, 9.7, and 8.3 have ruled in the destruction of natural rangeland in Central Bamyan province.

Identifying primary factors in the destruction of natural rangelands in Bamyan Center

Before conducting a principal components analysis, it is necessary to ensure suitable data. For this reason, two tests, KMO and Bartlett Sphericity, are used.

The sufficient quantity of the KMO sample for the rangelands destruction factors' scale was 0.64, which shows a suitable sufficient sample. Also, the chi-square statistic of the Bartlett sphericity test is at a significance level of less than 5 percent, indicating that there is a unity between related variables on this scale. Then, there is certainty about the data fitting for factor analysis. Varimax rotation with Kaiser Normalization has been used to achieve significant factors.

According to the data from factor analysis that was achieved in relation to a primary census of rangeland destruction factors, the special values of the first, second, and third variables are larger than one. These three factors explained 56.141 percent of all the variance scales. Statistical indicators extracted from the principal component analysis are presented in Table 3.

Based on survey findings, 3 of the ten factors had a special value of 1, as presented in Table 3. Central Bamyan rangelands destruction factors account for 56.141 percent of the total variance.

Table 3: *Extracted statistical indices of Pasture Destruction Factors Scale using principal component analysis*

Factors	Special Value	Percentage of explained variance	Cumulative explained Percentage variance
First factor	2.225	22.247	22.247
Second factor	2.043	20.432	42.679
Third factor	1.346	13.462	56.141

Among the three factors, the first has the highest participation variance (mentioned scale: 22.247 percent), the second has a variance of 20.432 percent, and the third has a variance of 13.462 percent of the total explained variances. In this case, I can say briefly that the factors leading to rangeland destruction are three. The third picture is a Scree graph and explains the special values against certain factors. In another explanation, this graph accepted the last result and showed only three factors had a special value bigger than the one indicated in Figure 4.

Each of the factors listed in Table 3 consists of several variables, and the loading status of these factors after the Varimax rotation is shown in Table 4 to achieve a clearer interpretation of this scale and transfer to new axes.

Based on the information in Table 4, the variables of financial poverty, collection and eradication of plants, breaking of pastures into agricultural lands, and lack of awareness of the importance of pastures are the variables that constitute the farmer's financial problems in the case of effective natural rangeland destruction factors.

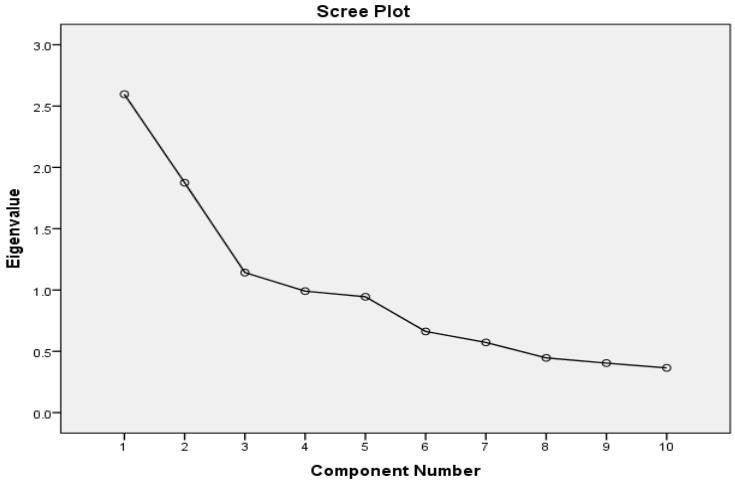

Figure 4: Scree graph explains the special values against factors and showed only 3 factors have the special value bigger than 1.

Table 4: *Variables related to each factor and the amount of factor load resulting from the rotated matrix*

Factors	Suggested name	Variables	Factor load
First	Economic Problems of Farmers	Financial poverty	0.686
		Collecting & eradicating plants	0.640
		Breaking of pasture into agricultural land	0.630
		Lake of awareness of the importance of pastures	0.601
Second	Grazing systems	Severe grazing	0.690
		Long grazing	0.611
		Not considering turn-based grazing	0.605
		Lake of rangeland quarantine	0.586
Third	Management	Mismanagement	0.740
		Less of a Professional person	0.404

Considering that this factor alone represents 24.27 percent of the total rangeland degradation factors variance, it is necessary. With a specific value of 2.225, this factor has the highest correlation with the variables financial poverty, collection and uprooting of plants, breaking of pastures into agricultural lands, and lack of awareness of the importance of pastures.

Financial problems for preparing fuel-warming houses in different seasons of the year and providing fodder for livestock are considered one of the main problems facing farmers.

This issue is now a big and basic problem for natural resource management. In addition, a lack of awareness of the importance of rangelands has led to the destruction of natural rangelands.

Conclusion

The present study prioritizes effective destruction factors for Afghanistan's sustainable rangeland management, ideal administration, and strategic planning. The country, characterized by a weak economy and anarchy in administration, faces numerous challenges, making it necessary to prioritize planning and involve all relevant parties in creating comprehensive management strategies. The findings, based on local input and factor analysis, highlight three critical factors; the first factor is the economic problems of farmers, which include these variables: financial poverty, collecting and eradication plants, breaking of pasture into agricultural land, and lack of awareness of the importance of pastures, the second factor is grazing system which includes the variances of severe grazing, long grazing, not considering turn-based grazing and lack of rangeland quarantine and the third factor is management which includes the variances of mismanagement and less of professional person. Data collection nationwide is urgently needed to inform policy design and create a strategic plan addressing these destruction factors.

Conflict of Interest: The author(s) declare no conflict of interest.

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