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Assessment of the level and readiness of local communities' financial participation in rangeland management (case study: Kharturan Rangelands, Biarjmand–Shahroud)

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ABSTRACT

Rangelands, as a critical component of natural ecosystems, are essential for supporting both ecological systems and human well-being. This study aimed to assess the financial participation of local communities in the management of the Kharturan rangelands in the Biarjmand region and to identify the determinants of their willingness to pay (WTP). Data were collected from 170 households using a stratified random sampling approach based on the Contingent Valuation Method (CVM) with a double-bounded dichotomous choice design, following the validation of the instrument through a pre-test survey. A logit model, estimated via Maximum Likelihood Estimation (MLE), was employed to analyze the data. The results indicate that the average WTP for rangeland conservation and restoration is 129,576 IRR. The econometric analysis highlights that the proposed bid amount exerts a significant negative effect on WTP at the 1% significance level, a crucial finding that underscores the sensitivity of local community participation to financial costs, alongside the negative influence of the size of the customary rangeland system. In contrast, factors such as the intention to continue livestock farming, the number of livestock owned, public awareness of ecosystem services, and the presence of natural resource experts in the region positively influence WTP at the 1% significance level. These findings provide significant insights for policymakers to design effective community-based rangeland conservation and restoration programs.

Highlights

- Local support for rangeland restoration is substantial, suggesting that community-based financing can complement public conservation efforts.
- Knowledge of ecosystem services and interaction with natural resource experts appear to strengthen confidence in restoration outcomes and enhance financial participation.
- Sustainable restoration policies should address both budget constraints and institutional trust by combining technical outreach, locally scaled management, and flexible contribution mechanisms.

1. Introduction

Rangelands provide essential ecosystem services, including forage production, soil protection, biodiversity conservation, carbon storage, and support for the livelihoods of pastoral communities. Their sustainability, however, is increasingly threatened by overgrazing, land degradation, soil erosion, and desertification. Previous evidence from Iran has indicated that human behavior, resource-use practices, and local awareness of degradation processes are important factors shaping forest and rangeland degradation; therefore, understanding local perceptions and participation incentives is essential for designing effective restoration policies (Ebrahimipour, 2001; Khorshidi and Ansari, 2003). In Iran, rangelands cover more than 53% of the country's land area and constitute a major ecological and economic resource (Forests, Rangeland and Watershed Management Organization of Iran, 2006). Given the extensive area of

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these ecosystems and the limited capacity of public agencies to monitor and restore them, the participation of local resource users is essential for effective conservation and rehabilitation (Jalali and Karami, 2006). Addressing this crisis necessitates collective action and the active participation of rangeland users in rehabilitation and restoration projects (Jingling et al., 2010). However, neglecting the socio-economic needs of resource users represents a major barrier to their participation in such initiatives (Faircheallaigh, 2010).

Participatory rangeland management extends beyond the involvement of local communities in project implementation. It requires their engagement in planning, decision-making, monitoring, and evaluation, while considering the livelihood conditions and institutional arrangements that shape their incentives to cooperate. Previous studies have shown that the success of natural resource management initiatives depends not only on ecological conditions but also on human, social, economic, and organizational capital (Heydari, 2008).

To design locally acceptable conservation policies, evaluating the non-market values of ecosystem services is crucial. Because many rangeland ecosystem services are not traded in formal markets, the Contingent Valuation Method (CVM) is widely accepted in environmental economics for estimating individuals' willingness to pay (WTP) for environmental conservation and restoration programs (Carson and Groves, 2007; Howarth and Farber, 2002). In CVM studies, WTP is commonly influenced by households' socioeconomic characteristics, environmental awareness, dependence on natural resources, perceived benefits of conservation, institutional trust, and the proposed payment amount (Birol et al., 2006; Hanemann, 1984; Whittington, 1998).

In particular, a negative relationship between the bid amount and acceptance probability is expected, reflecting the financial constraints faced by respondents**.**

Evidence from Iran and globally suggests that awareness of rangeland ecosystem services, participation in training programs, access to technical support, and the presence of natural resource experts can encourage pastoralists to engage in restoration activities (Lien et al., 2024; Ning et al., 2019).

The Kharturan rangelands in the Biarjmand region represent an important case for examining these issues. The area is characterized by pastoral livelihoods, ecological sensitivity, and dependence on customary rangeland management arrangements.

Despite the importance of local participation for rangeland restoration in this region, limited evidence is available regarding pastoralists' willingness to make financial contributions and the factors shaping their payment decisions. In particular, the effects of livestock dependence, future pastoral intentions, awareness of ecosystem services, expert presence, customary management arrangements, and payment bids have not been systematically examined in the study area**.**

Accordingly, this study estimates pastoralists' mean willingness to pay for rangeland restoration in the Kharturan rangelands and identifies the main determinants of their financial participation.

Using the CVM with a double-bounded dichotomous choice format, the study applies a logit model estimated through maximum likelihood (Hanemann et al., 1991) to analyze respondents' payment decisions. The findings are intended to provide empirical evidence for designing financially feasible, locally legitimate, and community-based rangeland restoration policies.

2. Materials and methods

2.1. Study area

Biarjmand, one of the three administrative districts of Shahroud County in Semnan Province, is located in an arid desert region. It is bordered by Meyami District to the north, Davarzan and Rudab (Sabzevar) to the east, Tabas to the south, and the central district of Shahroud to the west. Covering an area exceeding 2,091,907 hectares, Biarjmand constitutes the largest management unit in the province. The name "Biarjmand" is believed to derive from the local Kumesh language, combining *biar* (well) and *jamand* (garden), historically referring to the former Biar and Jamand territory. Major mountain ranges in the region include Sookhteh Kuh (2416 m), Peyghambar Mountain (2265 m), and Qal'eh Ahoo (1920 m). The Kharturan River, Kal-e Shourab, and several seasonal rivers such as Kaletgook and Ab-e Gorkho traverse the area. Agricultural lands are primarily irrigated through qanats and deep wells (Forests, Rangeland and Watershed Management Organization of Iran, 1997). Figure 1 illustrates the geographical location of the Biarjmand region within the national context (Figure 1).

Biarjmand is located within the Irano–Turanian semi-desert ecological zone. The vegetation cover is predominantly composed of xerophytic species, including *Artemisia sieberi* (Sagebrush), *Zygophyllum atriplicoides*, various halophytic species, and *Haloxylon persicum* and *Haloxylon ammodendron*. According to the Biarjmand watershed studies (General Office of Natural Resources and Watershed Management of Semnan Province, 2008), as presented in Table 1, the total canopy cover is reported to be only 15%, while bare soil accounts for 73.5% of the area.

The Kharturan rangelands, located in the Biarjmand region of northeastern Iran, are part of Turan National Park and represent one of the country's most ecologically significant arid ecosystems. The area is characterized by extensive rangelands, fragile vegetation cover, and high dependence of local pastoral households on natural resources for livestock production. It also hosts several nationally important wildlife species, including the Asiatic cheetah and the Persian onager, which underscores its conservation value and the need for effective participatory management. Due to its ecological sensitivity, livelihood dependence, and ongoing pressure from resource use, Kharturan provides a relevant case for examining local willingness to pay for rangeland restoration and community-based conservation.

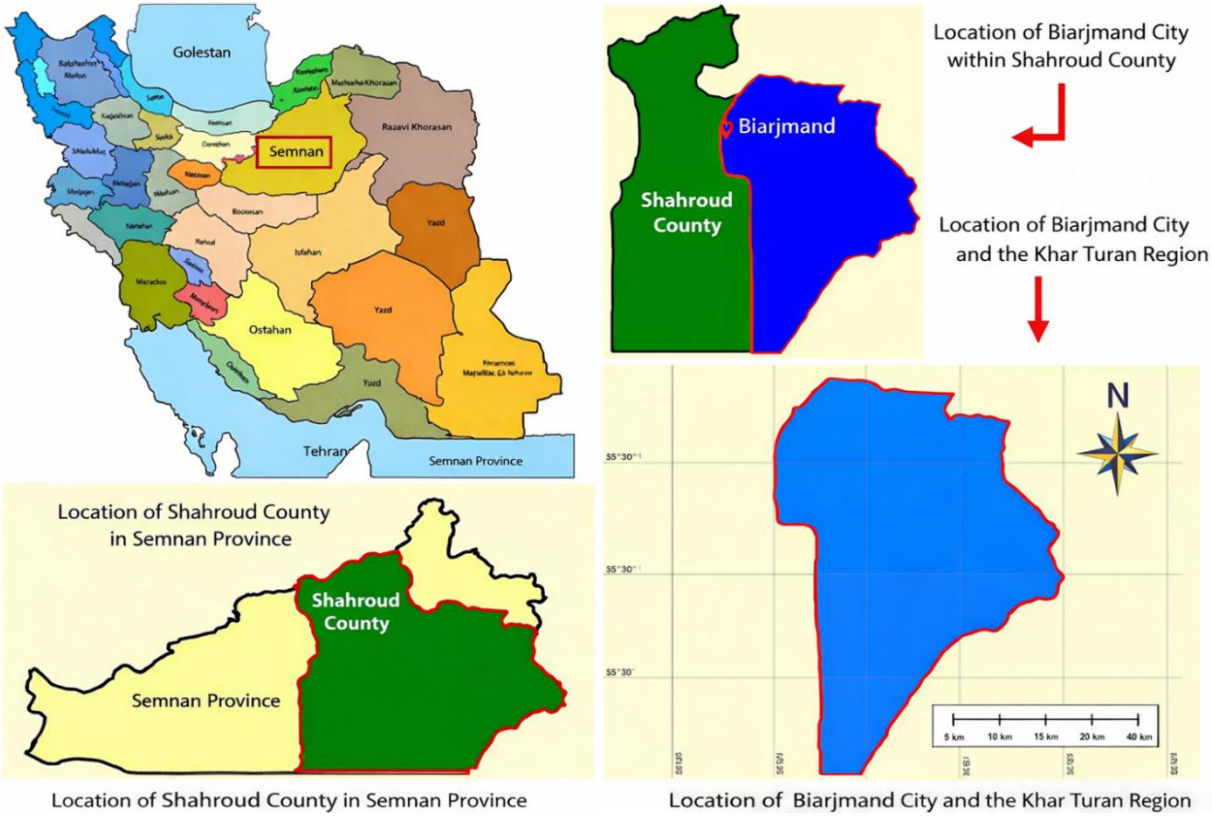


Figure 1. Geographical location of the Biarjmand region within the national territory of Iran.

Table 1. Assessment of canopy cover in the Biarjmand–Kharturan region (General Office of Natural Resources and Watershed Management of Semnan Province, 2008).

Variable	Percentage (%)
Total canopy cover	15.0
Litter cover	2.5
Gravel and stone cover	9.0
Total protected soil surface	26.5
Bare soil	73.5

Based on the modified De Martonne aridity classification, the regional climate is classified as arid, while under the Emberger system, it is categorized as cold arid. The mean annual precipitation is approximately 110 mm, according to five-year climatic records (2009–2013) from the Biarjmand meteorological station, and absolute temperatures range from –15 °C to +41 °C (General Office of Natural Resources and Watershed Management of Semnan Province, 2008). The prevailing wind direction is predominantly northerly (18%), followed by northeasterly winds (12%). These wind regimes play a significant role in moisture transport, enhanced evapotranspiration, and the formation of local climatic phenomena.

Geologically, the study area lies within the Central Iran structural zone, south of the Sabzevar ophiolitic belt and north of the Great Iranian Desert (Dasht-e Kavir). The oldest lithological units date back to the Triassic period and are primarily composed of various schist formations. The primary livelihoods of local residents are livestock husbandry and agriculture, including the cultivation of wheat, barley, pomegranate, and almond. Most villages are equipped with basic infrastructure such as water supply, electricity, telephone services, and educational facilities up to the high school level. Villages such as Qal'eh Bala and Rezaabad, due to their hilly topography, desert landscapes, and proximity to Turan National Park, are considered significant ecotourism destinations (General Department of Environmental Protection of Semnan Province, 2026).

Biarjmand represents the principal wintering ground (Qeshlaq) of the Sangsari nomads, who undertake the longest known pastoral migration route in the world, exceeding 1,500 km. These nomadic communities produce more than 32 distinctive dairy products derived from goat and sheep husbandry. Within the study area, approximately 410 nomadic households reside, collectively holding grazing rights over nearly 67% of the winter rangelands General Office of Natural Resources and Watershed Management of Semnan Province, 2008).

2.2. Research methodology and data collection

This study employed a combination of library-based and field-based research methods. Field data collection included qualitative approaches, such as direct observation and semi-structured interviews, as well as quantitative techniques based on questionnaire surveys. To estimate local communities' willingness to pay (WTP) for

participation in rangeland management, a logit model was applied within the framework of the Contingent Valuation Method (CVM) using a double-bounded dichotomous choice design (Lee and Han, 2002). The bid amounts were determined through a preliminary pre-test involving 30 open-ended questionnaires administered to local pastoralists. Based on the distribution of the stated WTP values obtained from the pre-test, three initial bid levels of 50,000, 100,000, and 200,000 IRR were selected. In the main survey, each respondent was asked two sequential closed-ended WTP questions. First, one of the three initial bids was randomly presented to the respondent. If the respondent accepted the initial bid, a higher follow-up bid equal to twice the initial amount was offered; if the respondent rejected it, a lower follow-up bid equal to half of the initial amount was proposed. Accordingly, the possible response patterns were yes-yes, yes-no, no-yes, and no-no. The responses obtained from this double-bounded questioning format were subsequently analyzed using maximum likelihood estimation.

Data were obtained from 170 questionnaires, administered through stratified random sampling among a population of 330 rangeland beneficiaries. The logit model assumes a logistic cumulative distribution function, as expressed in Equation (1 and 2):

$$P(L)=P[L\leq\beta_1+\beta_2 x]=\Delta(\beta_1+\beta_2 x)=\frac{1}{1+e^{-(\beta_1+\beta_2 x)}} \quad (1)$$

$$1-P=\frac{1}{1+e^{(\beta_1+\beta_2 x)}} \quad (2)$$

In the logit model, the dependent variable is expressed as a probability bounded between 0 and 1, exhibiting a nonlinear, S-shaped relationship with the independent variables. Model goodness-of-fit is commonly assessed using the pseudo R^2, where higher values indicate a better model fit, although its interpretation differs from that of the conventional R^2 in linear regression models (Green and Hensher, 2003).

In addition, classification accuracy is employed as an alternative performance measure to evaluate the model's predictive capability (Ben-Akiva and Lerman, 1985).

Because the marginal effects of independent variables on the predicted probability are nonlinear, variable, and conditional upon the values of other covariates, direct interpretation of the estimated coefficients is not feasible. Consequently, only the sign of the coefficient (positive or negative) is interpreted to indicate the direction of the effect of an independent variable on the probability of financial participation.

The reliability of the questionnaire was assessed using Cronbach's alpha coefficient based on a 30-respondent pre-test. The resulting coefficient for the entire set of questions exceeded 0.70, indicating an acceptable level of internal consistency and instrument reliability. To select the study sample, a stratified random sampling method was employed, and the required sample size was estimated using the Cochran formula (Equation 3). The statistical population consisted of 330 rangeland beneficiaries distributed across 131 customary management units. Based on Cochran's formula, the sample size was determined to be 170 respondents. Sampling was conducted through stratified random selection at the level of customary rangeland units (Zare Chahouki, 2010).

$$n=\frac{\frac{z^2pq}{d^2}}{1+\frac{1}{N}\left[\frac{z^2pq}{d^2}-1\right]} \quad (3)$$

The dependent variable was the acceptance or non-acceptance of financial participation in rangeland management, expressed as willingness to pay (WTP). The independent variables included socio-economic characteristics (gender, age, education level, income, number of livestock, livestock farming experience, and household size) as well as explanatory factors such as awareness of rangeland management, size of the customary rangeland unit, engagement in crop cultivation, and water resources availability (Zare Chahouki, 2010). In addition to these socioeconomic and institutional variables, two additional variables were considered in the analysis: the Management Index and Bilateral Financial Contribution. The Management Index was constructed to measure the respondents' level of involvement in rangeland-management activities. This index was based on respondents' reported participation in the relevant management activities included in the questionnaire, with higher values indicating a greater level of participation and involvement in rangeland management. Bilateral Financial Contribution was defined as the respondents' willingness to contribute financially through a joint mechanism involving both local rangeland users and relevant governmental or natural-resource-management institutions. This variable was treated as a binary variable, taking a value of 1 when the respondent accepted or reported willingness to participate in such bilateral financial contributions and 0 otherwise. These variables were included in the logit model to examine whether participation in management activities and support for joint financial mechanisms affected households' willingness to pay for rangeland management. Data analysis was conducted using SPSS and Shazam software packages, and model parameters were estimated using the maximum likelihood method. Model goodness-of-fit was evaluated using pseudo R^2 and classification accuracy indices (Green and Hensher, 2003; Ben-Akiva and Lerman, 1985).

3. Results

The socio-economic characteristics of the 170 surveyed rangeland users in the Kharturan–Biarjmand region are presented in Table 1. The sample consisted entirely of married men, nearly half of whom had more than 20 years of livestock farming experience. Most respondents had education levels below a high school diploma, and the dominant monthly household income category was 15–20 million IRR. Household size was mainly concentrated in four- and five-member families.

All respondents (100%) possessed official grazing permits or rangeland assessment cards, and 88.8% reported maintaining livestock numbers in accordance with the permitted carrying capacity. Furthermore, 100% of respondents fully complied with the prescribed livestock entry and exit periods.

With respect to financial participation, 85.9% of pastoralists expressed their willingness to contribute financially to rangeland restoration initiatives. Among those willing to pay, 51.8% cited consequence-based motivations (intrinsic benefits of rangelands), while 34.1% indicated duty-based motivations (ethical responsibility) as their primary reason for payment. Additionally, 42.9% expressed a preference for allocating their financial contributions to kappeh-kari (micro-catchment planting) activities, and 98.8% were willing to participate in operational restoration activities, such as kappeh-kari or spring rehabilitation.

The primary reasons for unwillingness to pay included lack of confidence that contributions would be spent on local restoration efforts (9.5%) and insufficient financial capacity (4.1%). Table 2 presents the percentage and frequency of financial participation among rangeland users in rangeland conservation and restoration efforts. Table 3 summarizes the percentage and frequency of stated reasons for financial contributions toward rangeland protection, conservation, and restoration.

Table 2. Percentage and frequency of rangeland users' financial participation in rangeland conservation and restoration

Percentage (%)	Frequency	Response
85.9	146	Yes
14.1	24	No
100.0	170	Total

Table 3. Percentage and frequency of stated reasons for (non-)payment toward rangeland conservation and restoration

Reason for payment decision	Code	Frequency	Percentage (%)
Unwillingness to pay	1	24	14.1
Payment based on expected outcomes (consequence-based motivation)	2	88	51.8
Payment based on moral obligation (duty-based motivation)	3	58	34.1
Total	-	146	100.0

Based on the study findings, pastoralists' attitudes within the statistical population toward rangeland management and restoration indicate the highest level of agreement with two statements: rangeland restoration led by resource users through self-initiated actions with limited technical or financial support from the government, and the perception that restoration and management programs are beneficial to rangeland users. Both statements received the highest mean score of 3.4. In contrast, the statement "investing in the conservation of natural resources for future generations, even at the expense of a reduced standard of living" received the lowest mean score (1.2), reflecting a relatively weak orientation toward long-term ecological considerations. Table 4 presents the mean scores of pastoralists' attitudes and perceptions, as derived from the questionnaire, regarding rangeland management and restoration.

Table 4. Mean scores of pastoralists' attitudes toward rangeland management and restoration

Mean score	Statement	Rank
4.3	Rangeland restoration should be carried out by resource users through self-initiated actions, with limited technical and financial support from the government.	1
4.3	Rangeland restoration and management programs are beneficial to rangeland users.	2
4.1	Cooperation with the government in rangeland restoration within the region is a moral obligation.	3
4	To address natural resource issues, rangeland users must coordinate with one another and work collectively.	4
2.8	I do not have sufficient financial capacity to pay for the conservation of natural resources.	5
2.6	Rangelands should be converted to agricultural and residential land to ensure food security and urban development.	6
2.5	Natural resources have no value for my family, and their degradation is unimportant.	7
2.2	Having money is more important to me than conserving natural resources and ensuring a healthy environment for future generations.	8
2.1	Investing in the conservation of natural resources for the benefit of future generations requires sacrificing part of one's current standard of living.	9

In the non-financial participation section, 98.8% of pastoralists expressed their willingness to participate in rangeland restoration activities through physical labor rather than monetary payment, such as constructing livestock shelters, rehabilitating springs, or implementing pit-seeding (kappeh-kari). This finding indicates that the studied community prefers to contribute to rangeland restoration through direct labor input. Among different restoration projects, pit-seeding was the most preferred option (42.9%), while planting fruit-bearing and non-fruit-bearing trees received no preference (0%). Following pit-seeding, the next priorities were cultivation of medicinal plants (20.6%) and shrub planting (18.2%), respectively. These results suggest that pastoralists prioritize restoration practices that are compatible with their technical capacities and directly enhance forage production. Regarding awareness of rangeland ecosystem services, 65% of respondents (combined "high" and "very high" categories) believed that awareness of these services plays a very important role in their decision-making regarding financial

participation. This finding is consistent with the results of the logit regression model, which identified awareness of rangeland ecosystem services as a positive and statistically significant determinant of willingness to pay (WTP). Moreover, 50.6% of respondents (combined "high" and "very high" levels) considered the success of previous rangeland restoration and management projects to be an influential or highly influential factor in their decision to participate financially. This result indicates that a successful track record of past government-led projects can serve as a motivational turning point for future participation by pastoralists.

Table 5. Results of the logit regression model for assessing the level and determinants of local communities' financial participation in rangeland management

Independent variables	Estimated coefficient (β)	Standard error (SE)	t-statistic	Weighted elasticity	Marginal effect
Bid	-0.00002	0.0000028	-8.05**	-1.01	-0.0000057
Intercept	-6.5	2.6	-2.45	-2.21	—
Occurrence of floods in rangelands	0.25	0.13	1.74	0.26	0.060
Participation in implementation of the management plan	-0.15	0.33	-0.45	-0.023	-0.038
Rangeland insurance	0.32	0.34	0.96	0.043	0.081
Occupational insurance for pastoralists and retirement services for degradation prevention	0.18	0.16	1.11	0.15	0.047
Attendance in extension training sessions	0.095	0.34	0.27	0.022	0.023
Willingness to continue pastoralism in the future	0.52	0.18	2.85**	0.66	0.13
Awareness of the consequences of natural resource degradation	0.23	0.49	0.47	0.071	0.059
Management Index	-0.59	0.34	-1.6	-0.64	-0.14
Area of customary rangeland system	-0.0003	0.00009	-3.338**	-0.48	-0.000075
Type of rangeland user (indigenous, nomadic, semi-nomadic)	0.13	0.13	0.966	0.099	0.032
Duration of pastoral activity	-0.4	0.28	-1.43	-0.47	-0.1
Rangeland tenure type (communal, council-based, individual)	0.099	0.17	0.56	0.054	0.024
Level of satisfaction with pastoralism	0.11	0.23	0.50	0.15	0.029
Livestock headcount in rangeland	0.0047	0.0011	4.06**	0.71	0.0011
Provision of livestock drinking water	0.11	0.082	1.411	0.092	0.029
Age	0.021	0.020	1.03	0.37	0.0052
Educational attainment	0.22	0.19	1.16	0.18	0.057
Household monthly income	-0.12	0.13	-0.95	-0.16	-0.032
Household size	-0.034	0.14	-0.24	-0.051	-0.0085
Non-participation of other rangeland users in the rangeland restoration plan	-0.11	0.19	-0.60	-0.15	-0.029
Bilateral financial contribution (government–pastoralist)	-0.071	0.22	0.32	0.1	0.017
Awareness of rangeland-related services	0.71	0.18	3.81**	0.92	0.17
Distrust of rangeland users toward natural resource experts	0.085	0.21	0.39	0.11	0.021
Provision of low-interest credit facilities by the government	0.19	0.20	0.96	0.30	0.049
Rangeland ownership registered under the pastoralist's name	-1	0.19	-0.51	-0.14	-0.024
Financial poverty of the rangeland user	0.37	0.19	1.91	0.49	0.094
Presence of natural resource specialists in rangeland	0.41	0.20	1.98**	0.53	0.10
Likelihood ratio test=118.681					P-value= 0.00000
Percentage of right predictions=0.76190					Cragg-uhler r-square=0.39681

Significant at the 5% level; ** significant at the 1% level

Using the contingent valuation method (CVM) and a logit regression model, the mean willingness to pay (WTP) for rangeland restoration was estimated at 129,576 IRR. Out of 170 respondents, 146 individuals (85.9%) expressed a positive willingness to pay. The logit model results revealed that six variables had statistically significant effects on WTP. The variables willingness to continue livestock husbandry (elasticity = 0.66), number of livestock (elasticity = 0.71), awareness of rangeland ecosystem services (elasticity = 0.92), and presence of a natural resources expert in the rangeland (elasticity = 0.51) exerted positive and significant effects at the 1% significance level on willingness to pay. In contrast, the bid amount (elasticity = -1.01) and size of the customary rangeland unit (elasticity = -0.48) showed negative and statistically significant effects at the 1% level on WTP.

The estimated elasticities provide critical insights into the sensitivity of pastoralists' financial participation. An elasticity of -1.01 for the proposed bid amount indicates that a 1% increase in the required financial contribution leads to approximately a 1.01% decrease in the probability of a positive WTP, confirming that local participation is

highly sensitive to the cost of the program. For the continuous variables, a 1% increase in the number of livestock owned leads to a 0.71% increase in the probability of participation, reflecting that larger herd owners, who depend more heavily on the rangeland resource, are more willing to invest in its sustainability. Similarly, a 1% increase in the size of the customary rangeland unit decreases the probability of WTP by 0.48%, which may point to free-riding behaviors or perceived governance challenges in larger, more diffuse commons.

For the qualitative indicator variables, the elasticities reflect the percentage change in the probability of a positive WTP resulting from a transition in the respondent's status. Specifically, an elasticity of 0.92 for awareness of ecosystem services implies that transitioning from being unaware to fully aware of these services increases the probability of financial participation by 92%. In the same vein, having a natural resources expert present in the customary unit increases the WTP probability by 51% (elasticity = 0.51), highlighting the role of institutional trust and technical support. Finally, a commitment to continuing livestock husbandry increases the probability of financial contribution by 66% (elasticity = 0.66), demonstrating the strong influence of long-term livelihood dependency on conservation incentives.

The likelihood ratio test statistic was 118.681 (p-value < 0.001), the Cragg–Uhler pseudo R^2 was 0.397, and the prediction accuracy of the model reached 76.2%, indicating a satisfactory model fit and strong predictive capability in explaining pastoralists' willingness to pay. The estimated results of the logit regression model are presented in Table 5.

Moreover, the results indicate that 88.8% of the livestock breeders are aware of the consequences of rangeland degradation, and 70% have participated in extension and training classes conducted by the Natural Resources Departments. Regarding willingness to continue livestock husbandry in the future, 54.1% reported a high willingness and 13.5% reported a very high willingness. Table (6) presents the educational level of the statistical population in the Biarjmand region.

Table 6. Educational level of the statistical population in the studied area of Biarjmand

Level	Education	Frequency	Percentage
1	Illiterate	13	7.6
2	Below diploma	91	53.5
3	Diploma	47	27.6
4	Associate degree	16	9.4
5	Bachelor's degree	2	1.2
6	Master's degree and higher	1	0.6
Total	-	170	100

Finally, the level of willingness to pay (WTP) was calculated using the maximum likelihood method and numerical integration over the interval from zero to 2,000,000 rials (200,000 tomans). Accordingly, the mean willingness to pay for rangeland restoration in the studied area was estimated at 129,576 tomans.

4. Discussion

Rangelands, as one of the main pillars of ecological health and sustainable livelihoods of local communities in arid and semi-arid regions, are of strategic importance—not only as a source of forage production and support for livestock husbandry, but also as active systems for carbon sequestration, erosion control, and biodiversity conservation. In the study area (the Kharturan–Biarjmand rangelands in Shahroud), as observed in many central regions of Iran, increasing pressure from human and livestock populations, together with overgrazing, climate change, and the conversion of natural lands to agricultural or residential uses, has led to widespread rangeland degradation and a decline in their ecological carrying capacity. Under such conditions, unilateral government approaches can no longer provide the basis for restoring the health of these ecosystems. Instead, active, voluntary, and financial participation of local communities is recognized as one of the most effective approaches for rangeland restoration and sustainable management.

The findings of this study, based on the analysis of data from 170 questionnaires and using the Contingent Valuation Method (CVM) and a logit model, indicate that 85.9% of beneficiaries are willing to participate financially in the restoration of their rangelands, and their mean willingness to pay (WTP) is estimated at 1,292,766 rials per month. This figure reflects the fact that local communities have an intrinsic willingness to conserve this natural capital; however, this willingness is accompanied by financial and economic constraints and is transformed into actual participation only when it is designed within a fair, technically sound framework supported by appropriate incentives. Statistical analysis of the factors affecting WTP showed that four key variables willingness to continue livestock husbandry in the future, number of existing livestock, awareness of rangeland ecosystem services, and the presence of a natural resources expert in the rangeland have a positive and statistically significant effect (at the 1% level) on willingness to pay. These findings indicate that local communities perceive rangelands not as a public resource that can be exploited, but as an economic and livelihood foundation for their long-term survival. The greater an individual's economic dependence on livestock husbandry, and the deeper their knowledge of indirect rangeland services (such as medicinal plant cultivation, rainfall harvesting, or forage production through pit-seeding), the higher their willingness to invest in rangeland restoration. These results are consistent with recent global studies; accordingly, Ning et al. (2019) also emphasize the determining role of livelihood dependence and ecological awareness in the WTP of rural communities.

On the other hand, the proposed bid amount and the area of the customary rangeland system had a negative and

statistically significant effect on WTP. This finding conveys two key messages: first, proposing unrealistic payment amounts (even at levels as low as 2 million rials) can suppress willingness to participate; and second, in larger customary systems, the sense of individual ownership decreases, leading to lower investment incentives. This directly supports the theory of commons governance (Ostrom, 1990) and indicates that management units should be designed in a way that strengthens individual responsibility. At the same time, more than 98% of respondents preferred to participate in implementation activities, such as corral construction, pit-seeding, and spring rehabilitation, rather than making cash payments. This reflects the preference of local communities for physical participation, which simultaneously reduces financial costs and strengthens a sense of belonging and ownership. In addition, a considerable readiness for two-sided participation was observed, with 87% expressing high or very high levels of support, indicating that local communities expect the government to act not as a substitute, but as a partner and facilitator, by providing free seeds, low-interest loans, or free labor. This study clearly demonstrates that the sustainability of the Kharturan–Biarjmand rangelands requires a combination of public participation and intelligent government support. Although willingness to participate exists within these communities, it requires capacity building, education, technical guidance, and strengthened economic incentives. Programs designed without considering the socio-economic realities of beneficiaries, such as proposing high payment amounts or ignoring customary structures, are likely to fail, even if they are technically sound.

5. Conclusions

This study investigated the willingness of local pastoral households to financially participate in rangeland restoration and management in the Kharturan–Biarjmand region using a contingent valuation framework and a double-bounded dichotomous choice logit model. The empirical results show that willingness to pay was high, with 85.9% of respondents indicating willingness to contribute financially and 98.8% preferring non-cash participation. These findings suggest that local communities already possess a substantial latent willingness to support rangeland restoration when institutional arrangements are credible, benefits are visible, and participation mechanisms are socially acceptable. The results are consistent with recent international evidence showing that willingness to pay for rangeland restoration is significantly shaped by socioeconomic conditions, farm experience, and ecological context, and that contingent valuation remains a useful tool for quantifying public support for landscape restoration policies (Mapiye et al., 2025).

Beyond the overall level of support, the model results indicate that willingness to participate is not determined solely by income or demographic characteristics, but is strongly influenced by institutional and perceptual variables. In particular, awareness of rangeland management, trust in collective action, and the perceived scale of customary rangeland units were important determinants of participation. The negative effect of larger management areas suggests that as the size of the commons increases, perceived accountability declines and the incentive to contribute weakens. This pattern is consistent with broader literature on ecosystem-service valuation and collective-action institutions, which shows that participation rises when users can clearly observe the link between their contribution and tangible ecological or livelihood outcomes (Karki and Yokota, 2024).

From a practical standpoint, the findings imply that rangeland policy should move beyond generalized top-down prescriptions and toward locally embedded, trust-building interventions. First, restoration programs should be implemented through field-based multidisciplinary teams that remain close to pastoral communities and translate technical recommendations into locally feasible actions. Second, small-scale, short-horizon projects with visible benefits such as pit-seeding, rainfall-harvesting structures, or rapid reseeding interventions can help convert abstract conservation goals into observable improvements and thereby strengthen willingness to cooperate. Third, free or subsidized distribution of rangeland and medicinal plant seeds can lower entry barriers for poorer households and reinforce the perception of fairness in restoration programs. Fourth, management units should be organized at smaller and more coherent spatial scales, because fragmented responsibility in large customary systems weakens accountability and dilutes the incentive to contribute. Finally, community-based organizations, cooperatives, and environmental NGOs can play an important role in coordinating collective labor and reducing implementation costs, especially for activities that require synchronized group action.

The study also has several limitations. First, the analysis is based on stated preferences rather than observed market behavior, so the reported willingness to pay may still be affected by hypothetical bias. Second, the sample is restricted to one rangeland region in northeast Iran, which limits the external validity of the findings across other ecological and institutional settings. Third, the cross-sectional design captures willingness at one point in time and cannot assess how trust, drought experience, policy changes, or repeated exposure to restoration programs might alter preferences over time. Future research should therefore combine contingent valuation with revealed-preference or experimental approaches, expand the analysis to multiple rangeland systems, and examine how institutional design, benefit-sharing rules, and local governance arrangements influence long-term participation.

Overall, this study reinforces the argument that environmental economics and participatory rangeland management should be treated not as abstract academic concepts but as operational tools for policy design. Recent international work on rangeland restoration and ecosystem-service valuation increasingly shows that effective conservation depends on aligning ecological objectives with household incentives, institutional trust, and locally meaningful participation mechanisms. In this sense, the

Kharturan–Biarjmand case illustrates a broader lesson for dryland management: sustainable restoration is most likely to succeed when technical interventions are co-produced with communities and when policy instruments are designed to transform willingness into sustained collective action.

References

Ben-Akiva, M., & Lerman, S. R. (1985). *Discrete choice analysis: Theory and application to travel demand*. MIT Press.

Birol, E., Koundouri, P., & Löschel, A. (2006). Using a choice experiment to account for preference heterogeneity in wetland attributes: The case of Cheimaditida wetland in Greece. *Ecological Economics*, *60*(1), 145–156. https://doi.org/10.1016/j.ecolecon.2006.06.002

Carson, R. T., & Groves, T. (2007). Incentive and informational properties of preference questions. *Environmental and Resource Economics*, *37*, 181–210. https://doi.org/10.1007/s10640-007-9124-5

Ebrahimipour, M. (2001). Human factors affecting forest and rangeland degradation with emphasis on the Zagros region. *Jihad Journal (Rural Development and Agricultural Extension)*, *32*(19), 234–240.

Faircheallaigh, C. (2010). Public participation and environmental impact assessment: Purposes, implications, and lessons for public policy making. *Environmental Impact Assessment Review*, *30*(1), 19–27. https://doi.org/10.1016/j.eiar.2009.05.001

Forests, Rangelands and Watershed Management Organization of Iran. (1997). *Studies and monitoring of rangelands and national lands across the country*. Compiled by the Rangeland Assessment Unit.

Forests, Rangelands and Watershed Management Organization of Iran. (2006). *Collection of laws, regulations, directives, and official correspondence related to rangeland assessment, grazing management, and rangeland management plans*. Compiled by the Rangeland Unit.

General Department of Environmental Protection of Semnan Province. (2026). Turan National Park. https://semnan.doe.ir/portal/home/1005720

General Office of Natural Resources and Watershed Management of Semnan Province. (2008). *Biarjmand watershed studies*. Department of Studies and Planning

Green, W. H., & Hensher, D. A. (2003). *Econometric modeling with discrete choice data*. Edward Elgar Publishing.

Hanemann, W. M. (1984). Welfare evaluations in contingent valuation experiments with discrete responses. *American Journal of Agricultural Economics*, *66*(3), 332–341. https://doi.org/10.2307/1240800

Hanemann, W. M., Loomis, J., & Kanninen, B. (1991). Statistical efficiency of double-bounded dichotomous choice contingent valuation. *American Journal of Agricultural Economics*, *73*(4), 1255–1263. https://doi.org/10.2307/1242453

Heydari, G. (2008). *Factors influencing managers of joint-stock companies across a wide range of insect management programs in Baladeh Noor, Mazandaran Province* [Doctoral dissertation]. Gorgan University of Agricultural Sciences and Natural Resources.

Howarth, R. B., & Farber, S. (2002). Accounting for the value of ecosystem services. *Ecological Economics*, *41*(3), 421–429. https://doi.org/10.1016/S0921-8009(02)00091-5

Jalali, M., & Karami, A. (2006). Determination of factors affecting rangeland users' participation in rangeland cooperatives in Kurdistan Province. *Quarterly Journal of Research and Development*, *19*(1), 35–45.

Jingling, L., Luan, Y., Liyaa, S., Zhiguoa, C., & Baoqiangb, Z. (2010). Public participation in water resources management of Haihe River Basin, China: The analysis and evaluation of status quo. *Procedia Environmental Sciences*, *2*, 1750–1758. https://doi.org/10.1016/j.proenv.2010.10.187

Karki, S., & Yokota, Y. (2024). Farmers' willingness to accept afforestation in farming land and its influencing factors in fragile landscapes based on the contingent valuation method. *Forests*, *15*(10), 1742. https://doi.org/10.3390/f15101742

Khorshidi, M., & Ansari, N. (2003). Assesment of tribes and rurals knowledge about natural resources degradation in Bazoft region, Charmahal and Bakhtiari province. *Iranian Journal of Range and Desert Research*, *10*(1), 95–110. https://doi.org/10.22092/ijrdr.2019.119698

Lee, C., & Han, S. (2002). Estimating the use and preservation values of national parks tourism resources using a contingent valuation method. *Tourism Management*, *23*, 531-540. https://doi.org/10.1016/s0261-5177(02)00010-9

Lien, A. M., Fletcher, A., Lin, A., Mackey, E., Cousins, K., Metz, L. J., & Houdeshell, C. (2024). Developing a valuation framework for rangeland conservation investment and ecosystem services. *The Journal of Soil and Water Conservation*, *80*(1), 35-52. https://doi.org/10.1080/00224561.2024.2433924

Mapiye, O., Makombe, G., Molotsi, A., & Dzama, K. (2025). Prospects and determinants of willingness to pay for sustainable restoration of rangelands among smallholder cattle producers in North West Province, South Africa. *Environmental Management*. *76*(2), 49. https://doi.org/10.21203/rs.3.rs-7263439/v2

Ning, J., Jianjun, J., Kuang, F., Wan, X., Zhang, Ch., &Gian, T. (2019). The Valuation of Grassland Ecosystem Services in Inner Mongolia of China and Its Spatial Differences. *Sustainability*, *11*(24), 7117. http://dx.doi.org/10.3390/su11247117

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press. https://doi.org/10.1017/cbo9780511807763

Semnan Provincial Office of Nomadic Affairs. (2008). Sangsari Tribe of Iran.

Whittington, D. (1998). Administering contingent

valuation surveys in developing countries. *World Development*, *26*(1), 21–30. https://doi.org/10.1016/s0305-750X(97)00125-3

Zare Chahouki, M. A. (2010). Data Analysis in Natural Resources Research Using SPSS Software. Jihad-e Daneshgahi, Tehran Branch, Publications