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Construction and Influencing Factors of Voluntary Compensation Subjects for Herders—From the Perspective of Sustainable Utilization of Grassland Resources

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Abstract: The grassland ecological compensation mechanism is a basic guarantee for promoting the sustainable utilization of grassland resources, and the reasonable determination of the compensation subject is the basic premise for the effective operation of the grassland ecological compensation mechanism. At present, grassland ecological compensation is mainly based on government compensation, and the compensation method generally adopted is financial transfer payment with a single source of compensation funds. Therefore, establishing diversified compensation entities is of great significance in expanding the sources of compensation funds. As important users of grassland resources, herders should become the main representatives of grassland ecological compensation according to the principle of "whoever uses, pays". In this study, based on survey data with respect to pastoral areas in Inner Mongolia, we used a multivariate ordered logistic regression model to empirically analyze the factors influencing the establishment of a voluntary compensation entity for herders. The results of this study showed that (1) the resource endowment factors of the respondents, including livestock inventory, grazing area, and cutting grassland area, have a significant positive impact on the willingness of herdsmen to voluntarily serve as the main representatives of grassland ecological compensation. When each influencing factor increased by one unit, the probability of voluntarily becoming a compensation subject increased by 3.5%, 1.91%, and 1.41%, respectively. (2) The factor of prohibited pasture area in the endowment of herders had a significant negative effect on their willingness to become compensation subjects, which indicates that the larger the prohibited pasture area owned by herders, the lower their grassland utilization rate and the lower their willingness to voluntarily become compensation subjects. (3) Among the cognitive factors of the respondents, "whether they will continue to support the implementation of the grassland compensation policy" had a positive promoting effect on herdsmen voluntarily becoming compensation subjects, showing that the higher the support of herdsmen for the ecological compensation system, the more willing they were to become compensation subjects. This article is based on the perspective of the sustainable utilization of grassland resources and empirically analyzes the influencing factors of herders' willingness to reduce their number of livestock. Through the voluntary reduction of livestock by herders, a voluntary compensation entity for herders is constructed. Based on the research conclusions, relevant countermeasures and suggestions are proposed, providing a reference for improving grassland ecological compensation policies and promoting the sustainable utilization of grassland resources.

Keywords: grassland management; grassland ecological compensation; compensation subject; sustainable use

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1. Introduction

As the largest managed terrestrial ecosystem on Earth, grasslands provide ecological services that have the characteristics of public or merit goods, and it is generally difficult to measure their intrinsic value through market mechanisms [1]. Ecological compensation is an important environmental and economic policy for the protection of natural resources

and the ecological environment, the construction of an ecological civilization, and the sustainable utilization of natural resources [2,3]. China has 392.8 million hectares of natural grassland, accounting for approximately 12% of the global grassland area and ranking first in the world [4]. In order to protect the grassland's ecological environment and achieve sustainable utilization of grassland resources, China has initially established a grassland ecological compensation mechanism. The Fifth Plenary Session of the 19th Central Committee of the Communist Party of China proposed adhering to the improvement of the ecological civilization system and enhancing the effectiveness of ecological environment governance. Ecological civilization refers to the total sum of the material and spiritual achievements that humans have achieved by following the objective law of harmonious development between humans, nature, and society. It refers to the cultural and ethical form with the basic purpose of harmonious coexistence, a virtuous cycle, comprehensive development, and sustained prosperity between humans and nature and between humans and society [5]. The grassland ecosystem, as an important ecological barrier in China, plays a fundamental and strategic role in maintaining national ecological security, promoting sustainable economic and social development, and increasing income for farmers and herders [6]. With the continuous development and utilization of grasslands, the problem of the "three modernizations" of grasslands is becoming increasingly severe. In order to better protect grassland resources, the central government established a comprehensive grassland ecological protection subsidy and reward mechanism (hereinafter referred to as the grassland ecological compensation policy) in 13 major grassland pastoral provinces or regions and the Xinjiang Production and Construction Corps beginning in 2011. This policy is also the most important grassland ecological compensation mechanism in China [7]. The purpose of implementing the grassland ecological compensation policy is to distribute compensation funds to herders, encourage them to reduce the number of livestock, achieve a balance between grassland and livestock, and achieve sustainable use of grassland resources. Since the implementation of the grassland ecological compensation policy, many scholars have conducted studies on mitigating grassland degradation, factors affecting livestock reduction by herders, and other aspects [8–10]. Most of these studies have been conducted on the basis of compensation standards, compensation methods, and other aspects. Government compensation remains the primary subject in research on compensation subjects [11–14], which can be expanded to include enterprises, residents in beneficiary areas, and grassland ecological protection organizations [15]. In December 2018, the National Development and Reform Commission and other departments released the "Action Plan for Establishing a Marketable and Diversified Ecological Protection Compensation Mechanism", which for the first time systematically proposed the establishment of a policy framework for market-oriented and diversified ecological compensation mechanisms, providing policy guidance for the subsequent development and improvement of ecological compensation in China.

The international concept of ecological compensation is PES (Payments for Environmental Services), which follows the principle of "beneficiary pays" [16,17]. The earliest and most influential definition of PES was proposed by the scholar Wunder from the International Forestry Research Center. He believed that so-called ecological compensation is a voluntary transaction between environmental service buyers and service providers to buy and sell ecological environmental services [18]. Under the PES system, the principle of beneficiary payment is followed. For grassland ecological compensation, herders have dual subjectivity, in which they can either become the compensation subject or the compensated subject, as shown in Figure 1. On the one hand, herdsmen should make reasonable use of grassland resources, strictly abide by the grass animal balance system and grazing prohibition system, and achieve sustainable utilization of grassland resources. At this time, herdsmen are the protectors of the grassland's ecological environment and should be compensated. On the other hand, as users of grassland resources, herders utilize grassland ecological services and are the direct beneficiaries of a good grassland ecological environment. In this case, they should provide compensation. According to the principles

of "whoever damages, pays" and "whoever benefits, pays", herders who overgraze should pay for damaging the environment, while herders who use the grasslands responsibly should be paid for their contribution to grasslands conservation. [19,20]. According to the principle of "whoever protects, benefits", herders reduce the number of livestock raised to protect grassland resources, which incurs a certain opportunity cost. Therefore, they should be compensated. At present, as the main body of grassland ecological compensation, the government provides grassland subsidies based on the area of grasslands, regardless of whether herdsmen comply with institutional requirements when distributing compensation funds. Over time, this will lead to insignificant policy effects, and participants will be prone to the free-rider phenomenon [21–23]. This means that herders can obtain grassland ecological compensation funds without paying any costs or taking any action to protect grasslands. In the context of the PES, the government should provide more compensation funds to herders who protect grasslands. For herders who do not comply with grassland utilization rules or damage the grassland ecological environment, their compensation should be reduced or they should be required to provide compensation. This can have a good motivating effect on herders. Effectively identifying the subjectivity of herders in grassland ecological compensation is the key to improving compensation efficiency. Previous studies have shown that overgrazing is the main cause of grassland degradation [24]. If herders are willing to actively reduce livestock and sacrifice their self-interest to protect the grassland ecological environment, they become the main representatives of grassland ecological compensation; reaching a consensus between their ecological and policy goals can effectively suppress the irrational behavior of herdsmen who pursue short-term benefits and excessively consume grassland resources [25,26].

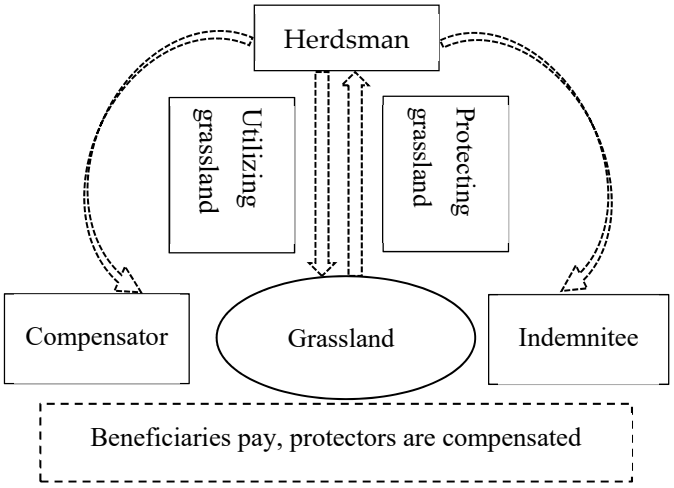

Figure 1. Construction diagram of voluntary compensation subjects for herdsmen.

In summary, the basic principle of ecological compensation is the "beneficiary pays principle". However, in the grassland ecological compensation mechanism currently implemented in China, herders are only regarded as compensated subjects and receive government compensation funds. In this article, we take the special subject nature of herdsmen as the research entry point, and we theoretically define the dual subject identity of herdsmen in the utilization of grassland resources. This definition enables herdsmen to transform from initial beneficiaries to compensators in the grassland ecological compensation mechanism. As the closest users and protectors of grassland resources, herdsmen voluntarily reduce their number of livestock and strictly implement the grass livestock balance system, which is an important path for promoting the sustainable utilization of grassland resources. Based on this, we use field survey data from Inner Mongolia pastoral areas and establish a multivariate ordered logistic model to empirically analyze the influencing factors of herdsmen voluntarily reducing livestock as compensation subjects. Based on the research results, relevant countermeasures and suggestions are proposed in order

to provide a reference for protecting grassland resources, coordinating the harmonious development of pastoral production, life, and ecology, and helping pastoral revitalization and modernization.

2. Materials and Methods

2.1. Data Sources and Sample Characteristics

2.1.1. Data Sources

The Inner Mongolia Autonomous Region is located on the northern border of China, with a total grassland area of 1.138 billion acres, accounting for approximately 22% of the total grassland area in the country. Its grassland types are diverse, including meadow, typical, and desertified grasslands. The data used in this article were collected from a field survey conducted by a research team from July to August 2021 on the basic situation of different pastoral areas in 2020. The team used a combination of random sampling and typical sampling methods to collect 406 survey questionnaires from 3 league cities, 6 pure husbandry banners, and 14 Sumu (towns) in Hulunbuir City, Chifeng City, and Xilingol League of the Inner Mongolia Autonomous Region. To ensure the validity of the data, we excluded questionnaires with missing core data and abnormal variables and ultimately obtained 380 valid questionnaires. Among them, 144 questionnaires were distributed to Xin Barag Zuoqi and Chen Barag Qi in Hulunbuir City, with 133 valid questionnaires remaining. A total of 120 questionnaires were distributed to Balin Right Banner and Hexigten Qi in Chifeng City, and 110 valid samples were obtained. A total of 142 questionnaires were distributed to Abaga Banner and Sunit Right Banner in the Xilingol League, with 137 valid samples remaining. The overall effective rate of the samples was 93.60%. The survey of herders adopted a semi-structured questionnaire design, which included the following main contents: (1) basic information about herders, including the respondent's age, sex, education years, number of family labor workers, and the distance from the nearest market to the family; (2) basic information about grasslands, including the area of cutting grasslands, the area of grazing grasslands, and the area of prohibited grazing grasslands; (3) livestock breeding structure, including the breeding situation of major livestock such as cattle and sheep; (4) selection of income from animal husbandry and sales methods of livestock products; (5) subsidy income and part-time income, including grassland and livestock balance subsidies, grazing prohibition subsidies, and income from part-time employment; (6) subjective feelings and breeding decisions of herders toward the grassland ecological compensation policy. The sample distribution of pastoral households is presented in Table 1.

Table 1. Sample distribution in the survey area.

Research Area	Research City	Research Banner County	Sample Quantity	Proportion (%)
Inner Mongolia Autonomous Region	Hulunbuir City	Xin Barag Left Banner	77	20.3
		Chenbarhu banner	56	14.7
	Chifeng City	Bairin West Banner	52	13.7
		Hexigten Banner	58	15.3
	Xilin Gol League	Abaga Banner	72	18.9
		Sonid Right Banner	65	17.1
Total	-		380	100

2.1.2. Sample Characteristics

By organizing and analyzing the samples, the basic characteristics of the herders in the survey area were established, as shown in Table 2. Among the surveyed herders, the proportion of male herders was high, accounting for 71.58% of the total sample. This indicates that animal husbandry management in grassland pastoral areas is dominated by men. Furthermore, during the survey process, it was found that male practitioners had a better understanding of their animal husbandry production-related situation than female

practitioners. From the age structure of herders, the majority of the surveyed herders were over 50 years old, accounting for 42.37%. Furthermore, 29.47% of herders were between the ages of 41 and 50, and 24.74% were between the ages of 30 and 40. The number of herders under the age of 30 was minute, accounting for only 2.63%, indicating that the age of practitioners in pastoral areas was generally high. In terms of cultural level, the majority of the surveyed herders had a junior high school education level, accounting for 53.42%, followed by primary school and below, accounting for 25%. However, only 6.58% of the herders had a college or above education level, indicating that the education level of herders in the survey area was generally low.

Table 2. Basic characteristics of the sample.

Basic Feature	Category	Sample Size	Proportion (%)
Sex	Male	272	71.58
	female	108	28.42
Age	≤30	10	2.63
	30–40	97	24.74
	41–50	112	29.47
	>50	161	42.37
Education level	Primary school and below	95	25.00
	Junior high school	203	53.42
	High school/technical secondary school	57	15.00
	College degree or above	25	6.58

2.2. Research Methodology

To better reflect the behavior and attitude of herdsmen in actively reducing their number of livestock, a discrete dataset based mainly on classified data was formed by assigning values to their willingness to reduce their number of livestock. Generally, when analyzing the selection of discrete problems, probability models were used for estimation. In this study, due to the satisfaction assignment being greater than two categories, a multivariate ordered logistic model was chosen for estimation [27]. A multivariate ordered logistic model can be used to explain and predict the relationship between multiple ordered classification variables and to compare these variables. The calculation formula for this model in this article was as follows:

For the multivariate ordered logistic model, where the model equation was $y^* = X^T * \beta + \varepsilon$ (y^* is an unobservable value), the possible choices for the model were as follows:

$$Y = \begin{cases} 1, \text{if} & y^* \le \gamma_0 \\ 2, \text{if} & \gamma_0 < y^* \le \gamma_1 \\ 3, \text{if} & y^* > \gamma_1 \end{cases}$$

where $\gamma_0 < \gamma_1$ is the parameter to be estimated, and Y is the tangent point of the value. When the Y value is equal to 1, this indicates that the herdsmen are unwilling to reduce their number of livestock. When the Y value is equal to 2, this indicates that the herdsmen are generally willing to reduce their number of livestock. When the Y value is equal to 3, this indicates that the herdsmen are willing to actively reduce their number of livestock. $X^{\mathrm{T}} = (x_1, x_2, \ldots, x_{\mathrm{m}})$ is a matrix of independent variable X, where $n = 13$. Based on this, we established a cumulative probability model as follows:

$$logit(P_j) = ln\left[\frac{P_j}{1 - P_j}\right] = \alpha + \sum_{i=1}^{n} \beta_i X_i + \varepsilon \quad (1)$$

$$P(Y = j|X_i) = \frac{e^{-(\alpha_j + \beta X_i)}}{1 + e^{-(\alpha_i + \beta X_i)}} (j = 1, 2, 3) \quad (2)$$

where P_j is the probability of i-herdsmen subjectively choosing to reduce their number of livestock, α is the constant term of the estimation equation, β_i is the regression coefficient of the independent variable X_i, ε is the random perturbation term, and n is the number of independent variables X. We used Stata15.0 software for multivariate ordered logit regression to analyze the influencing factors of the willingness of herders to voluntarily serve as the main representatives of grassland ecological compensation.

2.3. Variable Definitions

2.3.1. Dependent Variable

At present, overgrazing is still the direct cause of grassland degradation and ecological deterioration [24]. Compared with traditional compensation subjects, as close users of grassland resources, herders are able to strictly implement the grass–livestock balance system, voluntarily reduce the number of breeding livestock, and adjust the animal husbandry mode, which is the main way for herders to protect grassland resources. Therefore, herdsmen cannot be required to provide compensation funds as compensation subjects. The government should actively urge herdsmen to voluntarily reduce the number of live animals and alleviate the pressure on grassland carrying capacity. Reducing the opportunity cost of livestock is the performance of the funds provided by herdsmen as compensation subjects. When conducting field research, as herdsmen may not have a good understanding of the meaning of the compensation subject, if the investigator directly asks whether they are willing to become grassland ecological compensation subjects, the answer obtained will be inconsistent with the true intention of the herdsmen. Therefore, we measured the willingness of herdsmen to become compensation subjects by asking if they were willing to actively reduce the number of livestock and protect grassland resources. According to the research data (Table 3), 31.58% of herdsmen expressed a willingness to reduce their number of livestock and protect grassland resources, while 33.68% of herdsmen expressed that reducing their number of livestock would reduce their livestock income and were unwilling to actively reduce the size of their herd. A total of 34.74% of herdsmen had an average willingness to reduce their number of livestock and would choose to reduce the size of their herd in a timely manner based on relevant policies and the environment. Overall, the average willingness of respondents to reduce their number of livestock was 1.98, indicating that they would not actively reduce the size of their herd and would adjust the quantity of livestock based on the ecological environment of the grassland and the relevant institutional requirements.

Table 3. Dependent variable descriptive statistics.

Dependent Variable	Design of Questionnaire	Variable Assignment	Sample Quantity	Proportion (%)	Average Value	Standard Deviation
Are herders willing to serve as the main representatives of grassland ecological compensation? (DA)	Are you willing to protect the grassland ecological environment and voluntarily reduce the number of livestock?	Unwilling = 1	128	33.68	1.98	0.81
		Generally = 2	132	34.74		
		Willing = 3	120	31.58		
Total			380	100		

2.3.2. Independent Variables

Based on existing research, we combined the current development status of regional animal husbandry and the management methods of herdsmen to select four dimensions (individual characteristics, family characteristics, livestock management characteristics, and behavioral attitudes) to measure the influencing factors of herders' willingness to reduce their number of livestock [28–30]. The descriptive statistics of each indicator are shown in Table 4.

Table 4. Variable description and descriptive statistical analysis.

Variable	Meaning and Assignment of Variables	Average Value	Standard Deviation	Maximum	Minimum
Sex	Male = 1, female = 0	0.72	0.45	1	0
Age	The actual age of the surveyed herders/year	47.90	10.57	77	21
Education level (Edu)	Number of years of education received by the surveyed herders/year	8.61	2.77	16	2
Number of household labor workers (Lab)	Number of households that can engage in labor production or work/person	2.14	0.72	5	1
Household income (Inc)	ln(Income)	11.99	1.14	14.51	6.21
The distance between the family and the nearest market (Dis)	Distance/km	67.59	71.47	320	0.5
Whether or not they have part-time income (Par)	Sources of income other than livestock production/yuan, yes = 1, no = 0	0.23	0.42	1	0
Number of livestock (Anm)	ln(Number of livestock raised by households)	5.68	1.10	7.60	0
Cutting grassland area (Dcc)	ln(The area of pasture owned by herders)	6.12	3.32	9.9	0
Grazing pasture area (Fmc)	ln(The area of clipping pasture owned by herders)	3.43	3.48	8.89	0
Prohibited pasture area (Jmc)	ln(The area of prohibited pasture owned by herders)	0.51	1.72	8.59	0
Will we continue to support the implementation of the compensation mechanism (Zcjz)	yes = 1, uncertain = 2, no = 3	2.64	0.66	3	1
Does the ecological environment of the grassland need to be improved? (Hjgs)	no = 1, Generally = 2, yes = 3	2.36	0.71	3	1

In terms of individual characteristics, we selected sex, age, and years of education to reflect the individual characteristics of herdsmen. According to Table 4, the respondents were mainly male, with an average age of about 48 years old, and the education level of herdsmen was generally only junior high school. This also reflects the gradual aging of the labor force in grassland pastoral areas and the generally low level of education.

In terms of family characteristics, we selected the number of household laborers, household income, distance from the nearest market, and whether they had part-time income to reflect the family characteristics of herdsmen. The average number of laborers in the surveyed herdsmen's households was about 2, and the average distance between the households and the nearest market was 67.59 km. This indicates that herdsmen are generally remote from the market, and the cost of purchasing production and living materials is relatively high. According to the income structure of herdsmen, the average value of whether the respondents had part-time income was only 0.23, indicating that most herdsmen do not have part-time income and that their main source of income is animal husbandry production.

In terms of the characteristics of animal husbandry management, we selected the number of livestock, cutting grassland area, grazing area, and prohibited grazing area to reflect the characteristics of pastoral animal husbandry management. According to the research data, the average number of livestock raised by herdsmen was 413 sheep

units. The number of livestock was uniformly converted according to sheep units, and the conversion standard was as follows: 2 young animals = 1 adult animal, 1 sheep = 1 sheep unit, 1 cow = 5 sheep units, and 1 horse = 6 sheep units [29]. According to the mean and standard deviation of the areas of cutting grassland, grazing, and prohibited pastures in the table, the resource endowments possessed by herdsmen varied greatly, which led to significant differences in their animal husbandry management methods and livestock breeding costs, directly resulting in differences in the utilization of grassland resources.

In terms of the subjective cognition and willingness of herdsmen, we selected whether herders would continue to support the implementation of the compensation mechanism and whether the ecological environment of grassland needs to be improved to reflect their subjective feelings about the grassland ecological compensation policy and their cognition of the ecological environment. According to the research data, 49.74% of herders believed that the ecological environment of their own grasslands urgently needed improvement, while only 13.95% of herders believed that the quality of their grasslands was good and did not need improvement. Based on the interviews, herdsmen had a high willingness to protect grasslands, with a proportion of 74.47% continuing to support the grassland ecological compensation policy.

To eliminate the difference in range among the indicators in the model, we performed logarithmic processing of five indicators (family income, number of livestock, cutting grassland area, grazing area, and prohibited grazing area), which made the research data more stable and effectively weakened the heteroscedasticity in the model, ensuring the effectiveness of the model results.

3. Results

3.1. Model Estimation Results

We established a multivariate ordered logistic model to analyze the influencing factors of herdsmen's willingness to voluntarily serve as the main representatives of grassland ecological compensation. We also constructed an OLS model to verify the effectiveness of the coefficients of each variable in the model. The model results are shown in Table 5. The coefficient direction of the independent variable in the OLS model regression results was consistent with the regression coefficient direction of the logistic model, which further verified the effectiveness of the positive and negative effects of each variable in the logistic model on the dependent variable. In addition, the overall *p*-value of the model was 0.003, which was less than 1%, indicating that the model passed the validity test as a whole.

Table 5. Regression results and analysis of influencing factors.

Variable	Multivariate Ordered Logit Model		OLS Model	
	Regression Coefficient	***p*-Value**	**Regression Coefficient**	***p*-Value**
Sex	−0.2734	0.204	−0.1226	0.174
Age	−0.0019	0.854	−0.0017	0.686
Edu	−0.0082	0.823	−0.0039	0.802
Lab	−0.0179	0.891	−0.0062	0.910
Inc	−0.0595	0.630	−0.0265	0.578
Dis	−0.0011	0.386	−0.0053	0.348
Par	0.1728	0.509	0.0693	0.510
Anm	0.1699 *	0.093	0.0752 *	0.064
Fmc	0.0926 **	0.022	0.0360 **	0.021
Dcc	0.0685 **	0.049	0.0280 **	0.044
Jmc	−0.1175 **	0.032	−0.0529 **	0.017
Zcjz	0.4302 ***	0.002	0.1857 ***	0.002
Hjgs	0.0749	0.570	0.0351	0.520
N	380		380	
p-Value	0.0030		0.0004	

Note: *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

According to the model results, the impact of various dimensional indicators on whether herdsmen would voluntarily become compensation subjects was as follows:

3.1.1. Impact of Individual Characteristics

The individual characteristic indicators of sex, age, and years of education of herders did not pass the significance test, and the individual characteristics of herders in the study area would not have a decisive effect on whether they would voluntarily serve as the main representatives of grassland ecological compensation.

3.1.2. Impact of Family Characteristics

The household characteristic indicators of the number of labor workers, household income, distance from the nearest market, and whether there was part-time income among herders did not pass the significance test, and the family characteristics of herders in the study area would not have a decisive effect on whether they would voluntarily serve as the main representatives of grassland ecological compensation.

3.1.3. Impact of Animal Husbandry Management Characteristics

The four selected characteristic indicators of animal husbandry management passed significance tests at different levels. The number of livestock, cutting grassland area, and grazing pasture area had a positive impact on the willingness of herders to voluntarily serve as the main representatives of grassland ecological compensation at statistical levels of 10% and 5%; the regression coefficients were 0.1699, 0.0926, and 0.0685, respectively. This indicates that the larger the cutting grassland and grazing areas owned by herdsmen, the higher the utilization of grassland resources. Sufficient grass provided by natural grasslands can effectively reduce the operating costs of herdsmen. Therefore, herders were more willing to reduce their number of livestock to achieve a balance between grass and livestock, make reasonable use of grassland resources, protect the grassland ecological environment, and reduce the operating costs of animal husbandry. The area of prohibited pastures had a negative impact on the willingness of herders to voluntarily serve as the main representatives of grassland ecological compensation at a statistical level of 5%, with a regression coefficient of -0.1175. was is due to the fact that the more prohibited pastures herdsmen had, the lower their dependence on grasslands would be. Reducing the number of livestock will reduce the corresponding livestock income, leading to negative and resistant attitudes. Therefore, herdsmen were unwilling to reduce their already limited livestock numbers to protect grasslands.

3.1.4. Impact of Behavioral Attitudes

In terms of personal cognition and willingness, whether herdsmen would continue to support the implementation of grassland ecological compensation policies passed a significance test at the 1% level, with a regression coefficient of 0.4302. This indicates that this factor has a positive impact on herdsmen voluntarily serving as the main representatives of grassland ecological compensation. The more herdsmen that support the implementation of grassland ecological compensation policies, the more they realize the importance of protecting the grassland ecological environment and the more willing they are to contribute to the effective improvement of the grassland ecological environment by reducing the number of livestock.

3.2. Marginal Effect Analysis of Model Results

According to the results of the above model, it can be concluded that five factors, i.e., the number of livestock, the area of cutting grassland, the area of grazing pasture, the area of grazing prohibition, and whether herdsmen will continue to support the implementation of grassland ecological compensation policies, can have a significant impact on herdsmen voluntarily becoming compensation subjects. In the multivariate ordered logistic model, as the coefficient term can only explain the significance and direction of the action of the

explanatory variable, its actual economic significance is not obvious. To determine the degree of influence of each explanatory variable on the dependent variable, we calculated the marginal utility of each variable, as listed in Table 6.

Table 6. Marginal effect analysis of regression results.

Variable	Regression Coefficient	Marginal Effect		
		Unwilling	Generally	Willing
Sex	−0.2734	0.0570	−0.0007	−0.0563
Age	−0.0019	0.0004	−0.0000	−0.0004
Edu	−0.0082	0.0017	−0.0000	−0.0017
Lab	−0.0179	0.0037	−0.0000	−0.0037
Inc	−0.0595	0.0124	−0.0002	−0.0123
Dis	−0.0011	0.0002	−0.0000	−0.0002
Par	0.1728	−0.0360	0.0004	0.0356
Anm	0.1699 *	−0.0354 *	0.0004	0.0350 *
Fmc	0.0926 **	−0.0193 **	0.0002	0.0191 **
Dcc	0.0685 **	−0.0143 **	0.0002	0.0141 **
Jmc	−0.1175 **	0.0245 **	−0.0003	−0.0242 **
Zcjz	0.4302 ***	−0.0897 ***	0.0011	0.0886 ***
Hjgs	0.0749	−0.0156	0.0002	0.0154

Note: *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

When investigating the impact of marginal utility, we analyzed indicators that had a significant impact. For every unit increase in the number of livestock owned by herdsmen, their willingness to actively reduce their number of livestock and become the main representatives of grassland ecological compensation increased by 3.50%. This also indicates that livestock farmers with large herds are more receptive to reducing their number of livestock compared to farmers with small- and medium-sized herds, allowing their own grasslands to rest and sustain long-term use. For every unit increase in grazing area and cutting grassland area, the probability of herdsmen being willing to become the main representatives of grassland ecological compensation increased by 1.91% and 1.41%, respectively. This also reflects that herdsmen with more grasslands are more willing to actively protect grassland resources and improve the carrying capacity of their own grasslands. When the area of prohibited pastures increased by one unit, the probability of herdsmen being unwilling to become the main representatives of grassland ecological compensation increased by 2.42%. Due to the implementation of a year-round grazing ban in the grazing area, the dependence of herdsmen on grasslands is relatively low, and animal husbandry is mainly focused on captive breeding. Reducing the number of livestock will directly lead to a decrease in animal husbandry income. The willingness of herdsmen to support the grassland ecological compensation policy increased by 1%, which increased the probability of them being willing to be the main representatives of grassland ecological compensation by 8.86%. This also indicates that herdsmen who are willing to support this policy have a clearer understanding of the content of the policy, and implementing a subsidy policy can effectively protect grassland resources. Therefore, individuals were willing to protect their own grasslands.

Through the analysis of marginal benefits, it can be concluded that the intensity of the willingness of herders to reduce the number of livestock is sequentially influenced by their support for the grassland subsidy policy, the number of livestock, the area of prohibited pastures, the area of grazing areas, and the area of cutting grassland.

4. Discussion

The ecological compensation mechanism of grasslands includes five elements: compensation subject, compensation standard, compensation object, compensation method, and institutional guarantee. In grassland ecological compensation, the compensation subject is an important source of compensation funds [13]. In practice, grassland ecological com-

pensation mainly consists of two subjects: the compensating subject and the compensated subject. Previous studies have suggested that under the grassland ecological compensation mechanism, herders may incur certain opportunity costs due to strict implementation of grazing bans and animal balance policies, and should therefore be compensated [31–33]. The principle of ecological compensation is to determine the subject of compensation according to "who destroys, pays; who benefits, pays; and who protects, benefits" [34,35]. As practitioners of grassland livestock production, herders are the direct beneficiaries of the grassland ecological environment, and they should become compensation subjects providing funds. However, in practice, herders are the closest protectors of the grassland ecological environment by reducing the number of livestock needed to protect the grassland ecosystem. At this time, they should be compensated and receive compensation funds. Thus, herders play a dual role in grassland ecological compensation. This result is consistent with the viewpoint of Qing Yang that herders are the main participants in the grassland's ecological compensation and reward policy, and their behavioral response largely affects the effect of policy implementation [23]. Therefore, based on the dual identity of herdsmen in grassland resources, analyzing the influencing factors of their voluntary participation as compensation subjects is of great significance for protecting the grassland ecological environment and achieving the sustainable utilization of grassland resources.

Gong Fang proposed that herdsmen are the fourth and final level of compensation subjects in constructing a four-element compensation subject, but her research did not indicate how to compel herdsmen to voluntarily provide compensation [15]. This study suggests that, as they are the subjects of compensation, the way in which herders can provide ecological compensation funds cannot be in the form of direct payment; otherwise, this will discourage their enthusiasm for the grassland ecological compensation policy and generate negative emotions. At present, the phenomenon of overgrazing in grassland pastoral areas is still very serious, and the opportunity cost generated by herdsmen voluntarily reducing their number of livestock is the compensation fund they provide [24]. Through econometric analysis, we can safely conclude that the factors that affect the willingness of herdsmen to reduce their number of livestock include the number of livestock, the area of cutting grassland, the area of grazing land, the area of grazing prohibition, and whether they will continue to support the implementation of grassland ecological compensation policies. The so-called reduction in livestock numbers without a reduction in income refers to the fact that although herdsmen reduce the number of livestock, the quality of livestock will correspondingly increase due to the improvement of grassland quality, and the income due to animal husbandry will also significantly increase [36]. The research objective of this article is to increase the willingness of herdsmen to reduce their number of livestock and improve the ecological environment of grasslands without harming their interests. In the study of livestock reduction willingness, some scholars have observed, from a macro-perspective, that adjusting compensation methods, increasing compensation standards, and strengthening supervision can increase the willingness of herdsmen to reduce their number of livestock [37–39]. This article is based on the micro-perspective of herdsmen and has presented a path of voluntary compensation for herdsmen as the main representatives. A reduction in livestock numbers will inevitably increase the opportunity costs for herders, such as idle labor costs and reduced livestock income. If herdsmen are willing to reduce their number of livestock for free, the essence of the method is to use the lost opportunity cost of animal husbandry production to subsidize the restoration cost of the grassland ecological environment. At this point, herdsmen, as compensation subjects, compensate for themselves and achieve conscious compensation. However, in the long run, the grassland environment is in a virtuous cycle, with a significant increase in the number and quality of livestock that can be carried, achieving the dual goals of ecological beauty and industrial prosperity in grassland pastoral areas. Therefore, assessing whether herders have accomplished the livestock reduction target and achieved the grass–livestock balance is key to protecting the grassland ecological environment.

5. Conclusions and Recommendations

5.1. Conclusions

With a view toward designing an improved grassland ecological voluntary compensation scheme to promote the protection of grassland resources, this article researched the factors influencing the stated willingness of herders to accept payment for complying with limits on grazing. The research conclusions are as follows:

(1) The resource endowment factors of the respondents, including livestock inventory, grazing area, and cutting grassland area, had a significant positive impact on the willingness of herdsmen to voluntarily serve as the main representatives of grassland ecological compensation. When each influencing factor increased by one unit, the probability of voluntarily becoming a compensation subject increased by 3.5%, 1.91%, and 1.41%, respectively. The area of prohibited pastures had a negative impact on the willingness of herders to voluntarily serve as the main representatives of grassland ecological compensation. When the area of prohibited pastures increased by one unit, the probability of herdsmen being unwilling to become the main representatives of grassland ecological compensation increased by 2.42%.

(2) In terms of personal cognition and willingness, whether herders would continue to support the implementation of grassland ecological compensation policies had a positive impact on their voluntary participation as compensation subjects. The willingness of herdsmen to support the grassland ecological compensation policy increased by 1%, which increased the probability of being willing to be the main representatives of grassland ecological compensation by 8.86%.

5.2. Recommendations

Here, we propose relevant countermeasures and suggestions based on the conclusions drawn. First, it should be possible to increase the publicity of the grassland ecological compensation policy and to call on herders to enhance their awareness of environmental protection and change from passive protection of the grassland ecological environment to active protection. Second, we should dynamically adjust the method of pasture utilization of herdsman according to the degree of recovery of their pasture, and we should adjust the method of pasture utilization, which can effectively improve the quality of livestock breeding and enable sufficient rest and recuperation of the pasture. Third, we should increase technical training to improve the quality of livestock without increasing the quantity of livestock breeding to achieve scientific livestock reduction and ensure the sustainable improvement of herders' livestock income.

Based on the previous analysis, we found the factors affecting herders' willingness to reduce the number of livestock and "prescribe the right medicine" to construct relevant path options to determine the hindering factors of herders' livestock reduction from the root. The main forms of grassland ecological compensation should be diversified. In addition to the current governments at all levels, the main representatives of grassland ecological compensation should also be absorbed by the direct beneficiaries of the grassland ecological environment, including herdsmen. As a result, we can gradually achieve a transition from government-led to conscious compensation, give full play to the special role of herdsmen as the main representatives, and achieve the dual goals of sustainable ecological revitalization in grassland pastoral areas and scientific revitalization in the animal husbandry industry.

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