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Comparison Between the Sustainably- and Unsustainably-Managed Pastures: The Case of Urad-Middle Banner in Inner Mongolia, China

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Abstract

In order to compare the herd size, income level, and the vegetation in the sustainably-managed grazing pasture with unsustainably-managed grazing pasture, this study selected the two pastures that receive heavy-load of camel population and other two pastures receiving light-load of camel herds. In desert having xerophyite *Zygophyllum xanthoxylum*, the pastures were classified into unsustainably-managed herdsman pasture (UHPZ) and sustainably-managed herdsman pasture (SHPZ). In addition, pastures were ccategorized into unsustainably-managed herdsman pasture (UHPK) and sustainably-managed herdsman pasture (SHPK) in deserts dominated by *Krascheninnikovia ceratoides*. The vegetation volume of *Zygophyllum xanthoxylum* at SHPZ, UHPZ and the gravelization sample at UHPZ is 1560 cm^3, 480 cm^3 and 4 cm^3, respectively. On the other hand, the vegetation volume of *Krascheninnikovia ceratoides* at SHPK, UHPK and the gravelization sample at UHPK is 840 cm^3, 510 cm^3 and 8 cm^3, respectively. In addition, the herdsmen grazing animals in UHPZ and UHPK responded almost no income obtained over the past five years. In conclusion, the vegetation situation and the income level of the sustainable-managed pasture are significantly better than the unsustainable-managed pastures. The local ecological community maybe the major player in decision-making in favour of the Indigenous people, pastures' vegetation management, and the livelihoods.
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Keywords

Inner Mongolia; Deserts; Dominant Species; *Zygophyllum xanthoxylum*; *Krascheninnikovia ceratoides*

1. Introduction

Inner Mongolian grassland is vital to the ecological security of North China, while the animal-based sustainable production is crucial for the economic development of this country (Li & Huntsinger, 2011; Zhang et al., 2020). Based on the Chinese governmental reports, 10% of the total area of

the grasslands was degraded in the 1970s, increasing the degraded lands to 30% in the 1980s and 50% in the 1990s (Waldron et al., 2010). In 2010, about 61.5% of grasslands were degraded, and the degraded area increased to 90% in 2018 (Zhang et al., 2023).

Mongolia protects its grassland nomadism by establishing the Mongolian National Federation of Pasture User Groups at the initiative of a local herder organization (Hauck et al., 2024). In Inner Mongolia, the grassland privatization started from the year 1984 (Liu et al., 2017), but some investigators argue that the privatization of grasslands does not cause grassland degradation in Inner Mongolia (Liu et al., 2019). However, the cropland (Hu & Nacun, 2018) and the coal-mining expanded the most, reducing the grasslands considerably (Zhang et al., 2022). With the deferred or banned grazing policies in Inner Mongolia of China, the grassland privatization resulted in the fragmentation of the pastures usually fenced by large-scale wire fencing (2022; Wang & Lo, 2022; Xu & Huntsinger). Lastly, the local government has inclined to integrate the pastures by connecting the herdsmen (Conte & Tilt, 2014). In short, the current Inner Mongolia grasslands' ecological capacity is limited, leaving the pasture fragmentation occurring at large.

In order to increase the economic incomes, the local government subsidized the semi-extensive systematic feeding of the Bactrian camels, booming the numbers of the companies producing the camel products (Iglesias et al., 2020). The total population of Bactrian camel in Inner Mongolia has reached to about 187,000 in 2022, accounting for 40.48% of the total number of camels in the country. This number is expected to reach 170,000 in western Inner Mongolian deserts (Ming et al., 2022). There are few studies assessing the conditions of pasture vegetation at different levels of grazing of camel herds.

Overcoming the gap, this research investigated the herd size and the vegetation both in the sustainably managed grazing pastures in comparison with unsustainably managed grazing pastures in Urad-middle banner territory.

2. Study Areas & Methodology

Urad-middle banner (107° 16 'E to 109° 42'E , 41° 07 °N to 42° 28'N) is located in the western part of Inner Mongolia Autonomous Region, and the average annual temperature in most areas is between 3.0℃ and 6.8℃, and the average annual precipitation ranges between 50 mm and 150 mm (Yan et al., 2023). This study was conducted in Ehkchagan village of Bayanhanggai soum desert, which is major camel production region and is located north part of Urad-middle banner. The northern part of Bayanhanggai soum desert is mainly the desert having *Zygophyllum xanthoxylum* species, and the southern part of Bayinhanggai is mainly desert with *Kraschenninnikovia ceratoides* vegetation.

Photo 1 showed the field area of the "sustainably-managed herdsman pasture" (SHPZ), and photo 2 and 3 showed the cattle or camel herds of the "unsustainably-managed herdsman pasture" (UHPZ) in *Zygophyllum xanthoxylum* desert. Total 4 pastures were studied. In desert having xerophyite *Zygophyllum xanthoxylum*, the pastures were classified into "unsustainably-managed herdsman pasture" (UHPZ) and "sustainably-managed herdsman pasture" (SHPZ). Similarly, the pastures in

Krascheninnikovia ceratoides dominated deserts were categorized into "unsustainably-managed herdsman pasture" (UHPK) and "sustainably-managed herdsman pasture" (SHPK). Photos 4 and 5 show the camel herds and field area of the "sustainably-managed herdsman pasture", and Photo 6 and 7 show the camel herds and field are of the "unsustainably-managed herdsman pasture" in *Krascheninnikovia ceratoides* desert.

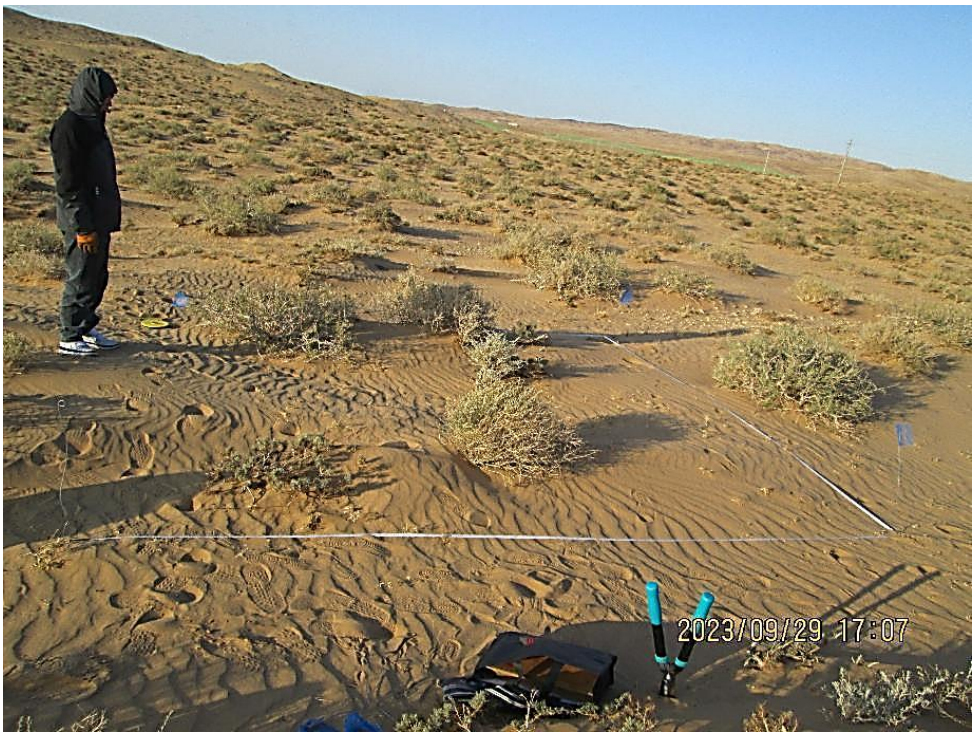

Photo 1: Field study of the "sustainably-managed herdsman pasture" (UHPZ) in desert having *Zygophyllum xanthoxylum* vegetation

Photo 2: Cattle herds of the "unsustainably-managed herdsman pasture" (UHPZ) in *Zygophyllum xanthoxylum* dominant desert

In terms of the income level and the herd size in the past five years, the data was collected during the direct interactions with and the field visit to the households through a questionnaire (Appendix-A). The village name is Ehkchagan. It was extremely difficult to find sustainably-managed pasture in

Urad-middle banner; the situation is similar in other regions in Western Inner Mongolia as well. At least 98% pastures have already degraded or have already dead. So, there is only these two sustainably-managed pastures that are available in the area. One quadrat was laid each in SHPZ and SHPK, because the vegetation is distributed uniformly. Researchers also conducted one quadrat in UHPZ and one in UHPK.

Photo 3: Camel herds of the "unsustainably-managed herdsman pasture" (UHPZ) in *Zygophyllum xanthoxylum* dominant desert

Photo 4: Camel herds in the "sustainably-managed herdsman pasture" (SHPK) in *Krascheninnikovia ceratoides* desert

Photo 5: Sample collection from the "sustainably-managed herdsman pasture" (SHPK) in *Krascheninnikovia ceratoides* desert

Photo 6: Camel herds in the "unsustainably-managed herdsman pasture" (UHPK) in *Krascheninnikovia ceratoides* desert

In order to assess the pasture vegetation, field study was conducted at each of the pastures during September and October 2023. The quadrats to measure the vegetation were of 4 m × 4 m size across all the samples. Authors laid down one quadrat as a typical sample at SHPZ and SHPK, respectively; one quadrat as typical sample for UHPZ and UHPK, respectively; and one quadrat as gravel sample for UHPZ and UHPK, respectively. The number of plant species were recorded in the quadrat, and the coverage of plants in the quadrat was determined by the direct observation. The coverage of sand and gravel was also observed. The natural height (cm) of each typical species was measured by a

flexible rule (5 m). The length and width of the shrubs was also measured by a flexible rule (10 m).

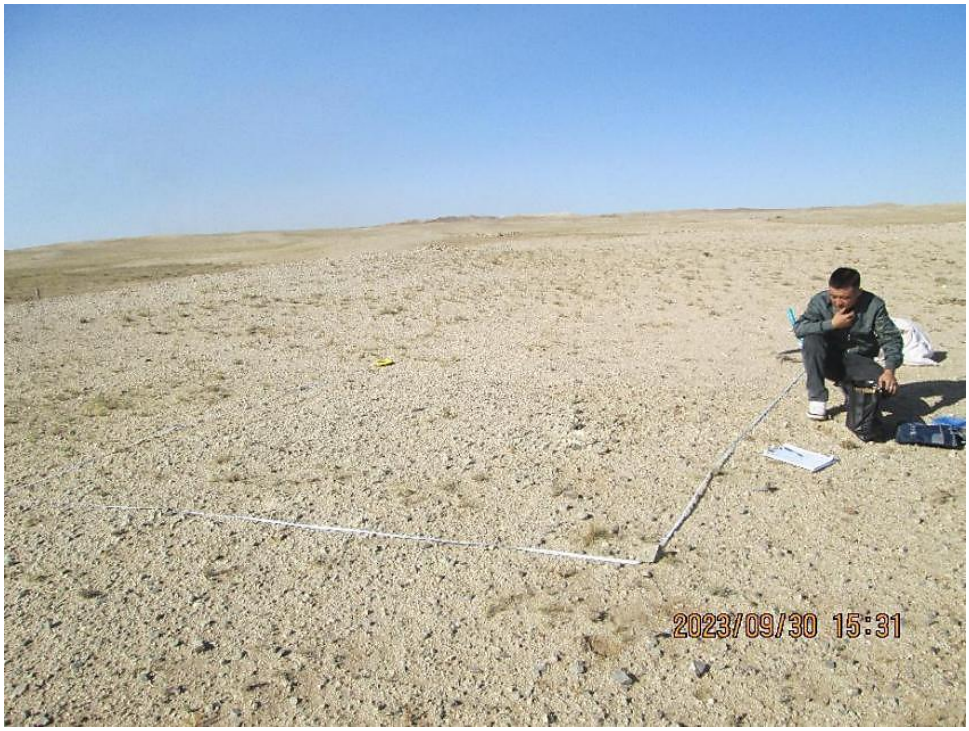

Photo 7: Field study in the "unsustainably-managed herdsman pasture" (UHPK) in *Krascheninnikovia ceratoides* desert

2.1 Data Analysis

A coverage of the vegetation was estimated using the formula: $1/4\pi LW)/S$ (L = length of the shrub, W = width of the shrub, S = 4 m × 4 m). It was applied on the *Zygophyllum xanthoxylum*, *Caragana brachypoda* and *Krascheninnikovia ceratoides* vegetations (Li et al., 2021). The relative volume of each species calculated by the maximum height (cm) multiplied by its coverage (%) (Ohtuka et al., 1993). The vegetation volume is the sum of all relative volume of the species abundance (Tekehiro et al., 2005). The relative species dominance determined by the species volume is divided by the vegetation volume (Ohsawa, 1984).

3. Results

As shown in table 1, in 2019, the herd size was same in both SHPZ and UHPZ, numbering 30-40 camels, 40-80 sheep/goats and 20-30 cattle. The herdsman decided to continue the same herd size in UHPZ, but the herdsman reduced the herd size in SHPZ to <10 camels, 20-40 sheep/goats and >10 cattle from year 2020. As a consequence, the herdsman had almost no income from UHPZ for the past 5 years.

In *Zygophyllum xanthoxylum* dominated deserts, the species composition for typical sample in SHPZ is exhibited in table 2, and the species composition for typical sample or gravelization sample in UHPZ is exhibited in table 3 and table 4. There are 7 species in SHPZ, whereas UHPZ has 4 species only. The vegetation

volume of *Zygophyllum xanthoxylum*, *Caragana brachypoda*, *Krascheninnikovia ceratoides* and *Stipa klemenzii* in SHPZ are 1843.5 cm^3, 1560 cm^3, 170 cm^3 and 37.5 cm^3, respectively. On the other hand, the relative corresponding species' vegetation volumes of the above species in UHPZ are 647 cm^3, 480 cm^3, 105 cm^3 and 14 cm^3, respectively. In sum, the vegetation volume and the species volume for *Zygophyllum xanthoxylum* in SHPZ are approximately three times greater than UHPZ. On the other hand, the relative species dominance of *Zygophyllum xanthoxylum* in SHPZ or UHPZ are 84.62% and 74.19%, respectively. However, the more serious situation was observed in the gravelization sample wherein the vegetation volume was only 86.5 cm^3, as well as the relative species dominance of *Zygophyllum xanthoxylum* is only 4.62%.

Table 1: Herd size and net income for SHPZ and UHPZ in *Zygophyllum xanthoxylum* deserts

Year	*Pasture*	*Herd Size*	*Area (ha)*	*Net Income (RMB)*
2019	SHPZ	30-40 camels; 40-80 sheep/goats; 20-30 cattle	670	No net income
	UHPZ	30-40 camels; 40-80 sheep/goats; 20-30 cattle	670	No net income
2020	SHPZ	> 10 camels; 20-40 sheep/goats; > 10 cattle	670	No net income
	UHPZ	30-40 camels; 40-80 sheep/goats; 20-30 cattle	670	No net income
2021	SHPZ	> 10 camels; 20-40 sheep/goats; > 10 cattle	670	200, 000 (2250 $)
	UHPZ	30-40 camels; 40-80 sheep/goats; 20-30 cattle	670	No net income
2022	SHPZ	> 10 camels; 20-40 sheep/goats; > 10 cattle	670	200, 000 (2250 $)
	UHPZ	30-40 camels; 40-80 sheep/goats; 20-30 cattle	670	No net income
2023	SHPZ	> 10 camels; 20-40 sheep/goats; > 10 cattle	670	200, 000 (2250 $)
	UHPZ	30-40 camels; 40-80 sheep/goats; 20-30 cattle	670	No net income

Table 2: Species composition for typical sample in trained herdsman pasture (SHPZ) in *Zygophyllum xanthoxylum* deserts

Sampled Quadrat size: 4 m × 4 m					
Altitude: 1331.60 m Longitude: 107.5364°E Latitude: 42.1332°N					
Gravel: 0%		Total Coverage: 35%			
Sand: 85%		*Height (cm)*	*Coverage (%)*	*Species Volume (cm^3)*	*Relative Species Dominance (%)*
	Plant species				
1.	*Zygophyllum xanthoxylum*	78	20	1560	84.62%
2.	*Caragana brachypoda*	34	5	170	9.22%
3.	*Krascheninnikovia ceratoides*	15	2.5	37.5	2.03%
4.	*Stipa klemenzii*	9	2	18	0.98%
5.	*Peganum harmala*	12	1.5	18	0.98%
6.	*Salsola collinsa*	8	0.5	4	0.22%
7.	*Salsola passerina*	18	2	36	1.95%
	Vegetation volume (cm^3)			1843.5	

Table 3: Species composition for typical sample in untrained herdsman (UHPZ) pasture in *Zygophyllum xanthoxylum* deserts

Sample Square: 4 m × 4 m					
Altitude: 1238.97 Longitude: 107.5071°E Latitude: 42.1655°N					
Gravel: 50%		Total Coverage: 20%			
Sand: 15%		*Height (cm)*	*Coverage (%)*	*Species Volume (cm^3)*	*Relative Species Dominance（%）*
	Plant				
1	*Zygophyllum xanthoxylum*	48	10	480	74.19%
2	*Caragana brachypoda*	21	5	105	16.23%
3	*Kraschenninnikovia ceratoides*	14	1	14	2.16%
4	*Stipa klemenzii*	8	6	48	7.42%
	Vegetation volume (cm^3)			647	

Table 4: Species composition for gravelization sample at untrained herdsman (UHPZ) pasture in *Zygophyllum xanthoxylum* deserts

Sample Square: 4m × 4m					
Altitude: 1251.2 Longitude: 107.4678°E Latitude: 42.1611°N					
Gravel: 92%		Total Coverage: 8%			
Sand: 5%		*Height (cm)*	*Coverage (%)*	*Species Volume (cm^3)*	*Relative Species Dominance（%）*
	Plant				
1	*Zygophyllum xanthoxylum*	1	4	4	4.62%
2	*Caragana intermedia*	19	4	76	87.86%
3	*Caragana tibetica*	1	0.5	0.5	0.58%
4	*Stipa klemenzii*	6	1	6	6.94%
	Vegetation volume (cm^3)			86.5	

As shown in table 5, from 2019 to 2023 at UHPK, the herd size was 40-60 camels, 80-120 sheep/goat and 40-60 cattle, but the herdsman purchase commercial feed for maintaining the livestock size. However, the herdsman at SHPK was raising the camel herd in 2019, but rotating to horse herd in 2020-2021, returning the camel herds in 2022-2023. As a result, he sustained the net income of 40,000 RMB (5500 USD) each year.

In *Kraschenninnkovia ceretoides* deserts, the species composition for SHPK is exhibited in table 6, and the species composition for typical sample or gravelization sample at UHPK is exhibited in table 7 and table 8. There are 10 species at SHPZ, whereas there are only 4 species at UHPK. The vegetation volumes of *Kraschenninnikovia ceratoides* and *Caragana brachypoda* at SHPK are 1377 cm^3 and 840 cm^3, respectively. In comparison, the vegetation volumes of two dominant species at UHPK are 561.5 cm^3 and 510 cm^3, respectively. In sum, the vegetation volume and the species abundance for *Kraschenninnkovia ceretoides* at SHPK are approximately two times greater than UHPK. On the other hand, the relative species dominance of *Kraschenninnkovia ceretoides* at SHPK and UHPK are 61.00% and 90.83%, respectively. However, the more serious situation is shown at the gravelization sample that the vegetation volume is only 20.5 cm^3, as well as the relative species dominance of the *Kraschenninnkovia ceretoides* is only 39.02%.

Table 5: Herd size and net income for SHPK and UHPK in *Kraschenninnkovia ceretoides* deserts

Year	*Type*	*Herd Size*	*Area (Hectare)*	*Net Income (RMB)*
2019	SHPK	50 camels; 40-60 sheep; 20 cattle	1340	400, 000 (5500 $)
	UHPK	40-60 camels; 80-120 sheep/goat; 40-60 cattle	1340	No net income
2020	SHPK	30 horses; 40-60 sheep; 20 cattle	1340	400, 000 (5500 $)
	UHPK	40-60 camels; 80-120 sheep/goat; 40-60 cattle	1340	No net income
2021	SHPK	30 horses; 40-60 sheep; 20 cattle	1340	400, 000 (5500 $)
	UHPK	40-60 camels; 80-120 sheep/goat; 40-60 cattle	1340	No net income
2022	SHPK	50 camels; 20-40 sheep; 10 cattle	1340	400, 000 (5500 $)
	UHPK	40-60 camels; 80-120 sheep/goat; 40-60 cattle	1340	No net income
2023	SHPK	50 camels; 20-40 sheep; 10 cattle	1340	400, 000 (5500 $)
	UHPK	40-60 camels; 80-120 sheep/goat; 40-60 cattle	1340	No net income

Table 6: Species composition for typical sample at trained herdsman pasture (SHPK) in *Kraschenninnkovia ceretoides* Deserts

Sample Square: 4 m × 4 m					
Altitude: 1297.46 Longitude: 107.7259°E Latitude: 42.0369°N					
Gravel: 0%		Total Coverage: 55%			
Sand: 95%		*Height (cm)*	*Coverage (%)*	*Species Volume (cm^3)*	*Relative Species Dominance（%）*
	Plant				
1	*Kraschenninnikovia ceratoides*	30	28	840	61.00%
2	*Caragana tibetica*	4	2	8	0.58%
3	*Caragana brachypoda*	30	14	420	30.50%
4	*Stipa klemenzii*	12	3	36	2.61%
5	*Salsola passerina*	3	1	3	0.22%
6	*Allium mongolicum*	14	4	56	4.07%
7	*Asparagus gobicus*	6	1	6	0.44%
8	*Cleistogenes songorica*	3	1	3	0.22%
9	*Tribulus terrestris*	1	1	1	0.07%
10	*Artemisia frigida*	4	1	4	0.29%
	Vegetation volume (cm^3)			1377	

4. Discussion

4.1 Dominant Species as Key Indicators of Vegetation Recovery

It is demonstrated that the dominant plant species determine ecosystem health and recovery of the ecology in the arid region (Bazzichetto et al., 2024). Biodiversity is expected to stabilize the vegetation ecology, but it might not be applicable in case of natural grassland ecology (Bai et al., 2004; Loreau et al., 2001; Tilman et al., 2014). Thus, the dominant species shape the vegetation stability and recover Inner Mongolian grassland (Wang et al., 2022).

Table 7: Species composition for typical sample at untrained herdsman (UHPK) pasture in *Kraschenninnikovia ceratoides* Deserts

Sample Square: 4 m × 4 m					
Altitude: 1261.83 Longitude: 107.6956°E Latitude: 42.2444°N					
Gravel: 70%		Total Coverage: 35%			
Sand: 5%		*Height (cm)*	*Coverage (%)*	*Species Volume (cm^3)*	*Relative Species Dominance（%）*
	Plant				
1	*Kraschenninnikovia ceratoides*	34	15	510	90.83%
2	*Stipa klemenzii*	9	5	45	8.01%
3	*Peganum harmala*	7	0.5	3.5	0.62%
4	*Salsola passerina*	3	1	3	0.53%
	Vegetation volume (cm^3)			561.5	

Table 8: Species composition for gravelization sample at untrained herdsman (UHPZ) pasture in *Kraschenninnikovia ceratoides* deserts

Sample Square: 4m × 4m					
Altitude: 1258.81 Longitude: 107.6691°E Latitude: 42.2556°N					
Gravel: 97%		Total Coverage: 3%			
Sand: 2%		*Height (cm)*	*Coverage (%)*	*Species Volume (cm^3)*	*Relative Species Dominance（%）*
	Plant				
1	*Krasheninnkovia ceretoides*	8	1	8	39.02%
2	*Achnatherum splendens*	15	0.5	7.5	36.59%
3	*Peganum harmala*	6	0.5	3	14.63%
4	*Stipa klemenzii*	4	0.5	2	9.76%
	Vegetation volume (cm^3)			20.5	

The *Zygophyllum xanthoxylum* is the most important species in UHPZ deserts (Zhao et al., 2017), whereas the *Kraschenninnikovia ceratoides* is the most important species in SHPK deserts (Anna et al., 2020). In this study, the relative species dominance of *Zygophyllum xanthoxylum* at SHPZ and UHPZ are 84.62% and 74.19%, respectively. Similarly, the relative species dominance of *Kraschenninnikovia ceratoides* at SHPK and UHPK are 61.00% and 90.8%, respectively. However, the relative species dominance of *Zygophyllum xanthoxylum* in gravelization sample at UHPZ and UHPK is below 40%: 4.62% and 39.02%, respectively. In addition, the species volume of *Zygophyllum xanthoxylum* and *Kraschenninnikovia ceratoides* is only 4 cm^3 and 8 cm^3, respectively, at the gravelization samples. Therefore, it is recommended to the herdsmen to take decision for sustainable grazing to recover the dominant species in their pastures.

4.2 The Challenges of Herdsmen Trained as Pasture Sustainable Managers

Camel is the key to the ecology, economy, and culture in the deserts (Ayman & Asim, 2023), so it is also necessary to mobilize the camel numbers according to the pasture's carrying capacity and families' income levels in Inner Mongolia as well. Herdsmen should be recognized as the core of sustainable development in the pastoral regions of China, but their sustainable

development capability is weak (Yin et al., 2023). Under the current situation in Inner Mongolia, the herdsmen' structural reduction of livestock is beneficial for the grassland's vegetation recovery and families' income level (Chu et al., 2022; Ding et al., 2022; Irene et al., 2010). In this study, the untrained herdsmen unwilling to decrease the number of the livestock gained no income for the past five years, paying out the commercial feeds for feeding the increasing camel herds.

Europe realizes the importance of pastoralists as environmental managers, and becomes aware of pastoralists contribution on ecological sustainability and economical sustainability (Caballero et al., 2009; Nori and Gemini, 2011). At the global scale, pastoralists have been playing essential role in sustaining the grassland resources and territories of life (Nori and Farinella, 2019).

Herdsmen play a key roles in maintaining the healthy pastures in China (Yang et al., 2024), but local community is not capable of training the herdsmen as the environmental managers by educating the herdsmen directly. In this study, the herdsmen of the sustainably managed pastures were actively engaged in the activities organized by the Urad-middle banner Ecological Research Association. Photo 8 shows the field study for training herdsman as pasture sustainable managers.

Photo 8: Field study for training herdsman as pasture sustainable managers

Therefore, it is proposed a new kind of educational system "Training system for herdsmen as pasture sustainable managers" managed by local ecological communities. It may encounter great difficulty in training the herdsmen, connecting the individual pastures, mobilizing the livestock, and creating a sustainable grazing system, but the trained herdsmen be able to establish the pasture sustainable development.

5. Conclusion

This is a comparative study on the pastures addressing vegetation and incomes obtained from the sustainably-managed and the unsustainably-managed pastures. The unsustainable management of herdsmen pastures has led to several serious issues, including a decline in biodiversity, dominance of certain species, and low income for the herdsmen. In contrast, sustainably-managed pastures adaptively mobilize camel or horse herds based on the specific year's vegetation, effectively reducing the number of livestock as needed. Local ecological communities play a major role in decision-making for Indigenous people, pasture vegetation management, and livelihoods.

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8. Appendix-A: Interview Questions

1. Would you please describe the herd size of the past five years, including the numbers of the camels, cattle, horse, goat, and sheep?
2. Would you tell me the net income level of the past five years? No income, or 100, 000 RMB, or 200, 000 RMB, or 300.000 RMB, or 400,000?
3. Would you please tell me the approximate area of your pasture?

Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (in accordance with ICMJE criteria for authorship)

Contribution	*Author 1*	*Author 2*	*Author 3*
Conceived and designed the research or analysis	Yes	Yes	Yes
Collected the data	No	Yes	No
Contributed to data analysis & interpretation	Yes	No	Yes
Wrote the article/paper	Yes	Yes	No
Critical revision of the article/paper	Yes	No	Yes
Editing of the article/paper	Yes	Yes	No
Supervision	No	Yes	No
Project Administration	Yes	No	No
Funding Acquisition	Yes	No	No
Overall Contribution Proportion (%)	40	40	20

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Research involving human bodies or organs or tissues (Helsinki Declaration)
The author(s) solemnly declare(s) that this research has not involved any human subject (body or organs) for experimentation. It was not a clinical research. The contexts of human population/participation were only indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or ethical obligation of Helsinki Declaration does not apply in cases of this study or written work.

Research involving animals (ARRIVE Checklist)
The author(s) solemnly declare(s) that this research has not involved any animal subject (body or organs) for experimentation. The research was not based on laboratory experiment involving any kind of animal. Some contexts of animals are also indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) does not apply in cases of this study or written work.

Research on Indigenous Peoples and/or Traditional Knowledge
The author(s) solemnly declare(s) that this research has involved Indigenous Peoples as participants or respondents, with the documentation of their Indigenous Knowledge. Some other contexts of Indigenous Peoples or Indigenous Knowledge are only indirectly covered through literature review. An Ethical Clearance 'to conduct research on indigenous peoples' Indigenous knowledge is not relevant. Yet, a Self-Declaration in this regard applies in cases of this study or written work. It is appended.

Research involving Plants
The author(s) solemnly declare(s) that this research has not involved the plants for experiment or field studies. The contexts of plants were only indirectly covered through literature review. Thus, during this research the

author(s) obeyed the principles of the Convention on Biological Diversity and the Convention on the Trade in Endangered Species of Wild Fauna and Flora.

(Optional) Research Involving Local Community Participants (Non-Indigenous)
The author(s) solemnly declare(s) that this research has not involved local community participants or respondents belonging to non-Indigenous peoples. Yet, this study did not involve any child in any form directly. The contexts of different humans, people, populations, men/women/children and ethnic people are also indirectly covered through literature review. Therefore, an Ethical Clearance (from a Committee or Authority) or prior informed consent (PIC) of the respondents or Self-Declaration in this regard does not apply in cases of this study or written work.

(Optional) PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)
The author(s) has/have NOT complied with PRISMA standards. It is not relevant in case of this study or written work.

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