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What Will the Future Bring? – Socio-Economic Challenges to Herder Households in the Great Gobi B Strictly Protected Area in Mongolia

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Abstract
Nomadic pastoralism is still practiced by around one-third of the Mongolian population. Recent socio-economic constraints have challenged pastoral livelihoods and rising livestock numbers threaten overall rangeland health and biodiversity conservation. In the Mongolian Gobi, herder households fully depend on livestock production but little is known about their livelihood trends and potential compatibility with protected area goals. We combined interview data in the Great Gobi B strictly protected area (SPA) with secondary data on regional and national herder households to determine the importance of social networks, willingness to continue a herding lifestyle, and degree of involvement in protected area (PA) management. Our descriptive data confirm that herding is no longer centred on a subsistence lifestyle but rather around cashmere production. Contrary to sustainability goals, especially in protected areas, herder households continue to increase livestock numbers in response to high expenditures in the economic reality of a market economy. We conclude that herders in the Great Gobi B SPA are reaching neither socio-economically nor ecologically sustainable livestock numbers which challenge herders' livelihoods and PA management alike. We recommend enhancing communication between the PA management and the herding community and increasing participatory conservation activities. National strategies are needed to resolve the current dilemma of increasing livestock numbers to meet livelihood demands and the growing threat to rangeland health.

Keywords Pastoralism · Livestock numbers · Protected area management · Dzungarian Gobi · Mongolia

Introduction

Extensive livestock husbandry on rangelands is important for the livelihoods and food security of 20 million herder households worldwide (FAO, 2001; Lund, 2007). Nomadic pastoralism has been practiced over millennia, especially in arid regions unsuitable for other agricultural production (Godde et al., 2020). However, in many rangeland systems globally changes in socio-economic conditions result in shifts from nomadic to sedentary forms of livestock grazing and increased rural-urban migration (Manzano et al., 2021). In addition, climatic extremes are

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challenging this traditional lifestyle, particularly in the most arid rangelands (Fernández-Giménez et al., 2017). While rangelands are widely studied (Addison et al., 2012; Godde et al., 2020), herders livelihood trends are poorly understood resulting in inadequate policy decisions (Johnsen et al., 2021).

In Mongolia, one-third of the population practice pastoral livelihoods (Mongolian Statistical Information Service, 2023) but the livestock sector has undergone multiple changes in the last century. For over 60 years, all herder households were part of livestock collectives and herded state-owned animals for a salary (Fernández-Giménez, 1999). With the end of the Soviet era, many people returned to household herding (Dyer et al., 2022; Fernández-Giménez et al., 2017; Meurs et al., 2017). Privatization and the development of an export market for cashmere wool has led to a shift from a subsistence to a market economy (Meurs et al., 2017), where herders have increased their livestock numbers, especially of cashmere goats (Berger et al., 2013; Wei & Zhen, 2020). Fluctuating cashmere prices and the unpredictable and harsh climate are challenging for the economy of herder households (Sternberg, 2008) and have increased livelihood vulnerability (Marin, 2019), while the rising livestock numbers put increasing pressure on the fragile rangelands threatening pasture health and the long-term viability of the pastoral economy (Addison & Brown, 2014).

Herder households in remote, rural areas no longer have access to free public services and only limited access to healthcare (WHO, 2021) and education (Ahearn & Bumochir, 2016; Steiner-Khamsi & Gerelmaa, 2008); around 30% of the rural Mongolian population live below the poverty line (World Bank, 2019). Along with the shift from subsistence to a market economy, labour previously shared within the extended family is increasingly outsourced to contracted herders (Murphy, 2015). While, especially in remote areas, the importance of kinship relations and social networks for herder household livelihoods remains high (Conte, 2022; Fernández-Giménez et al., 2017; Ichinkhorloo, 2018) increased rural-urban migration especially of younger Mongolians to seek labour or higher education (Park et al., 2017) has resulted in declining household numbers. This trend could potentially reduce overall grazing pressure but may also alter the livestock grazing sector from a household enterprise to a large-scale ranching style system (Fernández-Giménez et al., 2017). Socio-economic constraints already force many herder households to abandon the nomadic household-centred lifestyle during winter months, when women and children live in district or provincial centres where the schools are located, and men stay with the herds (Ahearn, 2018). These social changes result in increased livelihood costs, which in turn lead to rising livestock numbers, absentee herders, and increasing social inequality (Fernández-Giménez et al., 2017).

Livestock numbers in grazed and industrial systems are on the rise globally (FAO, 2022). Grazing systems have expanded and are used more intensively (Godde et al., 2018), leading to more land-use conflicts in or close to protected areas (DeFries et al., 2007). In Mongolia, where livestock grazing is practiced within most protected areas, the cash benefits of cashmere and the privatization of livestock production triggered a sharp increase of livestock number in the last decades (Rao et al., 2015; Wei & Zhen, 2020), posing challenges for biodiversity conservation, wildlife management (Kaczensky et al., 2020; Salvatori et al., 2021) and rangeland health (Fernández-Giménez et al., 2018). Currently high livestock numbers are not only threatening pasture productivity and biodiversity, but also, the nomadic herding culture depending on these very rangelands (Sainnemekh et al., 2022) and make herding communities more vulnerable to climate extremes (Sternberg, 2008). Protected areas are increasingly perceived and used as emergency pastures during droughts and harsh winter conditions (Bedunah & Schmidt, 2004; Hess et al., 2010), putting additional pressures on sensitive ecosystems during times when resources are already scarce and creating social conflicts (Bedunah & Angerer, 2012; Bedunah & Schmidt, 2004). In addition, rising livestock numbers could potentially increase competition with wild ungulates for decreasing resources (Niamir-Fuller et al., 2012), reduce wildlife numbers (Prins, 2000), and increase the risk of disease transmission between wild and domestic ungulates (Dayaram et al., 2021). Involvement of local communities in biodiversity monitoring and protected area decision making can mitigate conflict by focussing on common goals and finding a common knowledge base (Xu et al., 2006). Ultimately, sustainable use and biodiversity conservation require that livestock numbers and distribution are controlled.

Within the context of the regional and country-wide socio-economic trends over the last 20 years, we used semi-structured interviews to address four aspects of contemporary nomadic pastoralism in the Great Gobi B SPA:

1) the number and species of domestic animals that local herder households in the Great Gobi B SPA need for maintaining their livelihoods;
2) the current economic situation of local herder households in the context of regional and country-wide trends;

3) the importance of pastoralists' social networks and labour division under the ongoing socio-economic changes;
4) the perception of herders on using pasture resources in Great Gobi B SPA and their interaction with the Great Gobi B SPA's management.

We conclude with recommendations for pastoral livelihoods in the Great Gobi B SPA under current and potentially reduced livestock numbers to sustainably manage the pasture resources for wildlife and pastoral livelihoods in the future.

Materials and Methods

Study Site

The Great Gobi B SPA was established in 1975 and registered in 1991 as UNESCO Man and Biosphere reserve (UNESCO, 2020). Since expansion in 2019, the protected area spans over 18'000 km² across two provinces (Khovd and Govi-Altai) and five districts (Soum) (Fig. 1; Sansarbayar, 2019). Around 280 herder households and their livestock, namely (in decreasing order of importance) goats (*Capra aegagrus hircus*) and sheep (*Ovis aries*), cattle (*Bos taurus turano mongolicus*), horses (*Equus ferus caballus*), camels (*Camelus bactrianus*), and yaks (*Bos grunniens*) have seasonal access to the limited use zone of the protected

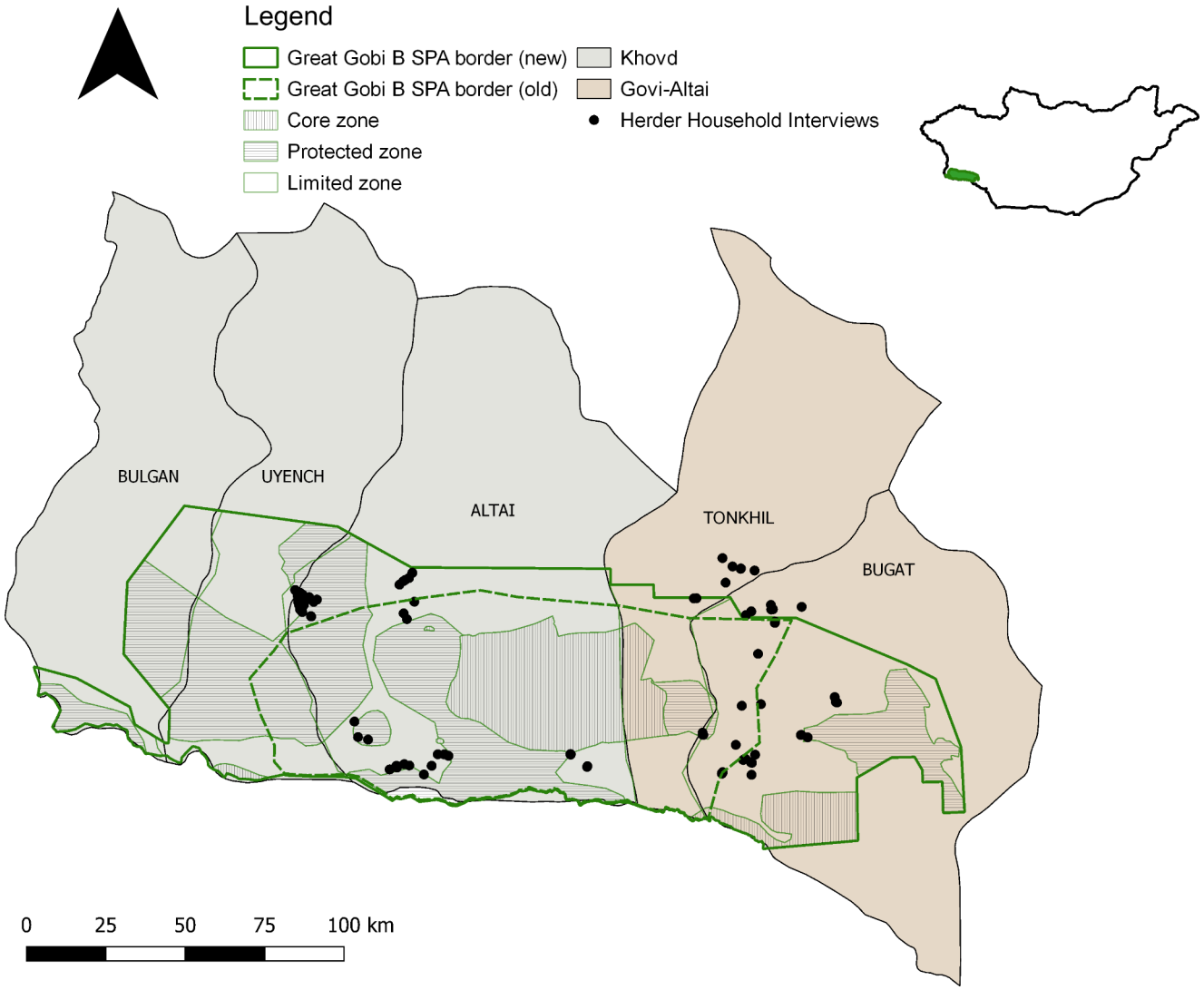

Fig. 1 Location of the Great Gobi B strictly protected area covering five districts in two provinces (Khovd = Bulgan, Uyench, and Altai; Govi-Altai = Tonkhil and Bugat) in Mongolia. The different protection zones of the Great Gobi B strictly protected area are shown with vertical hatching = core zone, horizontal hatching = protected zone, and without hatching = limited use zone. The locations of interviewed herder households are shown with points

area (Michler et al., 2022), while the core and protected zones are exclusively reserved for wildlife. Rare and endangered wildlife species of Great Gobi B SPA include the Przewalski horse (*Equus ferus przewalskii*), Asiatic wild ass (*Equus hemionus)*, goitered gazelle (*Gazella subgutturosa*), Argali sheep (*Ovis ammon*), Siberian ibex (*Capra sibirica*), and snow leopard (*Panthera uncia*; Clark et al., 2006; Kaczensky et al., 2007). This semi-desert and desert steppe has a harsh, continental climate characterized by extreme temperature differences of up to 80 °C between summer and winter, and highly variable precipitation (von Wehrden et al., 2009).

During the time of our study, herder households were allowed to use the pastures in the limited use zone in winter, based on contracts with the protected area (Altansukh Nanjid, director of the Great Gobi B SPA, pers. comm. 2022; Law of Mongolia on Specially Protected Areas, 1994). To date, there is little evidence for pasture degradation likely due to the combined effect of the non-equilibrium nature of the pastures (von Wehrden et al., 2012) and the high mobility of the herders (Michler et al., 2022). However, with rising livestock numbers in combination with fodder provision, there is concern over pasture degradation, as high grazing intensity is known to lower plant species diversity, biomass and vegetation cover (Menezes et al., 2020; Munkhzul et al., 2021), alter soil parameters (Abdalla et al., 2018; Zhang et al., 2022), and lead to soil erosion (Dong et al., 2022). In addition, decreasing livestock herd mobility and changes in pastoral management practices further threaten rangeland health (Fernández-Giménez et al., 2018; Manzano et al., 2020, 2022).

Herder Household Interviews

We conducted semi-structured interviews (Kallio et al., 2016) with 125 herder households in the Great Gobi B SPA in autumn 2017 and 2018 (Online Resource 1 and 2), which represented 96% of all herder households who used seasonal camp locations within the protected area at that time.[1] We identified the interviewed herder households with the help of the Great Gobi B SPA rangers. We structured interview questions to address household information, livestock situation, and economic conditions. Before the interviews, we informed the participants about the aim of the study and obtained signed informed consent of the interviewee (Nijhawan et al., 2013). Interviews were conducted in Mongolian and translated into English. In most cases the household heads (married couples) were interviewed together. The average age of household heads was 46 (± 12) years for men ($N = 120$) and 44 (± 12) for women ($N = 121$). Households had on average 4 (± 2) children with an average age of 17 (± 10) years.

Focus Group Discussions

During three focus group discussions in November 2019 (Michler et al., 2022), we asked 36 participants (11 women and 25 men) to complete a survey about information exchange between the pastoral community and the PA management. Questions covered the degree of collaboration, conflicts among the stakeholders, challenges regarding cooperation for conservation, and participation in certain management decisions concerning sustainable pasture use in the protected area following Batsukh & Benediktsson (2019) (Online Resource 3–5).

To learn more about future prospects of herding, in autumn 2019 we conducted one focus group discussion with three female and six male herders, average age 27 (± 5) years to address the challenges and visions of young herder households. The discussion was led by a moderator and an assistant (Krueger, 2014). During the discussion, we took notes simultaneously in Mongolian and English. We asked each participant to answer six general questions as background information (Online Resource 6) and divided the participants into three groups (two men and one woman each). Then we asked the groups to discuss seven questions jointly from the perspectives of: (1) livestock husbandry, (2) pasture use, and (3) social and household aspects (Online Resource 7 and 8[2]).

PA Ranger Interviews

We conducted two group expert interviews with six rangers of the protected area in autumn 2019. We interviewed three rangers each of the eastern and western parts of the Great Gobi B SPA together. The qualitative interviews were recorded and transcribed in Mongolian and translated to English while notes were taken in Mongolian and English simultaneously. During that time only seven rangers were employed in the Great Gobi B SPA, but the sample size is still very low and, therefore, we present the data only in the discussion.

Secondary Data on National Herder Household and Livestock Data

We used data from the Mongolian Statistical Information Service (2023) to obtain national and regional trends in livestock numbers, livestock species distribution, monetary

[1] The study started before the extension of GGB SPA in 2019 (Fig. 1).

[2] The focus group was very small and was convened opportunistically and hence we present this data only in the Online Resource and discussion.

expenditures and income, as well as overall population, and herder household numbers (Fig. 2). To illustrate trends in household living costs, we used the Consumer Price Index of Mongolia (Mongolian Statistical Information Service, 2023), a measurement to show changes in consumer prices over time based on a representative basket of goods and services (Fernando, 2024). We compared the Consumer Price Index with data on national and regional prices for "brown greasy cashmere" (Fig. 2).

For national trends, we used averages for all of Mongolia and for regional trends, we used data from the provinces of Khovd and Govi-Altai, or from the five districts that intersect Great Gobi B SPA and the buffer zone (Fig. 1). We defined the information of our own interviews ($N = 125$) in the Great Gobi B SPA in 2018 as local data.

Data Analysis

Data from structured and semi-structured questionnaires were analysed descriptively reporting percentages, means, and standard deviations. Answers to the open-ended question in the focus group discussions were reported by main categories that emerged according to Okoko et al. (2023).

Results

Herd Sizes Needed for Maintaining Pastoral Livelihoods

A total of 71,120,433 livestock (goats, sheep, horses, cattle, yaks, and camels) were reported for 248,296 herder households (286 livestock per herder household) in Mongolia for the year 2022 (Online Resource 9), mostly sheep and goats, both of which have risen sharply over the last 20 years (Fig. 3). The drop in national and regional livestock numbers in 2010 was due to severe winter conditions in 2009/10 resulting in mass mortality of over 20% of the national livestock population (Nandintsetseg et al., 2018; Rao et al., 2015).

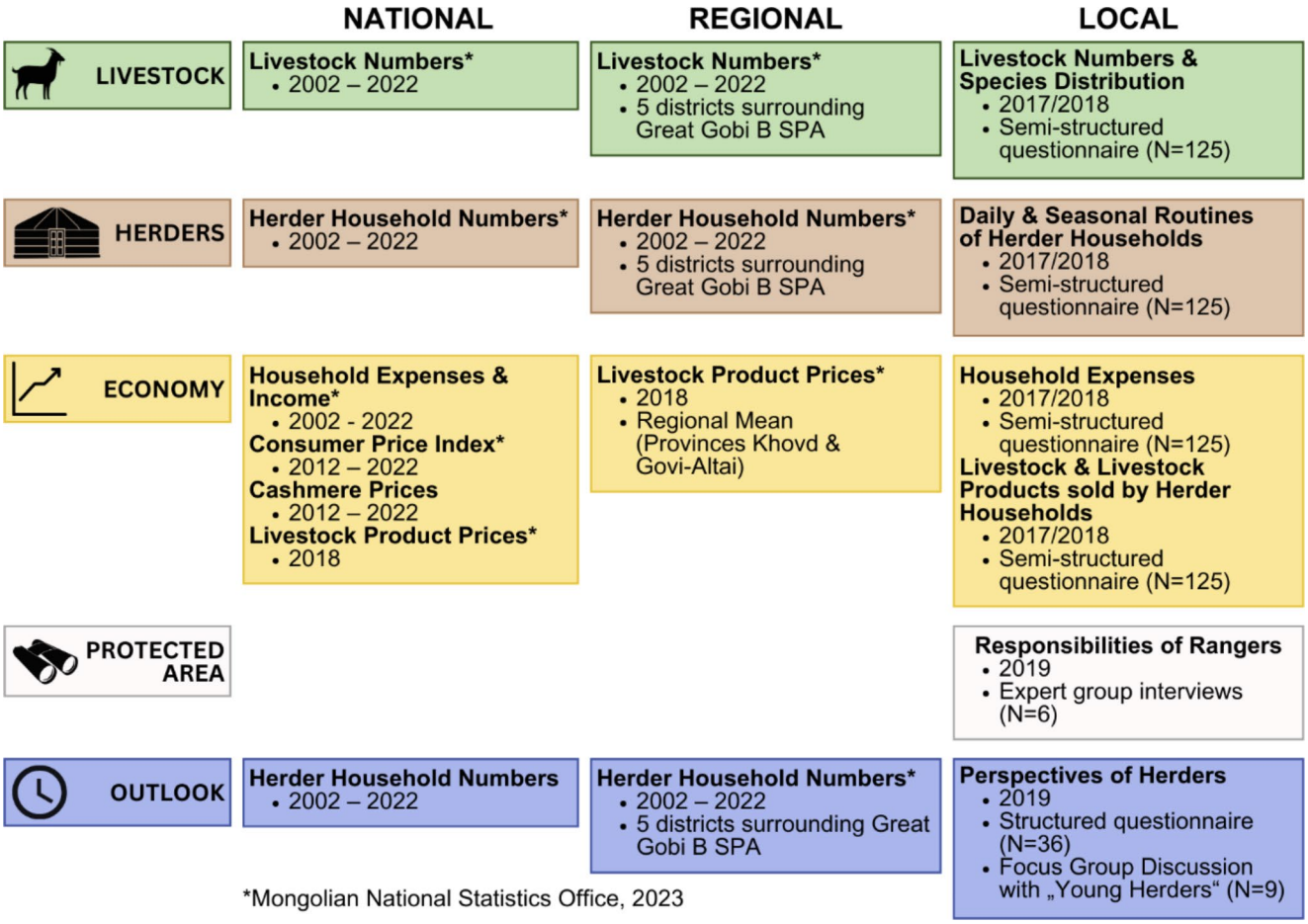

Fig. 2 Schematic graph of data collection from the years 2002 to 2022 in Mongolia (national), in the provinces and districts surrounding Great Gobi B strictly protected area (regional), and in 2017/2018 inside the Great Gobi B strictly protected area (local), Mongolia. The figure illustrates how we investigated livestock and herder household trends, herder household economy and future outlooks of the herder lifestyle using various data sources

Regionally, a total of 1,041,537 livestock were reported for 4,569 herder households (227 livestock per herder household). The percentage of goats was 12% higher than the national average. Regional livestock numbers followed a similar trend and were more severely affected by the 2009/2010 winter conditions.

The self-reported livestock numbers of the 125 interviewed households in 2017/2018 totalled 81,601 (mean: 653 ± 457 per household), with goats and sheep dominating in about the same proportion as in the regional data (Fig. 3). Most herders reported that they had increased their livestock herds over the previous three years, that they would like

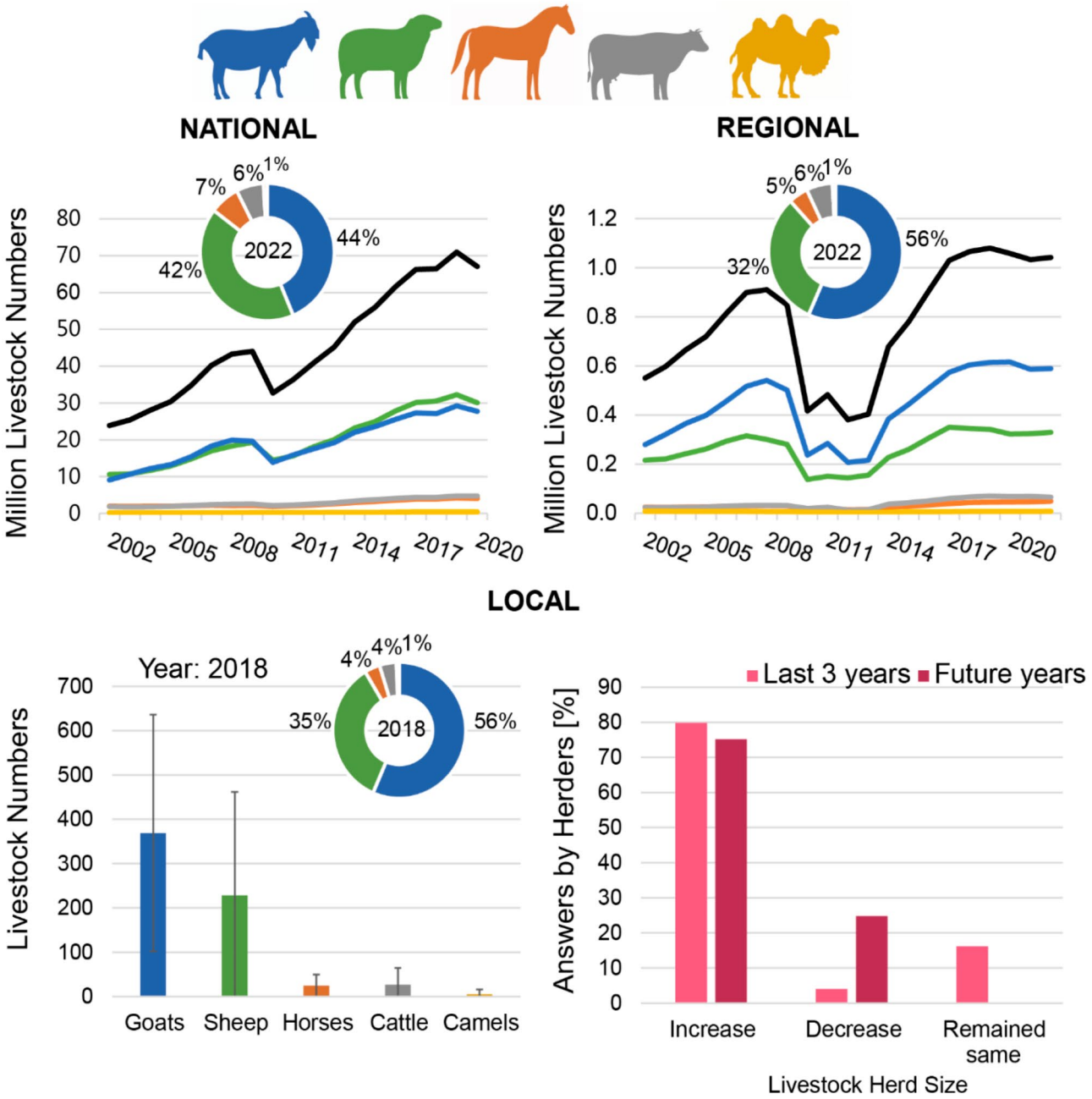

Fig. 3 Livestock numbers and livestock species distribution in Mongolia (national), within the five districts surrounding Great Gobi B strictly protected area (regional) and mean livestock numbers per herder household within the Great Gobi B strictly protected area, Mongolia (local). National and regional data are shown within the last 20 years (Mongolian Statistical Information Service, 2023) and local data are based on 125 herder household interviews conducted in 2017 and 2018. Colours represent different livestock species and the black line shows the total livestock population trends. The pie charts show the respective livestock species distribution. The right bar graph shows trends of herd size numbers over the last three years and preferred livestock trend for future years based on interviews with herder households ($N = 125$)

to further increase their herds, particularly their goats and sheep, and 65% wanted to increase their livestock products as well, especially cashmere production (23%). Herders told us that they would need for on average 774 (±452) sheep and goats to guarantee a good living, 16.4% more than they owned at the time of the interview. In addition, five herders who specialized in raising cattle reported that they needed on average 180 (±45), equalling 1080 (±268) sheep forage units (SFU)[3] for a good living.

Local Herder Household Economy

Locally, 54% of interviewed households had no income source other than livestock and 44% generated ≥ 75% of their income from livestock, with the remainder mainly in the form of government funds for child support (45%, $n = 55$) and/or pensions (49%, $n = 55$). Only three herder families reported a salaried job in addition to herding livestock.

Cashmere was the most important livestock product, harvested annually over the entire lifespan of the animals (Fig. 5; Table 1). We found that local cashmere prices in the Great Gobi B SPA were 3% higher in 2018 than the annual national average, but slightly lower than regional cashmere prices (Table 1). Herders in the Great Gobi B SPA sold their cashmere mainly to middlemen at the regional market price of the Khovd and Govi-Altai provinces.

Between 2012 and 2022, national and regional cashmere prices fluctuated widely between 12 and 28 US$/kg, but with an overall upward trend (Fig. 4). The drop of the cashmere price in 2020 was due to the global Covid-19 pandemic (Hafey, 2020). Over the last 10 years, the consumer price index has steadily increased at only a slightly lower rate than cashmere prices. On average, herders in the Great Gobi B strictly protected area harvest 300 g of raw cashmere per goat and for an average of 2,513 US$[4] per year in 2018 and 2019 (assuming average goat herd size of 369 and the local cashmere price of 22.7 US$).

Interviewed herders indicated that income from sheep and cattle products was only moderately important for household income (Fig. 5) as their prices were low (Table 1), and they were generally kept for household consumption to reduce food related expenses (estimated at 30% of annual income). Herders stated that horses and camels were least important for income and were traditionally kept as status symbols. Non-food expenses comprised 19% for travel/transportation, 17% on clothing, 8% on education, 8% on equipment, 6% on health care, 6% on livestock health, 3% on health insurance, 2% on retirement savings, 2% on other, and 1% on recreation (Online Resource 10).

National and regional prices for sheep and camel wool were similar although local prices were lower. Local prices for animal hides, live horses, cattle, and camels were distinctly higher than national and regional prices (Table 1).

Daily and Seasonal Herder Household Division of Labour

Herders have clear daily and seasonal routines in respect to household division of labour (Online Resource 11). Herding small livestock is important year-round and is primarily the responsibility of men (83%). Most herders

Table 1 Local livestock product prices reported by 125 herder household interviews in the great Gobi B SPA, Mongolia, in 2017/2018, mean national average prices within Mongolia, and the regional prices in Khovd and Govi-Altai provinces in 2018. Data sources: interview data (local prices) and Mongolian Statistical Information Service, 2023

Livestock Products	Livestock species	Mean National Prices [US$]	Regional Mean Prices [US$]	Local Prices [US$]	*N* (Number of herders reporting local prices)
Cashmere / Wool [price / kg]	Goat	22.0 ± 6.3	23.4 ± 5.6	22.7 ± 4.9	117
	Sheep	0.9 ± 0.1	0.9 ± 0.1	0.6 ± 0.5	107
	Camel	3.1 ± 0.8	3.1 ± 0.9	1.6 ± 0.9	40
Hide [price / animal hide]	Goat	4.7 ± 3.9	4.1 ± 4.5	5.4 ± 1.7	114
	Sheep	0.6 ± 0.2	0.7 ± 0.2	0.8 ± 0.7	88
	Horse	3.3 ± 0.6	3.0 ± 0.9	5.3 ± 1.9	19
	Cattle	4.1 ± 2.1	3.6 ± 1.2	5.8 ± 3.8	39
	Camel	-	-	5.6 ± 6.2	4
Live animal prices [price / animal]	Goat	17.6 ± 6.4	16.0 ± 6.3	17.0 ± 3.1	103
	Sheep	25.4 ± 8.4	24.0 ± 7.8	22.6 ± 5.2	95
	Horse	155.8 ± 36.7	150.9 ± 34.1	156.1 ± 29.4	50
	Cattle	181.6 ± 48.9	165.4 ± 46.0	201.2 ± 50.9	48
	Camel	192.7 ± 51.4	185.7 ± 69.9	237.5 ± 44.2	15

[3] SFU = Sheep forage units are used in Mongolia to compare livestock species to the consumption of one sheep. The sheep unit equivalent of cattle is six (Bedunah & Schmidt, 2000).

[4] Exchange rate on 15.06.2023: 1 $US = 3,438 MNT (www.mongolbank.mn).

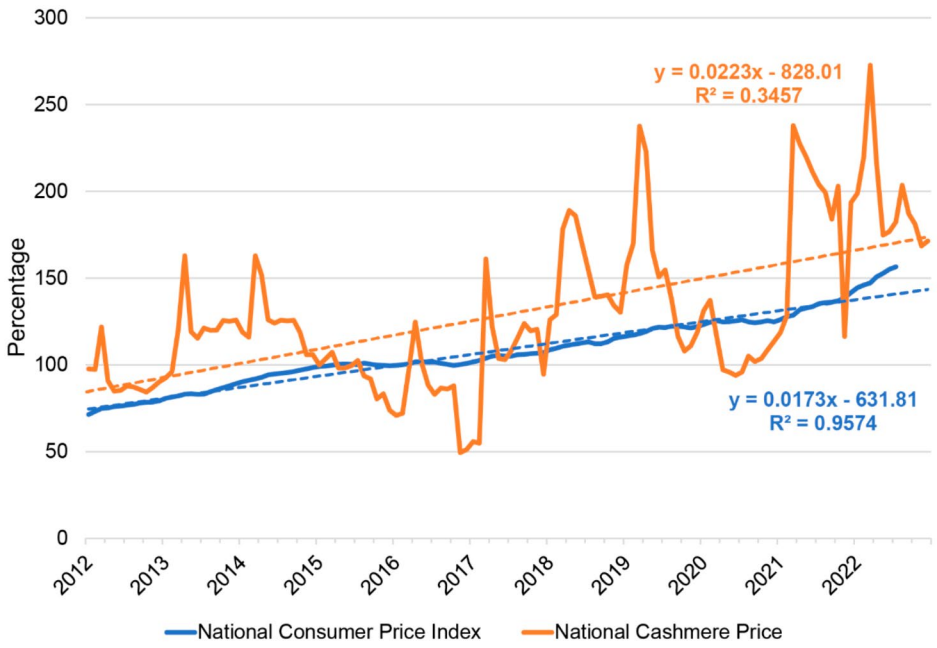

Fig. 4 Trends of cashmere (Mongolian national mean in orange), and consumer price index in percentage from 2012 until 2022; (Mongolian national mean in blue) 2015 = 100%. Trend lines are given in dotted lines. Data source: Mongolian Statistical Information Service, 2023

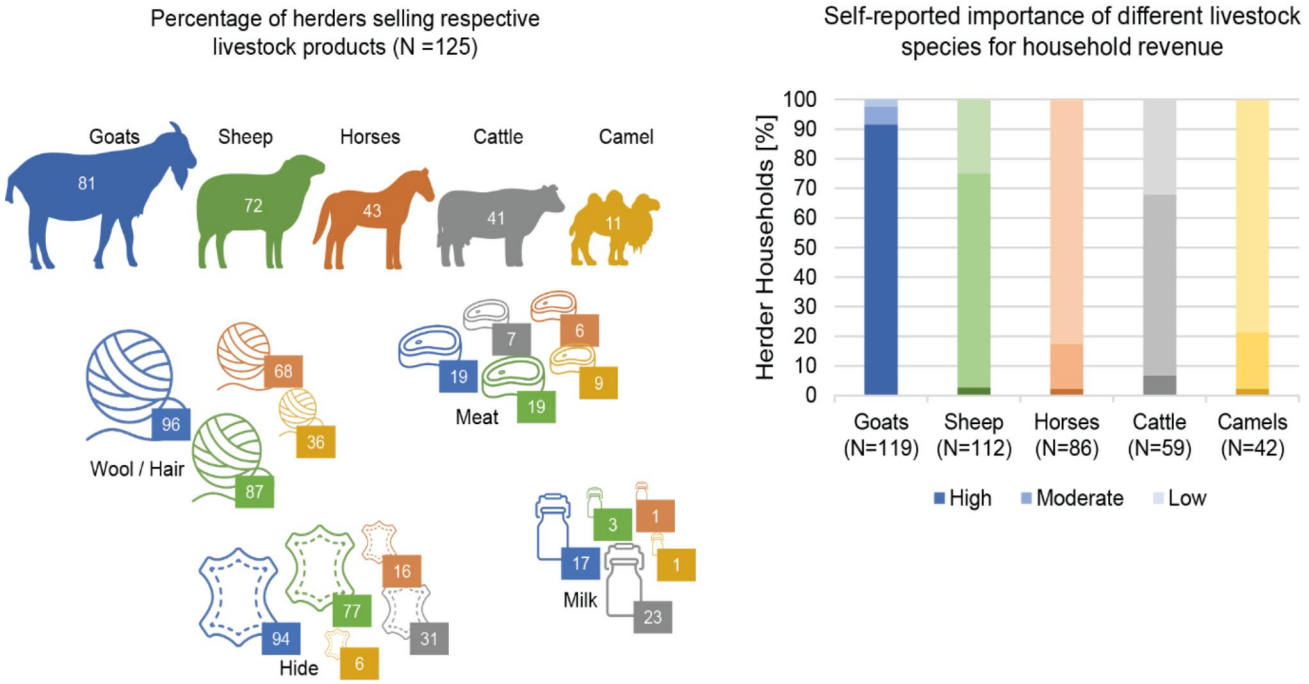

Fig. 5 Left Livestock and livestock products sold by herders in percentage ($N = 125$) in and around the Great Gobi B strictly protected area, Mongolia. Right: Self-reported importance of different livestock species for herder household revenue. Dark shades represent high, medium shades moderate and light shades low revenue gain

(72%) tend only their own livestock, while 25% also tended livestock of relatives. The most labour-intensive seasons are spring and summer (Online Resource 11), when the herds give birth, cashmere is combed, and sheep and camels are sheared. Most daily and seasonal routines are conducted by household members (Online Resource 12) with assistance from relatives and neighbours during labour-intensive periods.

The Future of the Herder Lifestyle

Local herder households have on average 3 (± 1; range 1–7) household members living at the herder camp in the Great Gobi B SPA, generally comprised of a married couple with pre-school or adult children who assist with herding and household responsibilities. At the time of our study, herder households in the Great Gobi B SPA had 460 children (mean per household = 4 (± 2)). Of those, 51 were pre-school age (mean = 1(± 1)) living with the household, 143 of school age (mean = 2 (± 1)) living close to schools in the municipalities, and 28 children were enrolled at universities (mean = 2 (± 1)). Further, 61 adult children remained with their parents at the camp (mean = 1 (± 1)), 52 adult children owned their own livestock herds (mean = 2 (± 2)), and 125 (mean = 2 (± 2)) adult children had salaried jobs in municipalities.

During a focus group discussion with young herders they highlighted the advantages of a herding lifestyle (Online Resource 7), including the freedom to move and unlimited access to the vast rangelands, improvement in access to media (TV, radio and internet), particularly for weather forecasts that can help determine when and where to graze livestock. Major challenges to life as a herder are mainly related to climate, namely extreme winters ("dzuds") and drought summers, and limited infrastructure and poor access to public services (Online Resource 7 and 8). Young herders participate much as the older generation in daily and seasonal tasks that are considered part of their traditional ecological knowledge (TEK; Online Resource 8).

Herders' Involvement in Protected Area Management

While 47% of herders consider living close to the Great Gobi B SPA as a livelihood advantage, the majority (50%) also stated that they follow the regulations and recommendations of the PA management (Online Resource 3). Most herders (58%) claim they regularly participate in consultative meetings with the PA management, although only 29% felt their views are taken into consideration in decision-making. The majority (76%) also felt that the local herder community and the PA management should collaborate on the conservation of nature and use of natural resources. However, 82% of herders stated that cooperation between the PA management and the local communities needs to be improved to ensure environmental protection and sustainable use of natural resources.

The main challenges of herders living close to the Great Gobi B SPA were the limited pasture for small livestock (42%), limitations in pasture mobility and rotation (42%), misunderstandings with the PA management when migrating through the protected area (42%; Online Resource 4). About half of the herders (53%) pointed out that the information about meetings and workshops by the PA management is not distributed sufficiently, especially to herders staying very remotely. Several herders (42%) even said that there are no meetings organized to listening to the views of the local people, and that complaints and views of local people are not considered (45%; Online Resource 5). According to the herders (55%) there is a lack of information and understanding of the rights of the herder community regarding co-operation with the PA management and sustainable pasture use in the limited use zone of the SPA.

Discussion

Livestock Trends

Data gathered from our focus group discussions and interviews indicated that local livestock trends in numbers and species composition in the Great Gobi B SPA roughly followed countrywide and regional patterns. With an average 653 head of livestock per household, average herd size in the Great Gobi B SPA is higher than other herding regions in Mongolia (Gombodorj, 2021).

Household Economy

The sharp increase of livestock numbers in Mongolia over the last 20 years, especially of goats, is associated with increased international demand for cashmere wool and privatization of the market (Munkhzul et al., 2021; Rysbyek & Lei, 2022; Wei & Zhen, 2020). Our interviews revealed that herder households in the Great Gobi B SPA were fully dependent on livestock production as their main income source, with cashmere as most important livestock product for income, similar to other regions in Mongolia (Gombodorj, 2021; Joly et al., 2019; Meurs et al., 2017). Other income possibilities are limited due to the harsh climate and the long distances between urban centres (IPECON / NZNI, 2003).

Despite local cashmere prices being slightly lower than the regional mean, local herders on average earned double the country's minimum wage from cashmere wool alone (Countryeconomy, 2024). In addition, the national cashmere price has increased by 119% over the last 10 years compensating for the 97% consumer price increase. However, local herders still earn 28% less than the annual average wage in Mongolia (Mongolian Statistical

Information Service, 2023). Income from other livestock products is minimal and although meat and milk are used for own consumption, expenditure for food was the single most important household expense, followed by expenses for travel and transport, and clothing - together amounting to over 60% of household expenses. Herder households therefore have a very narrow economic safety margin and the high dependence on cashmere as main income source results in high household vulnerability to volatile prices (Marin, 2019; Murphy, 2018). Further, unpredictable weather conditions with an increased risk of extreme winter events have resulted in high livestock losses (Bayasgalan et al., 2006). These combined uncertainties are likely the motivation for herders to keep more livestock during favourable conditions instead of selling (Xu et al., 2019) and might explain why we found that herder households want to further increase their livestock numbers to reach a "good livelihood." Herders pay for social insurance and debts when they seasonally sell their livestock products (Bristley, 2021). If prices are low and livestock losses high, their narrow economic margin will not allow them to recover, as happened in the winter of 2009/10 (Kaczensky et al., 2011) when high livestock deaths due to the extreme cold ultimately forced herders to give up their herding lifestyle. To reach ecological and economic sustainability, herder households need additional and diversified income for maintaining or even reducing livestock numbers (Hu et al., 2019). In Mongolia, several international and national organisations focus on herder groups jointly managing pasture resources while also improving cashmere value-chains through fostering market access and increased livestock product prices (Addison et al., 2013; Okamoto & Jamsranjav, 2019). Some of those initiatives focus on a wildlife-friendly cashmere value chain (Okamoto & Jamsranjav, 2019), which could also be a strategy for herder households using the pastures of the Great Gobi B SPA. To secure and diversify herder household incomes in line with conservation aims, wildlife tourism has widely been practiced in PAs (Goodwin & Roe, 2001). However, we claim that more than just minor contributions must find their way to local communities to sustainably contribute to herders' livelihoods (DeGeorges & Reilly, 2009; Nepal, 1997).

Herding Tradition

We found that livelihood practices of herder households in the Great Gobi B SPA remain based on traditions and social networks centred around the extended family, as has been shown for other areas in Mongolia (Fernández-Giménez, 1999; Fernández-Giménez et al., 2017). During seasonal labour-intensive periods herder households are dependent on external support (Schlecht et al., 2020), which agrees with our findings that herds of more than 1,000 small livestock are difficult for a single herder household to manage, according to our interviews. Larger numbers of small livestock require herders to divide animals into multiple herds, thus requiring additional herders, a trend already reported from other regions of Mongolia (Mijiddorj et al., 2019; Murphy, 2015). This results in absentee and contract herding arrangements, which are becoming more common in Mongolia (Fernández-Giménez, 1999; Mijiddorj et al., 2019; Murphy, 2015). In Eastern and South Africa, such arrangements are often considered exploitative, with negative effects on livestock well-being and pasture health (Michler et al., 2019; Moritz et al., 2011). While we found that currently children are still valuable assistants in labour-intensive times for herders in the Great Gobi B SPA, maintaining the connection to their homeland (Sukhbaatar & Tarkó, 2018), we also saw a trend of the younger generation leaving the herding lifestyle.

Future of Traditional Herding

Overall, livestock herding is becoming less important for Mongolia's economy and GDP per capita, but low market prices for livestock products and poor market access might drive herders into increasing their livestock herd sizes (Xu et al., 2019). Locally, slightly more than half of adult children of herder households are employed in salaried jobs and no longer live as herders, reflecting a countrywide trend of rural-urban migration and rapid urbanisation in Mongolia over the last three decades (Dyer et al., 2022). Worldwide, herding as a livelihood is becoming less attractive to the young (Schlecht et al., 2020) who are moving to urban areas to seek wage labour or higher education (Fernández-Giménez et al., 2017; Park et al., 2017).

There also seems to be a growing gender gap in education (Ahearn, 2018; Steiner-Khamsi & Gerelmaa, 2008), which was mentioned in our focus group discussions and interviews, where our participants expressed agreement with the propositions that: "the education of female youths was prioritized over that of male youths, the latter being more often expected to continue as livestock herders," and that this makes it "difficult for young men to find a partner and continue a traditional family-centred herding lifestyle". The long distances to urban centres also result in some herder households have to separate during winter, with women and school children staying in settled centres with schools while the men stay in the field to care for the livestock (Ahearn, 2018). During our household interviews, this practice was mentioned but was not yet a general trend. However, in our focus group discussion participants highlighted limited access to social services such as education and health care

as a major challenge, which is in line with findings among nomadic herders in Africa (Dika et al. 2021; Gammino et al., 2020), South America (Caine, 2021), and other parts of Asia (Dyer & Rajan, 2023).

Herders and Protected Areas

Our results indicate that herders face challenges with PA management over pasture use, although they described living close to the Great Gobi B SPA as a livelihood advantage. In Africa, making use of pastures inside PAs is considered an important traditional pastoral coping strategy for environmental uncertainty (Butt, 2011) due to better pasture availability (Michler et al., 2019). In Mongolia, protected areas are often used as emergency pastures in times of limited resource availability during climate extremes (Bedunah & Schmidt, 2004; Hess et al., 2010). However, this also puts added pressure on threatened, rare wildlife populations, some of which are found only in PAs (Turghan et al., 2022), and might result in competition between herders with access permits to the PA and those without (Michler et al., 2019). This highlights the importance of good communication practices between PA management and the local pastoral community, which our interviewees perceived as insufficient. It should be noted, however, that most of the rangers in the Great Gobi B SPA do have a herding background and are well connected to the herding community. According to the PA rangers, the relationship and communication with the herding community was good. Being familiar with the seasonal routines of herder households is helpful for PA management to find the most suitable times to hold their meetings with herders. This should also be considered in the planning of scientific studies if the involvement of local herder households is intended. According to Abukari and Mwalyosi (2020) local communities in Ghana and Tanzania perceive the impact of PAs on their livelihoods and community development positively when PA governance is inclusive and engages with local communities requirements and preferences. We highlight that it is not the PAs responsibility to maintain or improve local herders' livelihoods. However, research has showed that effective conservation is only possible when PA management is participatory and involving local communities (Nepal, 2002; Oldekop et al., 2016). According to our group expert interviews with the Great Gobi B SPA rangers, they participate in so-called Eco-clubs for children of the Great Gobi B SPA buffer zone founded by WWF and UNDP (Swenson & Erdenebileg, 2012; WWF, 2018). Further, our expert group interviews revealed that around 20 herder households were engaged as community rangers reporting illegal activities and wildlife sightings. In addition, the PA management includes local herders in conservation activities such as wildlife counts (Ransom et al., 2012; Vogler et al., 2023), or the fencing of water springs, as reported by the rangers. We recommend the continuation or even intensification of such activities to strengthen the identification of the herder community with the PA conservation aims. This would also help herders and conservation managers to come to a mutually accepted understanding of rights and responsibilities within a PA (Molnár et al., 2016).

Conclusion

We conclude that herder households in the Great Gobi B SPA are reaching livestock herd sizes that are no longer manageable in the traditional way, threaten pasture health (Sainnemekh et al., 2022), and compete with wildlife populations (Berger et al., 2013). Therefore, we recommend a reduction in livestock numbers in and around the Great Gobi B SPA before pasture overexploitation jeopardizes biodiversity conservation and herder livelihoods. This can only be successful when local communities are involved in management decisions and profit directly or indirectly from the protected area. While a well-managed protected area can offer healthy pastures, job opportunities, and additional income from eco-tourism for some, PA management cannot solve the current dilemma of increasing livestock numbers to meet livelihood demands in the Great Gobi B SPA. National strategies are needed to enable local herding communities to maintain mobility, gain access to markets and social services, and diversify their economic basis to enhance their resilience to environmental and economic fluctuations. Involving local communities surrounding protected areas in participatory activities enhances the understanding and successful implementation of conservation aims. However, to successfully reduce livestock numbers to safeguard the pastures of the Great Gobi B SPA and the livelihoods of the herder households over the long-term, we conclude that government restrictions are inevitable.

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Data Availability No datasets were generated or analysed during the current study.

Declarations

Competing Interests The authors declare no competing interests.

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