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Changing Systems, Changing Effects—Pasture Utilization in the Post-Soviet Transition

Case Studies From Southwestern Kyrgyzstan

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Kyrgyzstan's vast grasslands are mountain ecosystems that provide many ecological services (such as water cycling and filtration, nutrient cycling, and soil formation) as well as economic services (such as fodder supply). During

the post-Soviet transformation, pasture-related challenges arose in new forms and intensities and came to endanger the continued provision of these services. Degradation leads to a worsening shortage of grassland resources, and pasture-related conflicts jeopardize Kyrgyzstan's social integrity. Socioecological problems vary in type and intensity and cannot be explained solely in terms of excessive use by

local people. This study looks at the ways in which historical preconditions, current socioeconomic conditions, laws and regulations, and administrative and management practices influence current pasture problems. We analyzed the social and ecological characteristics of diverse pastures in the walnut fruit forest region in southwestern Kyrgyzstan. This study offers an interdisciplinary approach to the establishment of socially and ecologically sustainable pasture management systems, combining social and historical research with ecological vegetation analyses.

Keywords: Grassland; pasture; human–environment interaction; post-Soviet transition; resource management; vegetation ecology; Central Asia; Kyrgyzstan.

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Introduction: Pasture-related challenges in Kyrgyzstan

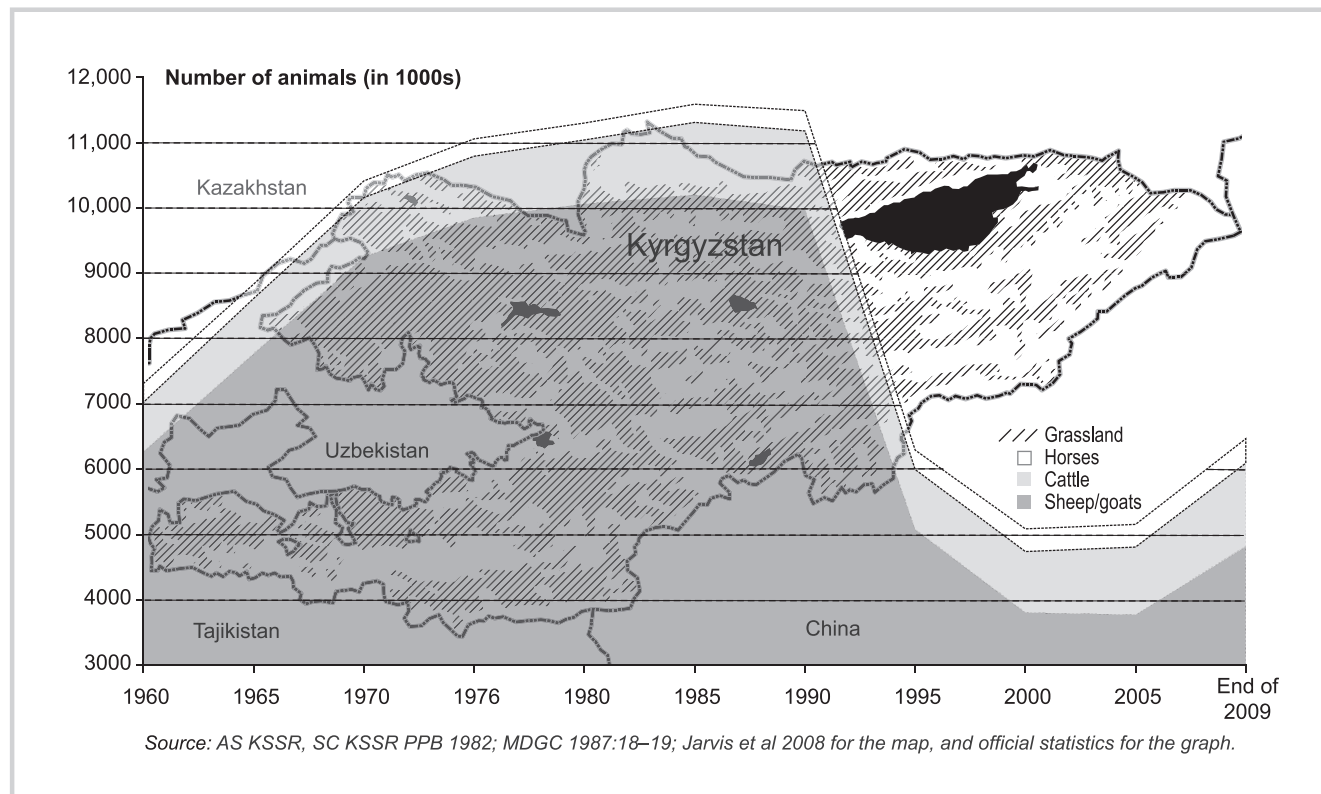
Animal husbandry has long been important in Central Asia. Nomadic pastoralists used the ample grasslands for forage. During the Soviet era's forced sedentarization and collectivization campaigns, pasture use sharply intensified as part of socialist agro-industrial practices. As designated in the early 5 year plans, the Kyrgyz Socialist Soviet Republic became a wool, milk, and meat production center. Nomads, sedentary local communities, and settlers from European Russia were the main pastoralists during colonial times, but they were replaced by *sovkhozes* (state-owned farms) and *kolkhozes* (collective farms). Technical measures, such as pasture irrigation and fertilization and highly structured mobility patterns, were implemented in an attempt to mitigate the ecologically harmful impacts of the intensified exploitation of pastures (SPCPCC SSSR 1934: 243; Isakov 1974: 3–14; Ludi 2003: 119; Undeland 2005: 18–21).

Kyrgyzstan's first decade of independence was characterized by a steep economic decline, followed by deindustrialization and social disintegration. Many employees lost their jobs and wages due to the restructuring, retrenchment, or liquidation of numerous

enterprises. The increased socioeconomic uncertainty led to a rising dependency on natural resources by both the national economy and individual households, especially in the countryside (IBRD 2001; Schmidt 2005; UNEP et al 2005: 19). The national economy is not very diversified and is characterized by a large primary sector. In 2008, livestock production added more than 40% to the whole sectoral value creation (NSCKR 2009: 89, 178–179; CIA 2011). This livestock production relies heavily on the relatively cheap natural fodder provided by grasslands, which cover more than 90,000 km² (nearly 90% of all agricultural lands). Pastures are central to animal husbandry and thus a vital economic resource (Figure 1). Furthermore, they have essential ecological importance. They prevent the high costs that could otherwise result from uncontrolled drainage, extreme runoff variations, soil transport, and erosion. They also provide habitat for broad biodiversity (Brylski et al 2001; Schmidt 2001: 109; Shamsiev et al 2007: 52–53).

In spite of the immensity of pasture lands and the reduction of livestock numbers in the 1990s, the scope and diversity of pasture-related socioecological challenges have increased markedly (Figure 1; Wilson 1997: 62–63; Undeland 2005: 22). Disputes about pasture access and use have occurred repeatedly throughout the country—

FIGURE 1 Grassland distribution and livestock numbers (1960–2009) in Kyrgyzstan. (Design and map by A. Dörre, 2012)



for example, in border areas of the Fergana Valley, between local pasture users in the walnut fruit forest region in Jalalabad Province, and between Kyrgyz herders and a Chinese mining enterprise in Naryn Province (UNEP et al 2005: 19; Mamaraimov 2007; Anonymous 2010; Steimann 2011: 1, 205–206).

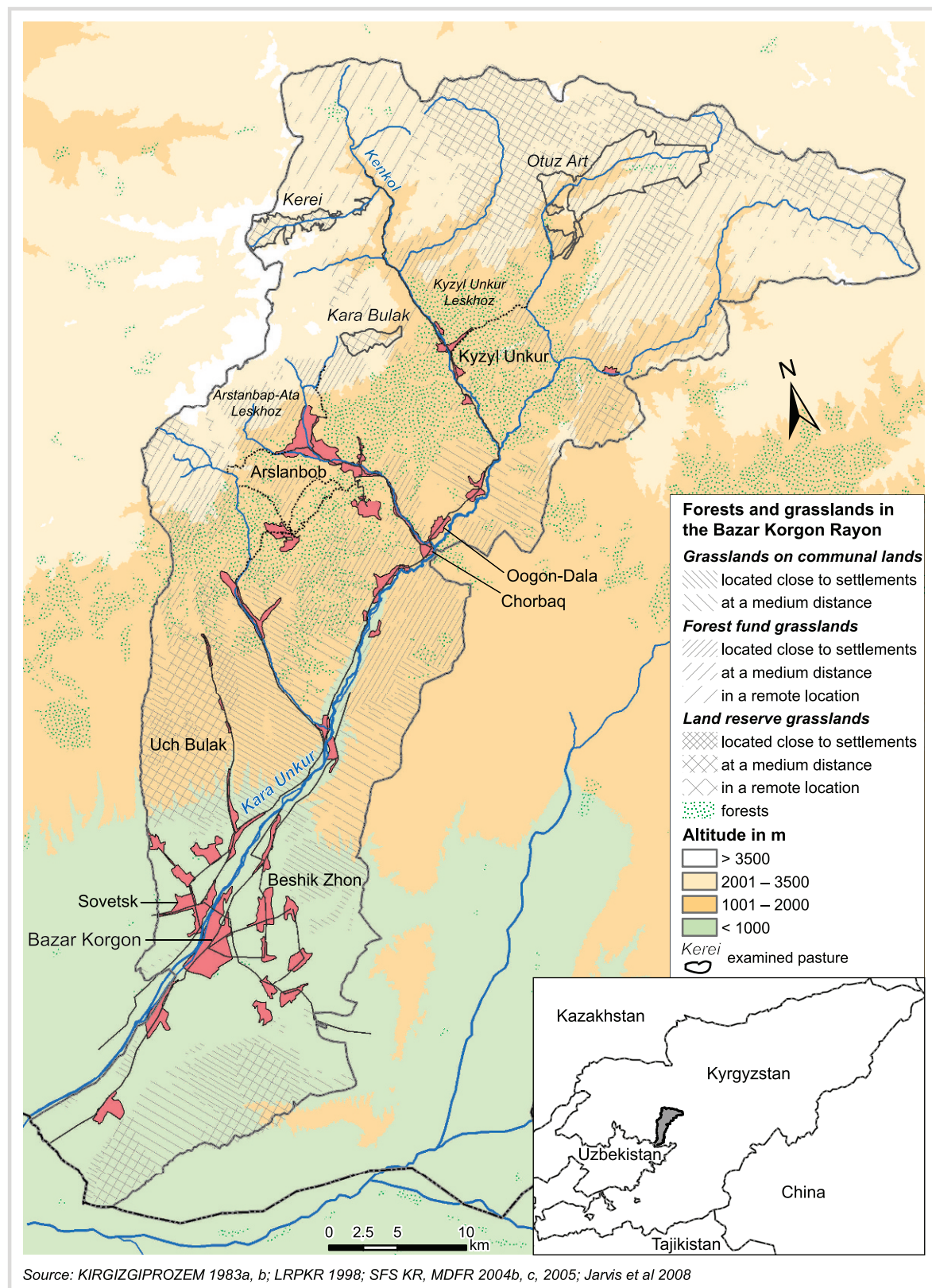
Other ecological problems that were already well known in Soviet times have persisted, including degradation, the “substantial decrease in either or both of an area’s biological productivity or usefulness due to human interference” (Johnson and Lewis 1995: 2). The intensity and spatial pattern of pasture degradation changed after 1991 because of the changed resource exploitation and management regimes. Generally, degradation of *kishtoos* (winter pastures), *jazdoos* (spring pastures), and *kyzdoos* (autumn pastures) increased, whereas degradation of *jailoos* (summer pastures), which are located farther from settlements and at higher altitudes, decreased (Ludi 2003: 121; SAEFUGKR/ UNDPKR 2007: 23; Baibagushev 2011: 107–108). Degradation leads to a growing pasture shortage and potentially to a rise in conflicts with considerable negative impacts on the national economy (SAEFUGKR/ UNDPKR 2007: 20, 23–24). Therefore, ecological pasture problems are closely related to the social sphere, including the maintenance of individual incomes and the social integrity and political stability of the country.

Our aim in the present paper is to assess the ways in which both historical and more recent conditions have influenced pasture use and, subsequently, pasture vegetation patterns. By examining the social and ecological characteristics of three pastures in southwestern Kyrgyzstan, we show that the pasture-related challenges are considerably influenced by factors such as historical preconditions, current socioeconomic conditions, laws and regulations, and resource management practices. Our approach combines empirical social and historical research methods with ecological vegetation analysis.

Study area

Our study area is on the south-facing slopes of the Fergana Range within the Bazar Korgon district (41°N; 73°E), where vast mountain pastures form a vegetation zone above the walnut fruit forests, ranging in altitude from 1800 m to 3500 m (Figure 2). The forest zone receives a mean annual precipitation of 1090 mm. The mean annual temperature is 9°C, with relatively mild winters (average 1°C) and warm summers (average 20°C) (based on meteorological data recorded from 1983 to 2007 at the station Ak Terek, 1748 m, 41°17′20.0N; 72°49′41.8E). The region has mainly meadow and alpine meadow soils (similar to Cambisols and Leptosols), whereas meadow steppe soils (corresponding to

FIGURE 2 Forests and grassland of the Bazar Korgon Rayon. (Map by A. Dörre, 2012)



Kastanozems) only cover a marginal area (Borchardt et al 2011). The dominant vegetation types in the pastures examined for this study range from extensively grazed remote slopes (*Aconogonon-Prangos* community) to alpine meadows (*Phlomooides-Geranium* community) to intensively grazed and trampled areas, which are often located close to settlements (*Plantago-Polygonum* community) (Borchardt et al 2011). Today, over 50,000 people live within the forests and their surroundings. Their livelihoods depend significantly on local land and forest resources (Schmidt 2005: 93, 99–101; Grisa et al 2008: 46; Schmidt and Doerre 2011: 2).

Legal background

Another feature of the research area is the diversity of legal land categories, which are important for pasture management and allocation. Pastures, since Soviet time an exclusive state property, are located on communal lands that belong to the *ayıl oktmotu* (Kyrgyz for local authority, since 2009 expressed in Russian as *aiylnyi okrug*) and on areas of the forest fund and the land reserve. They are categorized based on their distance from settlements (Figure 2). According to the legal requirements formulated in the Land Code of the Kyrgyz Republic and the Resolution “On Pasture Lease and Use” (ROPLU 2002), which was valid until 2009, local authorities were responsible for managing pastures located close to settlements. *Rayon* (district) and *oblast* (province) authorities were responsible for pastures located a middle distance from settlements and in remote areas, respectively. Precise distance values were not defined. Individual leases of 5 to 10 years were the norm and were to be obtained via auction (LCKR 1999: art. 4.2, 13, 15, 17; ROPLU 2002: par. 10, 15). For pastures located in forest fund areas, the State Agency on Environment Protection and Forestry (SAEPFUGKR) and local *leskhoz*es (forest enterprises) were responsible for resource management and allocation (ROPLU 2002: par. 4, 7, 10, 15, 39). The Forest Code also applied to these pastures.

Because most ROPLU regulations failed in practice, and because informal and unequal resource allocations became more widespread, a new law on pastures was established in 2009. Pasture auctions were abolished, and leasing was banned. Local administrations and committees of pasture users became responsible for managing and allocating grasslands located on communal land and land reserve territory, irrespective of their distance from settlements. This new approach has failed to have the intended effect on forest fund pastures, where the SAEPFUGKR and the forest enterprises remain responsible (LKROP 2009: art. 1, 4, 15). Therefore, different pasture-related regulations exist in the study area and influence the management and allocation regimes there.

Methods and material: Combining social and historical research with ecological vegetation analysis

This paper is based on a compilation of socioeconomic information and ecological data that were collected over 4 years (2007–2010).

Empirical social and historical research

Initially, we talked with representatives of governmental, nongovernmental, and international organizations, as well as with members of local public authorities. The aim was to assess the main pasture-related challenges and the laws and regulations governing pasture access, use, and management. Equipped with this initial knowledge, we visited several settlements and pastures in the study area to observe pasture use and management. We also conducted guided interviews with pasture users and representatives of the responsible management authorities. We asked about resource entitlements, management practices, allocation, and utilization practices in past and present, as well as individual assessments of the laws and regulations and their implications. Knowledge of historical preconditions was gained by archival research and analysis of historical documents from Soviet times.

Ecological vegetation analysis

Published information on plant communities in mountain pastures and their relationships with the environment and land use is very rare. Research on mountain grassland vegetation in the Tien Shan is still in its infancy (Wagner 2009; Borchardt et al 2011; Taft et al 2011). The ecological data for our study were sampled randomly on 5 m² plots by Borchardt et al (2011) on different pastures in the Bazar Korgon Rayon (Figure 2). The fieldwork and statistical analysis enabled us to give a detailed description of conditions (including vegetation, chemical and physical soil parameters, and relief) in the pastures under study. We also calculated the Normalized Difference Vegetation Index (NDVI) (Rouse et al 1973) using remotely sensed information (SPOT 5 image, acquisition date June 26, 2008). Satellite-derived vegetation indices, of which the NDVI is one of the most frequently used (Pettorelli et al 2005), are helpful for analyzing species richness and vegetation cover and vitality in remote mountain areas (Levin et al 2007). In our study, the NDVI was used to analyze the vegetation's vitality in SAGA-GIS (www.saga-gis.org). The index was calculated as follows:

$$NDVI = (NIR - R) / (NIR + R),$$

where NIR is the near-infrared band of an image pixel, and R is the red band of an image pixel. Positive values between 0 and 1 indicated vital vegetation.

TABLE 1 Pasture characteristics.

Feature/pasture	Kara Bulak	Kerei	Otuz Art
Elevation (m)	2100–2750	2800–3500	1700–2800
Predominant plant community	<i>Plantago–Polygonum</i> (central parts) and <i>Aconogonon–Prangos</i> (on steeper slopes)	<i>Phlomoïdes–Geranium</i>	<i>Aconogonon–Prangos</i> and <i>Plantago–Polygonum</i> (on flat sites near the camps)
Ecological parameters	<ul style="list-style-type: none"> • NDVI: 0.21 • Density of the herb cover layer: 51% • Mean species richness per plot: 18 	<ul style="list-style-type: none"> • NDVI: 0.22 • Density of the herb cover layer: 55% • Mean species richness per plot: 22 	<ul style="list-style-type: none"> • NDVI: 0.3 (western parts), 0.34 (eastern parts) • Density of the herb cover layer: 80% • Mean species richness per plot: 24 (western parts), 35 (eastern parts)
Distance from a settlement (km)	10	25	20
Land category	Land reserve territory	Land reserve territory	Forest fund land
Legal category (during the time of this research)	Intensive-use pasture	Intensive-use pasture	Village-adjacent pasture and intensive-use pasture
Official responsibility for pasture allocation and management (during the time of this research)	Rayon administration	Rayon administration	Forest enterprise and rayon administration

Borchardt et al (2011) classified the three most frequent and dominant plant communities according to their species composition using hierarchical β -flexible cluster analysis. In the *Aconogonon–Prangos* community, nongraminoid perennial species and tall perennial herbs occurred frequently. Several alpine and subalpine species were diagnostic for the *Phlomoïdes–Geranium* community. Small ruderal and/or widespread graminoid and forb species characterized the *Plantago–Polygonum* community.

Linking social and ecological research

The effects of altered utilization and management on pasture vegetation patterns and structures, and on pasture-related social challenges, were examined through analysis of the ecological conditions of three pastures and the vegetation analyses of Borchardt et al (2011) against the background of historical preconditions and post-Soviet socioeconomic and legal conditions of the study area.

Results: Social and ecological features of the pastures

Our research was conducted on the *jailoos* named Kara Bulak, Kerei, and Otuz Art. We chose these summer pastures because they differed in several features: elevation, distance from a settlement, land category, and the authority that was legally responsible (according to the

laws in force during the time of research) for pasture management (Table 1). Local pasture users reported that the amount and quality of fodder plants on several pasture sections had decreased over the past few years. *Leskhoz* employees, several herders, and people who had been livestock experts in Soviet enterprises shared this view.

Kara Bulak *jailoo*

The Kara Bulak *jailoo* has the shortest distance to a settlement (less than 10 km) and is easily accessible. It is located at elevations between 2100 m and 2750 m and covers 5 km² (cf. Figure 3; KIRGIZGIPOZEM 1983a, 1983b). At the time of our research, the pasture was located on land reserve territory and classified as a pasture with a middle distance from settlements—a so-called intensively used pasture. Therefore, the *rayon* administration was responsible for its management (Figure 2). During our presence, 5 herders were using the pasture to graze relatively large herds of different species. All of them came from the settlement Chorbq.

Most of the plots have experienced a high grazing impact. Because of constant disturbance, the 29 vegetation samples on Kara Bulak had the lowest density of herb cover layer (51%). Thus, Kara Bulak had the lowest NDVI (0.21) as well as the lowest species richness (mean = 18 species per plot). The central parts, where most of the users are concentrated, were characterized by the ruderal *Plantago–Polygonum* community, whereas the

FIGURE 3 Kara Bulak *jailoo*, located on land reserve territory. (Photo by the authors, 2008)



Aconogonon-Prangos community was found on steeper slopes at its margins.

Kerei *jailoo*

The closest settlement to this pasture is about 25 km away. Because the access paths are long, high, and in places very steep, the approach is difficult. Kerei lies on land reserve territory at elevations between 2800 m and 3500 m and covers nearly 20 km² (Figure 4; KIRGIZGIPROZEM 1983a, 1983b). Like Kara Bulak, Kerei was classified as an intensively used pasture and thus managed by the *rayon* (Figure 2). Despite the large area, only 4 to 6 herders—a farmer from Oogon-Dala and 3 to 5 shepherds from Uch Bulak (both about 50 km away)—grazed large herds of sheep, goats, cattle, and horses here.

The cover of the herb layer was only 55%. The grazing impact was the lowest of all surveyed pastures (II, medium). The species richness was higher than at Kara Bulak (22 species), but the NDVI was similar (0.22). The pasture is dominated by the alpine *Phlomoides-Geranium* community.

Otuz Art *jailoo*

Otuz Art is officially divided into forest fund areas, located at elevations between 1700 m and 2800 m and covering more than 20 km², and land reserve territory, located at altitudes between 2000 m and 3300 m (Figure 5; SFS KR/MDFR 2004a: survey maps no. 1, 2, 3, 4, 6, 9;

KIRGIZGIPROZEM 1983b). The distance to the nearest settlement is about 20 km. The approach is particularly difficult, as a river has to be crossed several times, and the road is often damaged by landslides and is at times very steep. The parts located at higher elevations and longer distances from the settlements were used by herders from Beshik Zhon (more than 75 km away) to graze large herds of cattle, sheep, goats, and horses.

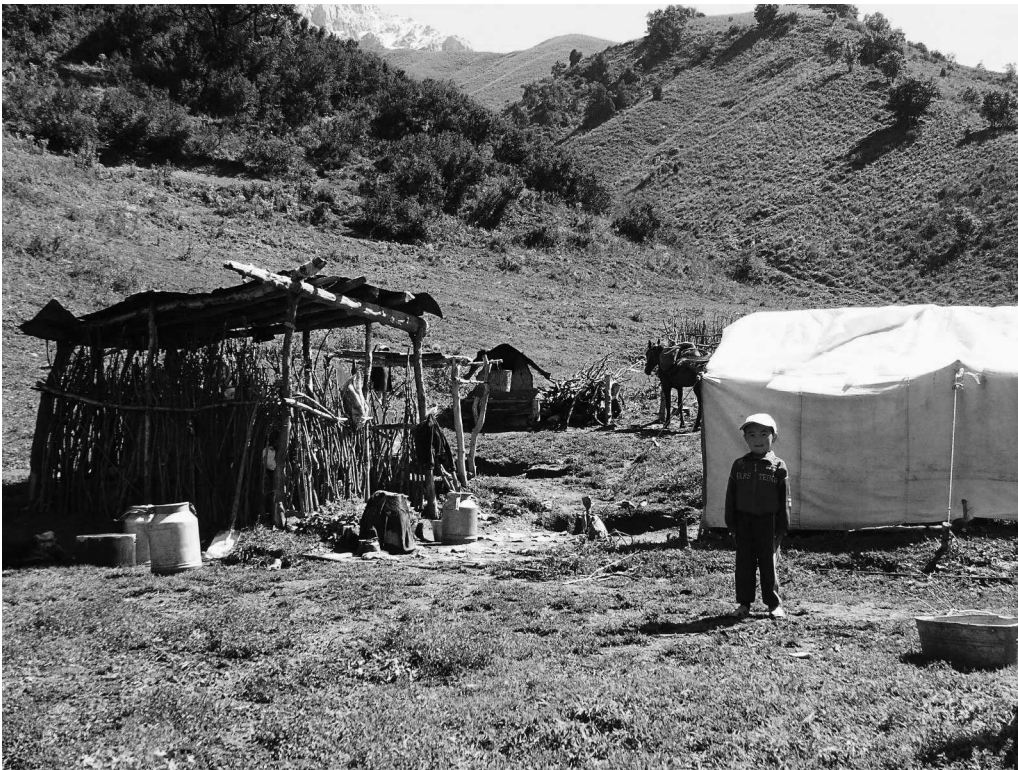
We concentrated on the forest fund areas, where we observed about 30 users who practiced different uses. Locals were represented primarily by beekeepers working on behalf of the Kyzyl Unkur *leskhoz*. They also practiced subsistence-oriented animal grazing and rain-fed farming on small fields. Due to their distance from the next settlement, these parts of the pasture were classified as middle-distance pasture. The forest enterprise was (and still is) primarily responsible for their management (Figure 2).

Only a few cattle tracks and other traces of grazing and trampling were found there. Due to the moderate impact of livestock, vegetation samples on Otuz Art had the densest vegetation cover (80% of the herb layer). The western part showed an average species richness of 24 species per plot. The eastern part had the highest richness of the examined pastures with an average 35 species per plot. The NDVI was higher than in the other two *jailoo* (0.3 in western parts and 0.34 in eastern parts). The *Aconogonon-Prangos* community dominated here. In the

FIGURE 4 Kerei *jailoo*, located on land reserve territory. (Photo by the authors, 2008)



FIGURE 5 Otuz Art *jailoo*, located on forest fund territory. (Photo by the authors, 2007)



western parts, we also found the *Plantago–Polygonum* community on flat sites near the camps.

Discussion: Relations between historical and current conditions and the socioecological characteristics of the pastures

Kara Bulak: Intensified use, poor management, and informal allocation

Kara Bulak was used in Soviet times by the state-owned fattening farm Zhivprom solely as a *jailoo* for its own cattle. Grazing of private animals was banned. As was common in nearly every Soviet farm practicing animal husbandry, the grazing regime and the assumed carrying capacity of the pasture were derived from the average amount of natural fodder and its seasonal availability. These parameters were calculated by the State Design Institute for Land Management. The average summer grazing season on Kara Bulak lasted from the middle of May until the middle or end of August. The paid *kolkhoz* herders were obliged to safeguard the animals and to fulfill a weight gain plan for each animal. They were liable for losses and required to use the pasture in a gentle way (KIRGIZGIPROZEM 1983a, 1983b; pasture user information).

When the farm was dissolved in the early 1990s, all employees lost their jobs, but the herders from Chorbaq ensured their and their descendants' access to Kara Bulak and continued to visit the pasture. They started to apply a markedly changed usage regime and corporately leased an area of 150 ha. The herds were composed of sheep, goats, cattle, and horses belonging to Chorbaq inhabitants, and the herders were paid a set fee per animal for their services. The average grazing period on the *jailoo* became longer; it now lasts until September because the herders lost access to most of Zhivprom's spring and autumn pastures. In turn, the pasture's resilience to disturbances introduced by human use has decreased. Our ecological survey of the vegetation confirmed that Kara Bulak is heavily grazed. This has resulted in the lowest vegetation density, NDVI, and species richness of all of the examined pastures. The *Plantago–Polygonum* community is dominant here, which is an indicator of high grazing and trampling impact.

Neither users from neighboring districts nor those from elsewhere in the region aimed to use Kara Bulak, despite the disappearance of entry restrictions, pasture scarcity in other parts of the study area, and the fact that only a part of the pasture was officially leased. This is especially interesting considering the regulation, valid until 2009, that gave every legal entity (individual or body corporate) the chance to participate in pasture lease auctions (ROPLU 2002: par. 4). However, this procedure was never applied here. Use rights were allocated through informal agreements between the users and representatives of the *rayon* administration, excluding interested third parties. The *rayon* administration proved

unable to fulfill its resource allocation and management duties properly (pasture user information; author's survey). A comparison of historical and current use suggests that the high impact, as evidenced by the low NDVI value, is the result of intense use and the almost complete absence of functioning pasture management.

Kerei: Extensive use and sustainable management by users

During the last Soviet decade, Kerei was one of the *jailoos* of the collective farm 60 Years of October, which specialized in breeding fine-fleeced sheep, such as merino, for the production of high-quality wool. Up to eight shepherds from Uch Bulak, located in the western part of the *rayon*, grazed flocks of about 500 animals from June through August. To avoid health threats and interbreeding with sheep of lesser quality, the *kolkhoz* management forbade the grazing of any species except fine-fleeced sheep and horses, and of animals privately owned by *kolkhoz* members, on this pasture.

As elsewhere, the herders had to fulfill ambitious production plans. From a total of 100 ewes, at least 120 lambs were expected. Every adult sheep was expected to produce an average of 6.5 kg of wool per year. An adult sheep had to provide 50 kg of mutton. To reach these goals, a resource-saving utilization strategy based on the average amount of natural fodder and its seasonal availability was applied. Seasonal mobility over long distances was enforced, and the shepherds were obliged to change campsites during a season to minimize damage to the pasture's vegetation cover and soil (KIRGIZGIPROZEM 1983a, 1983b; SAOJ 1997; pasture user information; author's survey).

When the *kolkhoz* was liquidated in the early 1990s, some of the herders continued to visit the pasture as private entrepreneurs. Shepherds leased pasture areas of up to 200 ha and offered herding services to their neighbors in Uch Bulak. With professional experience from the Soviet era and with herds of up to 500 sheep and goats, 20 cattle, and 20 horses, they still practice seasonal migration between spring and autumn pastures close to their settlement and the *jailoo*, as well as regular campsite changes within each pasture.

The average duration of the grazing period on Kerei has not changed. However, wool sheep breeding has been replaced with meat production of fat-tailed sheep (pasture user information; author's survey). Even if the NDVI value is low here, more sustainable land use and management practices performed by the shepherds themselves, such as extensive use and regular campsite changes, have made up for the lack of resource management by the *rayon* administration. This is mirrored by a relatively high diversity of species compared to the other pastures (pasture user information; author's survey). We think that the density of the *Phlomoideis–Geranium* community and the NDVI are naturally low due to the immature soil, exposed rocks, and frequent rock falls.

Otuz Art: Diverse uses, poor management, but low degradation

The areas of the Otuz Art *jailoo* located on forest fund land were used by herders of the Felix Dzerzhinskii *kolkhoz* based in Bazar Korgon and by beekeepers of the Kyzyl Unkur *leskhoz*. The *kolkhoz* also specialized in breeding fine-fleeced sheep. Purebred cattle were kept in the lower parts of the *jailoo*. The farm's shepherds came mainly from the settlement Beshik Zhon, as they do today. They had nearly the same obligations as those on Kerei and practiced similar grazing strategies. The cattle herders were obliged to reach a specific weight increase for every animal or a specific amount of milk per cow. The grazing of other species, underbred species, and private animals was banned for the reasons mentioned above. Goat grazing was forbidden because the pasture was located on forest fund territory (CPC USSR 1945; KIRGIZGIPOZEM 1983a, 1983b; SAOJ n.d.; pasture user information).

After 1991, former farm members continued to use the *jailoo* for their private livestock. When they were obliged to conclude leases after 2002, many users from Beshik Zhon obtained mid- to long-term leases on areas up to 150 ha, not by auction but by direct purchase. For the beekeepers, such pasture leasing was not necessary. However, all users had and still have to buy special annual permits issued by the *leskhoz* (so-called forest tickets) because the area is located on forest fund territory. Nevertheless, many use the *jailoo* without a formal contract or registration. Goat grazing, although still forbidden, has increased.

Due to its difficult and costly access, only users with certain capital assets are able to visit this pasture. For this reason, and because of the large area, the average density of grazing animals and users on this pasture is low. The former *kolkhoz* herders have continued to practice various measures to protect the resource. The high diversity and density of the vegetation layer in most sites indicate a medium grazing impact, lower than that in the other two examined pastures. This is also indicated by the dominance of the *Aconogonon-Prangos* community, which generally characterizes less intensely grazed slopes (pasture user information; author's survey).

Despite the high vegetation density and species richness, several problems threaten the pasture. Informal purchasing of leases that evade the auction procedure (which was obligatory until 2009), exclusion of interested third parties during this process, pasture use without

official documents, and toleration of goat grazing were enabled in most cases through informal agreements with underpaid staff members of the allocation and management institutions of the *leskhoz* and the *rayon*. These practices are manifestations of the insufficient management services provided by these authorities (pasture user information; author's survey).

Conclusion and recommendation: Strengthening local structures

The pastures examined in this study differ in social and ecological features. Such specific resource-related socioecological characteristics can only be explained adequately by taking into account social and ecological factors. Therefore, our research combined sociohistorical and ecological research. This hitherto rarely applied approach has considerable potential to produce new insights into pasture-related socioecological problems, such as access and utilization conflicts, and into the resilience of pastures to disturbances introduced by human activities.

Our findings suggest that lack of management is a particularly important factor in such problems. This issue was present in all three pastures under study and seems to be common across the country (Shamsiev et al 2007: xiv). In order to establish sustainable utilization regimes, pasture users should be encouraged to develop management systems suitable to the specific conditions of the particular pasture. The new pasture law focuses on this aim and assigns management responsibilities to the pasture users, who have to create so-called pasture committees.

However, given their lack of knowledge and financial assets, pasture users are often asked to do too much. Hence, the formal delegation of responsibilities to these new institutions should be accompanied by capacity building, particularly educational programs on pasture ecology and resource management. Material support is also necessary for committees with little financial capital. Although forest enterprises are relatively strong economically and officially responsible for forest fund pastures, they often manage them carelessly, as at Otuz Art. The approach pursued by the new pasture law should be extended to pastures located on forest fund lands.

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