

OBSERVATIONS ON CHANGES IN KAZAK PASTORAL USE IN TWO TOWNSHIPS IN WESTERN CHINA: A LOSS OF TRADITIONS

Don Bedunah and Richard Harris

Abstract

We provide observations regarding changes in pastoral use within two Kazak areas in the People's Republic of China to illustrate how very different pastoral use can be in similar areas within the same cultural group. The first area is Jianshe Township of Aksai Kazak Autonomous County, in western Gansu Province. The second area is Kurti Township in Fuyun County, Xinjiang Uighur Autonomous Region. In both townships, livestock production from extensive rangelands was the primary economic activity. Our main reason for examining rangeland issues arose from a general view among county officials that overgrazing was threatening rangeland sustainability. Kazak pastoralists were traditional users in the study areas, at least for most of the twentieth century. By the time of our study, the largely Kazak-owned herds in Jianshe had given way to a Han majority, and traditional pastoral practices had been largely replaced by inexperienced contract herders who originated from other regions of China. The change to contract herders with little livestock experience may be a serious threat to sustainable grazing management as traditional ecological knowledge has been lost. In Kurti Township, Kazaks have maintained more traditional movement of livestock, with some herders moving 400 km between winter and summer pastures. However, even in this area the traditional Kazak pastoral culture is threatened from both within (Kazaks themselves) and from outside (policies from Beijing) by attempts to settle herders. In this township, agriculture has become important along rivers, herders are securing rights over irrigated lands to produce hay crops, and many complain of the long distances between pastures and want to become settled.

Keywords: pastoralists, China, Kazaks, Xinjiang, Gansu, degradation, migration, indigenous knowledge, sedentarisation, conversion

Introduction

China has one of the largest rangeland areas of the world with about 400 million ha classified as rangeland, predominantly in western China (National Resource Council 1992: 9).¹ Nomadic pastoralists, now classified as minority nationalities, historically grazed livestock in these rangelands. The political, social and economic changes in the twentieth century dramatically altered relations among people, land and livestock. This has led a number of researchers and many official Chinese documents to express concerns regarding land degradation in western

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China (National Research Council 1992, Ho 2000, Huang 2000, Ho 2001, U.S. Embassy 2002, Zhang et al. 2002, Zhang and Jixi 2004, Sheehy, In Press), with the main causes of degradation generally attributed to overgrazing² and conversion of rangelands to croplands.

The extent and degree of environmental damage is still in debate; however, there is little doubt that western China is rapidly changing and the future of habitat for wildlife and possibly for semi-nomadic pastoralism is gravely threatened. We have worked on a number of biodiversity/wildlife projects in China since 1991. These projects have involved areas used by various pastoral minority groups including Mongolians, Tibetans, Kazaks and Yugurs.³ This article discusses pastoral land use in two Kazak townships that illustrate different land use changes in western China. These Kazak areas were sites of interest because of their wildlife and biodiversity resources.

Our concerns are directed toward ensuring wildlife populations and biodiversity values of these western rangelands; however, a key aspect in providing for these values is the development and/or revival of a pastoral culture that maintains livestock in an extensive system where forage remains for wild ungulates. As such, current land use policies that will continue to have an impact on pastoral use in much of China are also examined here. Schwarzwald et al. (2004: 29) conclude that additional field research is needed to show the variety of land tenure arrangements currently employed in grasslands throughout China. Their research showed that a 'one-size-fits-all approach', based on arable land tenure policies, ignores unique characteristics of rangeland as well as the diversity of tenure management methods that have been adapted to those characteristics.

The Study Areas

The two townships examined were Kurti (Ku'erte in Chinese) in Fuyun County, Xinjiang-Uighur Autonomous Region (hereafter Xinjiang) and Jianshe in Aksai (Akesai in Chinese) County in Gansu Province (see Figure 1). These areas are situated at an important biological crossroads between the Palearctic and Oriental Realm and contain two eco-regions that are included in World Wide Fund for Nature (WWF) Global 200 list of priority areas for conservation of biodiversity: the Tibetan Steppe and the Middle Asian Mountain Temperate Forest and Steppe (Olson and Dinerstein 2002). The Qilian Shan mountains are included in the Tibetan Steppe Eco-region and the Altai and Tian Shan mountains are included in the Middle Asian Mountain Temperate Forest and Steppe Ecoregion.

Kurti represents the ecoregions of the eastern Tian Shan and Altai Shan.⁴ The northern portion of Kurti is in the Altai Shan, with a diverse and productive forest and grassland mix, whereas the southern portion includes desert and semidesert types of the Jungar basin. Kurti Township is 583,900 ha with pasture area of 492,900 ha and elevation ranges from 700 m to 3,500 m. Major rangeland types

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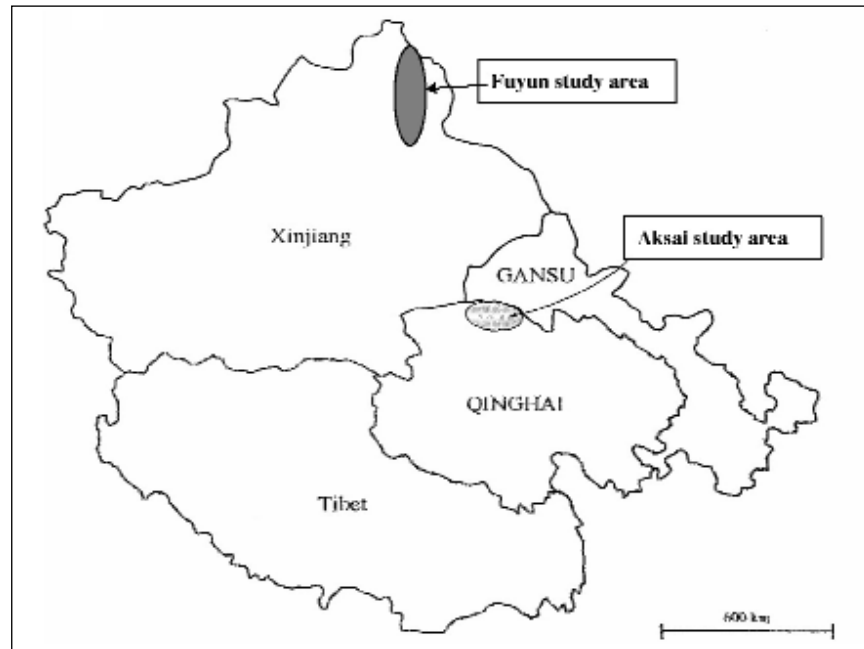


Figure 1: Approximate Locations of Aksai County and Fuyun County Study Areas where Jianshe and Kurti Townships, respectively are located. Note that the Aksai area is administered by Gansu, but it is situated in Qinghai Province on most Chinese maps.

include desert, semidesert, desert grassland, steppe, mountain steppe, mountain shrublands, forest and alpine ecosystems. Crop production is mainly limited to stream and river valleys where there is water for irrigation, although there is some dryland wheat and barley. There are 1,973 households comprising 659 pastoral households and 1,314 'farming' households, in Kurti. These farming households rely on growing vegetables and livestock forage on small plots along rivers and streams and have a lower level of income than pastoral households.⁵ The greater number of farming households compared to pastoral households represents a large change in land use of this historically Kazak grazing area; this will be discussed further when examining population issues.

Jianshe represents the Qilian Shan ecoregion; although not as ecologically diverse as the Kurti area, its habitats and remoteness have maintained many wild species, including large ungulates and predators, in relatively significant populations. Jianshe has an area of 1.34 million ha, but a population of only about six hundred. The elevations of most livestock ranges are between 3,200 m and 4,200 m (although the highest peaks in Jianshe rise to almost 5,700 m). We grouped the rangeland types of Jianshe into four broad groups based on elevation,

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climate or with special moisture conditions: (1) a semidesert type; (2) a dry, alpine grassland type; (3) an alpine dwarf-shrub type; and (4) a wetland type (Bedunah and Harris 2002).

Jianshe is drained by the Kharteng River, which drains internally, unlike Kurti, which controls the headwaters of an internationally important river (the Irtysh). Provincial officials are considering a large-scale diversion scheme to move much of this water to adjacent Dunhuang County for agricultural use. Gold dredging was also occurring in the Kharteng River (we counted seven large river dredges in 2000) and gold mining was also occurring in adjacent drainages. We were not able to document the area of mining damage, but these mining endeavours are certainly having negative impacts on livestock grazing resources and on wildlife. Likewise, in Kurti mining is having impacts on other natural resources and in Fuyun County (in which Kurti is located), mining accounts for more economic activity than does livestock production. The area reported as degraded from mining in Fuyun County is 67,000 ha⁶ although we did not determine how much of this area was actually in Kurti Township.

It should be stressed that the rangelands of Jianshe and Kurti are dominated by low and highly variable rainfall conditions both spatially and temporally.⁷ This type of climate results in a 'non-equilibrium ecological system',⁸ where factors independent of livestock density, such as rainfall timing and rainfall amounts, have a greater impact on vegetation than livestock numbers. In other words, there is a weak coupling of plant-herbivore interactions that greatly influence the herders' movements and responses to changing conditions (Ellis and Swift 1988, Behnke and Scoones 1993).

Although these lower areas are dominated by non-equilibrium ecological systems the higher elevation areas (e.g., steppe, mountain steppe, forest steppe) would be classified as 'equilibrium systems', where plant community attributes are significantly impacted by animal density-dependent feedback controls. It should also be stressed that ecological systems are complex and exhibit a continuum between equilibrium and non-equilibrium characteristics and that livestock can have significant impacts on vegetation attributes, even in areas considered to be dominated by 'non-equilibrium dynamics' (Fernandez-Gimenez and Allen-Diaz 1999). Management of non-equilibrium rangelands will be discussed in later sections.

Livestock production is the major economic endeavour in both townships, but as stated previously, these areas have also been recognised for their biodiversity values. A number of endemic plants and several wildlife species, especially large ungulates and predators, have been identified as species of concern as they are considered vulnerable to human reduction and/or on the Chinese national 'key species' list.⁹ For example, Fox and Jiao (2002: 10) suggest that intense livestock grazing is a major factor in reducing habitat for musk deer and also is responsible for relatively low populations of red deer in Kurti, and Harris and Pletscher (2002) implicate livestock grazing as limiting argali sheep in Jianshe.

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Methodology

In both areas we interviewed individual herders or small groups to determine their concerns regarding livestock production and rangeland conditions. Officials at both township and county level were also interviewed individually or in groups to discuss their issues and concerns. We also conducted transect walks with herders and estimated range conditions using a rapid reconnaissance where possible. Because of the size of the townships and time we were on site we were not able to inspect more than a small portion of the areas. We also used LANDSAT ETM+ images in discussions with pastoralists and government officials. For example, pastoralists were asked to show us on these images their important resource areas or areas of concern.

In our interviews with herders we were generally accompanied by government officials and therefore we did not ask what we considered controversial questions. We believe the interviews, group meetings and rangeland reconnaissance provided us with a great deal of information on conditions; however, we realise that our questioning of policy aspects and interaction of herders with government officials may have been limited by the presence of officials.

Kazak Pastoral Land Use in the Past

Pastoralists today and in the past predominately raise(d) sheep with some horses, cattle, camels and goats. Kazak pastoralists have been the major ethnic group in Fuyun County for centuries as they migrated into northern Xinjiang in the mid-eighteenth century (Benson and Svanberg 1998: 35–43). However, in the area that is now Jianshe, Kazak pastoralists began moving into the area in the early 1930s from Xinjiang and their gradual migration continued through the 1940s (Aksai County 1985, Yang 1993). In both areas it is likely that Mongolians herded livestock prior to the Kazaks, but both areas were sparsely populated before the twentieth century.

Before the creation of the Peoples' Republic of China (PRC), Kazak households moved in an awil, a group of households related by kinship ties, each led by an awil bastiq, who was responsible for such matters as deciding when and where to move and, as needed, communicating important matters to the next highest level and to other awils (Benson and Svanberg 1998: 50). With the foundation of the PRC in 1949, dramatic changes rapidly occurred that altered social organisations and land tenure throughout China. Several authors have reviewed the changes, which started with a period of increasing collectivisation and culminated in the establishment of communes and nationalisation of the pastoral sector (Banks 1999: 297, Ho 2000, Longworth and Williamson 1993).

During the 1960s, a large number of Han Chinese moved to Jianshe. Most immigrants were farmers and workers from Wuwei in central Gansu who fled

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unemployment and starvation during the Great Leap Forward and Cultural Revolution. These migrations were evidently voluntary, and not part of a specific government programme, although out-migration from poverty-stricken areas in eastern Gansu has been government policy at times (World Bank 1988). Han Chinese also moved into the Kurti area, but apparently have not become a significant part of its herding community.

No livestock could be privately owned during the communal period and pastoralists were compensated for herding livestock through 'work points' rather than cash. In both townships, efforts to improve livestock productivity were initiated during the collectivisation and communal periods. Irrigation was developed for growing hay, improved breeding stock were introduced and exotic grasses were planted in an attempt to increase livestock productivity. The irrigation projects and introduced grass plantings failed in Jianshe because of salinity problems and the low productivity of these cold, high-elevation rangelands. In Kurti, salinity is also a significant problem, but there is a continued effort to produce hay to allow herders to settle in the river valleys and these hay fields are an important resource to these families.

Houses and corrals for livestock operations were built, wells were dug and even an administrative centre, far from any paved road, was constructed in Jianshe. In Kurti, efforts to 'improve' livestock productivity by developing irrigation, planting introduced forages and construction of houses are currently ongoing. With the dismantling of the commune systems in the 1980s, grasslands in China were typically allocated to whole villages or groups of households, varying in size from several hundred households to just a few (Banks et al. 2003: 132).

The disbanding of the Jianshe People's Commune and the establishment of the 'household responsibility system' occurred in 1983. Seasonal pastures were allocated to all households based partly on their length of residence in the region; Kazaks generally received spring ranges in the lowest elevation areas. Han immigrants who had arrived in the 1960s received areas for spring in slightly higher elevation areas than Kazaks. Later immigrants were allocated the least preferred spring areas. A countywide survey and carrying capacity estimate was completed in 1983 (Liu 1986). All families were given seventy sheep per family member during the distribution period. Early on, rules required that herd size remain at that size.

In Kurti, the communes were disbanded in 1984 and livestock were distributed to households on the basis of the number of family members; hay fields were also allocated in the same year. The area of pasture assigned to groups was crudely based on the number of commune livestock distributed to their constituent households.

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Current Land Tenure and Pastoral Use

Under the current 'household responsibility system', livestock is privately owned but the pastureland is owned by the state and leased to pastoral households by a rangeland use contract. The contract specifies the area of different seasonal pastures assigned to a household; the season in which pastures can be grazed (therefore there is a particular time herders must move to different pastures); the maximum stocking rate; and rangeland use fees; and it states that the households must ensure that productivity is sustained over time. Pastoralists have been free to ply the open market since the disbanding of communes and initiation of the household responsibility system. Thus, in both Jianshe and Kurti the stocking rates and rangeland use contracts were established; however, Kurti has maintained a more 'traditional' pastoral system, whereas in Jianshe, the pastoral system has become more of a 'ranching' enterprise with much greater changes than in the Kurti area. These changes are explained in the next sections.

Jianshe Township

Currently, Kazak families own only sixteen of one hundred livestock operations, the remainder being owned by Han Chinese. Most livestock owners (about 90 percent) have contracted out the herding work and moved to live in the county seat. Even among the sixteen Kazak family-owned herds, seven use contracted labour to manage their livestock.¹⁰ Benson and Svanberg (1998: 50) report that previous to the PRC, wealthy Kazak leaders in the Ili Valley hired herdsmen to care for their animals. They report that the wealthiest leaders chose to settle in towns or villages, retaining almost feudal ties with herdsmen, who raised animals for them in return for a share of the herd. In Jianshe it was apparent that some of the Kazaks had chosen this method; however, certainly the greatest transformation of Jianshe was from a Kazak pastoral area to a 'Han pastoral area'. This occurred as a result of emigration of Kazaks back to the newly independent Kazakhstan in 1991.¹¹ Most herders who left did so because of the harsh conditions in this remote alpine desert; infant mortality was high due to hypoxia and lack of medical facilities. However, it is worth asking if most of the Kazak community would have left their homes had the dramatic changes in land tenure, including a loss of traditional communal management, had not occurred throughout the last half of the twentieth century.

Thus, by the late 1990s the largely Kazak-owned herds had given way to a Han majority, which were perhaps becoming the new 'rich herders' who had been eliminated in the 1947 Ethnic Reform Law. Inexperienced contract herders who originated from other regions of western China had largely replaced the traditional Kazak pastoralists. Our interviews showed that these contract herders were a diverse group, but most considered herding a short-term position until they could find more pleasant work. For example, our first herder interviewed was sixteen years old and had been herding for six months. He was presently herding 734

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sheep and ten to twenty goats and had a salary of 4,000 yuan/year. His parents had five mu (one-third ha) of farming land in Wuwei, and with only five mu the opportunities for farming on his parents' land seemed very limited. Other contract herders we interviewed included a butcher, miners, a young woman, and several farmers including Uighur and Hui, but we also interviewed more experienced Han herders that had been herding since the 1960s and most of the remaining Kazak herders.

Livestock operations are legally restricted to grazing only in designated pastures at designated times, but there is some latitude in using summer ranges and in emergencies (e.g. when snow is excessive, the County grazing bureau can allow livestock to use other areas). Herders do not work together and the sheer number of 'short-term' contract herders seems to reduce the possibility of any type of shared or cooperative arrangements. Therefore, the herding is done much like a private property or ranch system with seasonal ranges, but many herders still move livestock up to 100 km between summer and winter pastures. These ranges are not fenced but are bounded by recognisable geographical features. The County Grazing Bureau maintains a list of families, descriptions of the locations of their assigned seasonal pastures and their respective carrying capacities.

Kurti Township

There was no evidence of the type of contract operations seen in Jianshe or changes in livestock ownership from Kazak to Han. It was not uncommon for herders to manage animals for relatives or friends who had moved to towns, but apparently some were also contracting to herd livestock from farming families. It was also usual that some families developed a reciprocal arrangement whereby one family managed haylands while others managed livestock in the summer pastures. Kazaks remain the majority ethnic group in Fuyun County with about 69 percent of the population (Statistics Bureau of Xinjiang Uighur Autonomous Region 2002: 109). However, Han make up the next largest ethnic group (26 percent); certainly the same type of situation that occurred in Jianshe is possible in Kurti and presently Han are often a significant portion of the 'farming households'.

A big difference between the areas was that the pastoral production brigades established in Kurti did not have the large influx of Han as occurred in Jianshe.¹² With that said, Xinjiang's population pressure and growing Han population is likely to continue to impact on pastoral production systems as the populations continue to expand. In Xinjiang, the migration of Han began in the early 1950s, but increased during the Great Leap Forward era (1958 to 1961) (Longworth and Williamson 1993: 140) and by 1957 Han outnumbered Kazaks (see Figure 2). With the migration of Han there was an increase in conversion of rangeland to cropland (Williamson and Longworth 1993, Banks 1999: 307; see also Williams 1996a for Inner Mongolia). Banks (1999: 307) in a study of a nearby county to Kurti found that the loss or damage to pasture from arable farming was not so

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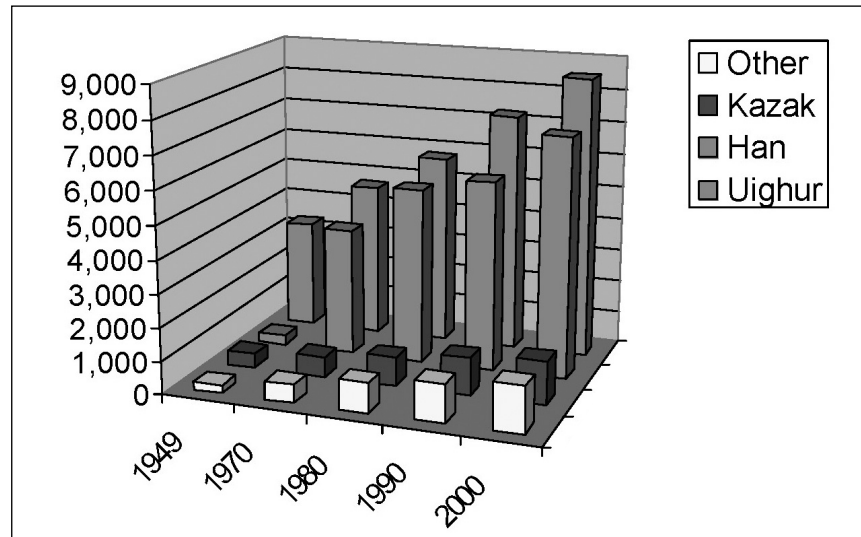


Figure 2: Major Ethnic Groups Populations (1,000's) in 1949–2000 for Xinjiang Uighur Autonomous Region, Peoples Republic of China. Data (1949 and 1970) from Longworth and Williamson (1993: 140); other years are from Statistics Bureau of Xinjiang Uygur Autonomous Region (2002: 109).

much the amount of area converted from pasture to cropping, but that new crop land incorporated key pastoral resources such as early spring pasture and cutting lands for hay production. The impact of the loss of key areas has been increased by the fact that the new farmers also raise livestock that often graze outside of their farms.

There was a clear consensus of Kurti herders that overgrazing of natural pastures was the major problem. This problem was largely associated with herders contracting to graze other people's livestock, mostly belonging to friends from the city or to local farmers. Other problems mentioned were the difficulty in moving between winter and summer pastures and subsequent livestock losses, inadequate winter shelters, lack of hay growing areas and low quality and productivity of livestock breeds – all of which resulted in low herder incomes. A few herders mentioned illegal timber harvest resulting in erosion; other issues were a lack of investment capital for constructing houses and shelters, or buying hay or materials for production, and several herders reported that overgrazing was causing a decrease in wildlife.

Many herders still migrate over 400 km from desert to high summer mountains and pastoralists and government officials considered the migrations a major constraint on family and livestock well-being. In our interviews, all pastoral families were in favour of 'settling down', although there appeared to be limited opportunities to do so. Since 1990, the government has carried out a settlement

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programme for the herders. Xinjiang Animal Husbandry Bureau (AHB) staff estimated that 60 percent of the herders were settled or semisettled, having a wintering area with improved pasture.

Between 1990 and 2000, 5,067 ha of artificial grassland and 4,800 ha of improved pasture had been developed for the winter feed supply within the Fuyun County. The county had applied for support from the national planning committee for the rehabilitation and improvement of the grasslands. One plan consisted of developing 5,330 ha of artificial pastures, including corn and alfalfa, in the Ulungur River basin. Government officials estimated that once complete, the project would allow 80 percent of the herders to be 'settled or semisettled'. The national government will invest 9.1 million Yuan and the total cost was estimated at 16.14 million Yuan.¹³ The plan is to develop 'ranches' with a combination of agriculture and animal husbandry 'to change the condition of traditional grassland-based animal husbandry'. In this proposal, some winter grazing lands would be converted from extensive grazing to irrigated hay pastures and some agricultural crops.¹⁴ These changes reduce some of the risks associated with overwintering livestock by increasing the supply of fodder; as such, it is likely to increase the pastoralists' incentive to expand livestock numbers. There is little doubt that these changes will create other pressures on an already stressed land resource.

Livestock Populations, Stocking Rates and Non-equilibrium in the Two Townships

Livestock Numbers

In Kurti Township and Fuyun County, livestock pressure and numbers have continued to increase since the establishment of the PRC in 1949, with some of the largest rate increases occurring in the 1990s (Figures 3 and 4). Livestock numbers in Kurti were 1.62 times greater in 2001 than 1984, the year of livestock distribution following decollectivization (Figure 4). A significant proportion of this increase in animal numbers is likely to be associated with an increase in pastoral households by 1.33 (from 487 households in 1984 to 648 households in 2001). Livestock figures were available for the county from 1949, and although it is difficult to verify the accuracy of some of these historical numbers, it is apparent that livestock pressure, as measured as sheep units, has rapidly increased (Figure 3).

Total livestock numbers and sheep units increased from the late 1940s to 1965, but in 1966 there was a significant decline in livestock numbers. This decline in livestock was reported to be associated with a spring storm in March 1966 (personal communication with AHB staff, July 2002), when a combination of a snowstorm and low temperatures (known as a *jut*) resulted in a loss of 190,000 livestock. However, it is likely that social/political changes also combined to cause

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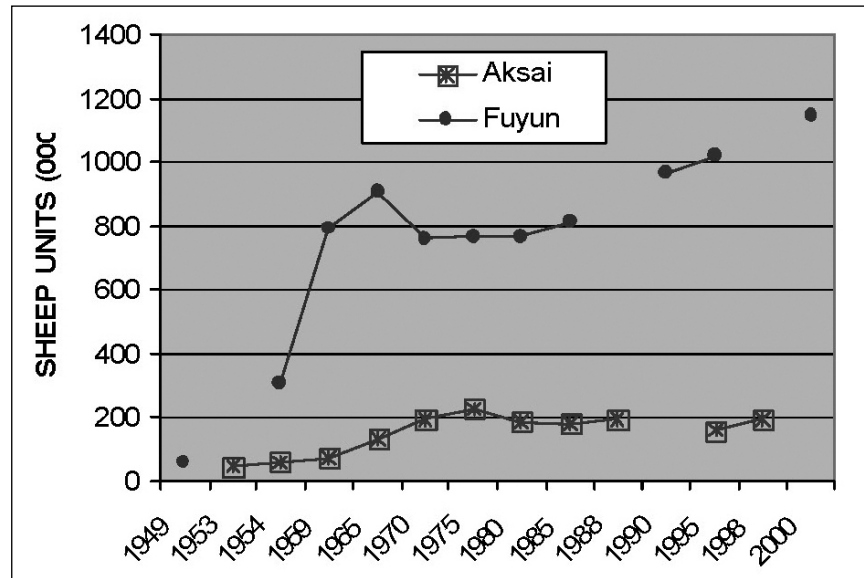


Figure 3: Sheep Units (1,000s) for Aksai County, Gansu Province and Fuyun County, Xinjiang Uighur Autonomous Region, Peoples Republic of China. The Sheep Units (SU) conversion is based on animal body size and feed requirements and provides a comparison between different kinds of livestock species. For this study the following conversions were used: 1 cow = 5 SU, 1 horse = 7 SU, 1 camel = 9 SU, 1 sheep = 1 SU, and 1 goat = 0.9 SU.

these high losses.¹⁵ Livestock numbers (sheep units) remained relatively stable between the late 1960s and 1985.

Livestock numbers have decreased in Jianshe, and to a lesser extent in Aksai County, since the late 1970s (Figures 3 and 5). This is in contrast to the Kurti area. Goats increased during the early 1990s, but sheep numbers remain much lower than in the 1970s in Jianshe (Figure 5). The decrease in livestock in the mid 1970s is dramatic and it is likely to be associated with a cessation of subsidies during this period as well as rangeland degradation caused by intensive management of too many livestock in an extensive rangeland ecosystem.

Even with the reduced number of livestock in Jianshe compared to the 1970s, we suggest the number of livestock may still be too high given the available human management. Most owners are absentee owners, many herders are inexperienced and there is no apparent land ethic among either contract herders or herd owners. Under these conditions, we believe rangeland sustainability of Jianshe is threatened by the current system of livestock management.

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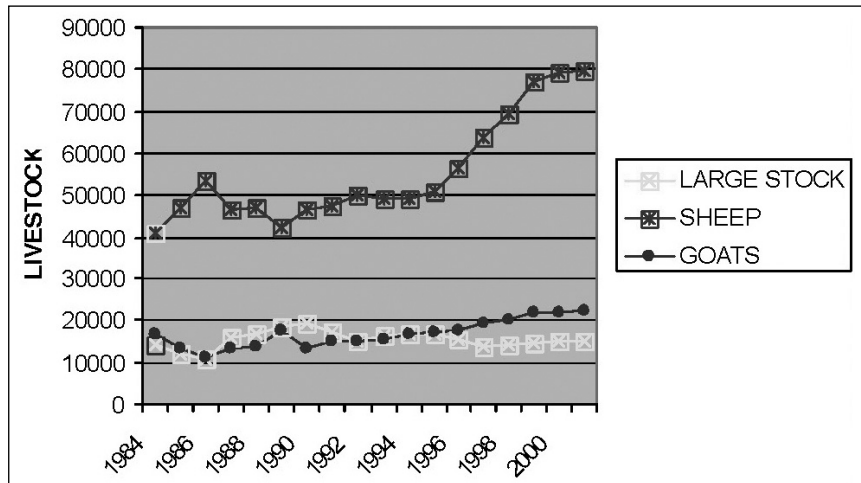


Figure 4: Large Stock (Cattle, Horses and Camels) and Sheep and Goat numbers in Kurti Township, Fuyun County, Xinjiang Uighur Autonomous Region, Peoples Republic of China between 1984 and 2001.

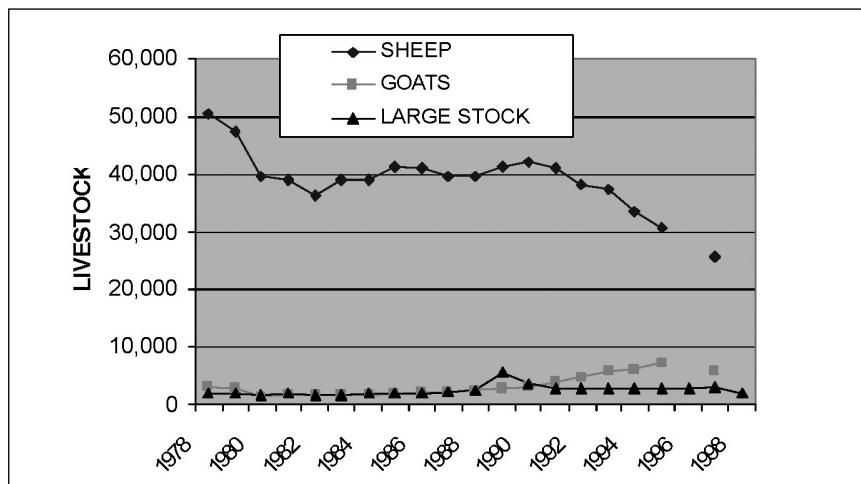


Figure 5: Large Stock (Horses and Camels) and Sheep and Goat Numbers in Jianshe Township, Aksai County, Gansu Province, Peoples Republic of China between 1978 and 1999.

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Users' Control of Grazing

Banks reports on usufruct right transfer to pastures in a nearby county, where he found that in two instances where usufruct rights to pasture were assigned to small groups of households, the groups had persisted to varying degrees (Banks 1999). He concluded that, due to a significant degree of grazing exclusion and regulation of resource use, there was no 'tragedy of the commons' (2001: 738). It was unclear if there were similar differences in distribution of rights to pasture in our Kurti study area within the three pastoral villages.¹⁶ However, for the most part, in Kurti usufruct rights to pasture were transferred to individual households and not to pastoral groups by the state through the Xinjiang AHB.¹⁷ The allocation of pasture was based on the number of livestock allocated by pastoral production brigades to their former households. There was little, if any, evidence of group control or shared responsibility over grazing lands in Kurti. This is not to say that pastures were not shared, as some reciprocal grazing occurred and there was little control over where large animals grazed in summer, spring or autumn ranges. But as sheep and goats are always herded, there is more control over where small stock graze. In the spring and autumn ranges, rangeland use contracts show narrow strips of land as leases, which cannot be protected from other grazing animals; herders did not appear to keep their livestock within their contracted areas except in spring lambing areas. Grazing boundaries in spring and autumn ranges seemed to be almost completely ignored, except in areas of spring lambing sheds. Notably, grazing on winter ranges was the most strictly controlled.

In Kurti the major concern of the pastoralists was of too many livestock, resulting in overuse of pastures. As stated previously, this situation was at least partially associated with herders contracting out to herd other livestock from towns and farms, but we were told by herders that government officials did allow for new users in an area that was already considered overstocked. This strongly suggests a current lack of mechanisms for regulating stocking rates or collective action to reduce 'free access'. Therefore, the increased numbers of pastoralists and associated rise in animal numbers have resulted in loosening stocking rate rules. Group efforts to deal with the problem are lacking or ineffective. The Xinjiang AHB appears to have recognised the problem of overstocking, but for the most part individuals within the AHB believe the solutions will come from technological fixes (fencing, hay pastures, improved breeds) rather than from understanding the need for controlling stocking rates, managing for the variable environment in these predominately non-equilibrium systems; and development of group planning for rangeland use.

Degradation, Stocking Rates and Non-equilibrium

The amount and degree of land degradation in the study areas of Kurti and Jianshe and western China as a whole is open to debate. No doubt the causes are complex, but there is little question that the degradation does threaten biodiversity values and rangeland sustainability. One can suggest that the underlying cause of land

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degradation is associated with government policies that have not considered the real underlying problems in rangeland management. Miller (2003) states that Chinese rangeland research has largely not applied interdisciplinary ecosystem-level research that could provide a better basis for more integrated and sustainable rangeland and pastoral development and also better ensure biodiversity values.

The current Chinese policy appears to be prescribing semi-intensive livestock production systems in areas where non-equilibrium environments dictate a need for extensive systems where livestock can be herded over large areas. This policy of intensification is threatening to wildlife and rangelands. Ho (2001) provides an in-depth review on non-equilibrium rangeland ecology and downplays the application of the theory in regard to changes in animal population and range condition in western China.¹⁸ Banks (1997: 9, in Ho 2001: 124) and Cincotta et al. (1992: 18, 20) also refer to animal-caused degradation in western China. We see little need to belabour the fact that herbivory can result in vegetation and soil changes if animal numbers remain above some theoretical level for some period of time, in both non-equilibrium and equilibrium environments.

The more important question is whether the concept of carrying capacity is valid in areas such as Kurti and Jianshe, which are rangelands with non-equilibrium characteristics where livestock can be grazed in a semi-nomadic manner.¹⁹ Ho (2002: 124, 125) states that 'mainstream rangeland management attempts to fix the number of livestock on a certain plot of rangeland, which inevitably entail lower conservative stocking rates (leading to an underutilization of the resource during periods of rain abundance)' and advocates that in non-equilibrium systems there should be policy supporting opportunistic herd management with high mobility and high stocking rates, since stocking rate controls are too costly. He suggests this can be achieved by devolving decision-making to the community of direct rangeland users.

Livestock and Wildlife: Maintaining Biodiversity

For the most part, both townships have maintained wildlife populations and biodiversity values, although there are certainly areas where conditions could be improved. Our projects in these counties were designed to evaluate vegetation and wildlife, but it became obvious that changes in pastoral use were extremely important in understanding the impact of past, and potential changes in, land use on biodiversity. The rangelands of Jianshe were either overstocked or stocked to near capacity during the last thirty to forty years, leaving few areas that could function as reserve pastures during drought conditions. A grazing system that allowed for pastures to be rested or reserved would benefit both wildlife and pastoralists.

The weak application of prescribed stocking rate (as suggested by Ho 2001 and discussed above) concerns us (as advocates of wildlife and wildlife habitat),

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especially considering that wild ungulates use the same forage resource as livestock. Wildlife are obviously direct users of these rangelands, but have no control over land management unless someone acts on their behalf. We suggest this must be the state, by ensuring conservation of wildlife habitat. We recognise that Central Asian pastoralists generally see value in wildlife and may work for their protection, but when forage conditions are poor, wildlife are likely to suffer from a lack of consideration for their 'fair share' of forage. A mean or range of stocking rates could be based on climate conditions and trends (which would require monitoring), but there must be some formalisation of rules to insure against overgrazing by livestock, especially in key wildlife areas such as winter range, birthing areas, etc. We advocate natural-resource coordinated range management plans, developed with the direct input of pastoral users, but the state must provide the rules to conserve resources for the maintenance of biodiversity values. Often, many county officials seemed to lack an appreciation of multiple-resource values, especially those officials involved in livestock policies; therefore, wildlife and other biodiversity values must have a proponent that will work for their conservation.²⁰

Although some may argue that stocking rate controls are too costly to enforce, it is clear that in Jianshe and Kurti the impact of overgrazing, even on these mostly non-equilibrium environments,²¹ is being recognised by pastoralists, township and county officials and by technical staff within the AHB. We were told that because of overgrazing, pasture production had decreased by one-third to one-half in Kurti between 1980 and 2002,²² although it was not clear how these estimates were obtained. While there are some controls on grazing use and stocking rates set in rangeland use contracts, at present pastoral groups, communities or government agencies do not effectively apply those controls. As a consequence, the situation is threatening to both pastoralists and wildlife that rely on the same rangelands.

At this time, because of the population pressures on these rangelands and a dearth of other livelihood opportunities, it will be difficult to balance the needs of people and wildlife unless there is a concerted effort to ensure the broad-based values of these rangelands. Some solutions to problems with livestock management will be technical; as we have stated previously, it is vital to implement coordinated resource management planning with the pastoralists. Such a co-management system would provide a complementary role for both the state and pastoral communities and China's revised Grassland Law provides legal space for group management (see Banks et al. 2003: 132). At this time, because of the population pressures on these rangelands and a dearth of other livelihood opportunities, it will be difficult to balance the needs of people and wildlife unless there is a concerted effort to ensure the broad-based values of these rangelands. The need for conserving wildlife habitat, especially that of large ungulates, is great if China is to avoid eliminating these populations from all areas except reserves. It is well known that many species have decreased dramatically during the last several decades. The saiga antelope and Przewalski's horse were

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exterminated in China in the last century.²³ The wild Bactrian camel has been reduced to a small population.²⁴ The goitered gazelle, wild ass, wild yak and Tibetan antelope have declined to occupy a fraction of their former habitat (National Research Council 1992, Schaller 1998). Predators on the grasslands have also suffered the same fate as ungulates. Small mammals, especially pikas (*Ochotona* spp.) have been subjected to large-scale extermination programmes, largely through the use of poisons, which has also affected birds of prey and other small predators (e.g., fox) that feed on them. In sum, we believe there is an urgent case for stocking-rate controls, to protect wildlife resources and rangeland sustainability.

Concluding Policy Issues

Policy-makers in Beijing have been facing major challenges in dealing with the simultaneous problems of improving pastoral populations' livelihoods and sustaining the values and products provided by rangeland ecosystems. Our study was initially concerned with an aspect of the latter – how to provide biodiversity values – but we quickly realized that without an understanding of how past and current rangeland management had influenced biodiversity and especially those species of concern, we would be unlikely to be able to provide suggestions for how to conserve these values.

There is awareness in both study area townships of the loss of biodiversity and the continued threat of greater losses. Officials and those herders with a long history in the area stated that rangeland conditions had deteriorated. They informed us of a general loss of vegetative cover and productivity of many areas, and were specific in mentioning reductions of a few plant species: *Salix* species, *Ceratoides compacta* and *Juniperus chinensis*, a low-growing juniper used for fuel, were specifically mentioned in Jianshe.

Government programmes have attempted to deal with both the issues of livelihoods and ecological preservation. Programmes have provided pastoralists with seasonal grazing pastures, winter houses and spring lambing sheds. In Kurti, where there is still long-distance migration of livestock from desert to forest pastures, there are plans to provide additional hay pastures, improved forages and improved livestock breeds as part of the Great Western Development Strategy. Both areas have recently begun pilot projects under the rubric of the national 'Retire Livestock, Rehabilitate Grassland' programme (*tuimu huancao*), in which herders are encouraged to build fences and 'settle' in fixed houses. In Fuyun County, the establishment of a new nature reserve near the source of the Irtysh River has resulted in 'ecological emigration' of 460 pastoral families to newly built centres.²⁵ The Xinhua News Agency (25 October 2002)²⁶ earlier reported that some natural grasslands would be closed for three to five years and herding would be forbidden in some overgrazed Tian Shan rangelands in order to restore

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pastures. These closures will no doubt have impacts on users and it is unknown if the Chinese government will alleviate the impact of these changes on these people.

In Jianshe, the pastoral system is already 'ranch-like', as there are strict controls over the use of specific pastures at specific times, with limited perceived opportunities to vary grazing patterns. In Kurti, the development of pastures, improved breeds, fencing, shelters and hay production will work to create 'ranch-like' conditions in future. In many ways we believe this is unfortunate as Western approaches to livestock grazing have just begun to understand the problems and ramifications of 'settled' livestock operations in highly variable rangelands. In both Jianshe and Kurti, government policies have been more directed at managing carrying capacity and seasonal ranges under the assumption of an equilibrium system, even though some livestock officials have realised the problems of mandating carrying capacity in these environments. In both areas officials recognised large inter-annual differences in forage production, stating that production between years may vary by 50 percent. Longworth and Williamson (1993:251) also state that when they talked of stocking rates in Sunan County, Gansu, the official pointed out how difficult it was to determine the carrying capacity of each particular pasture area because the weather is so variable and because each area had its own peculiarities.

This is not to imply that stocking rate considerations should be ignored; in fact, in both of these study areas we believe the stocking rates were initially set too high, largely associated with high assigned use rates and no forage being allocated to other users (wildlife, including insects, rodents, etc.). The root of the grazing problem is also closely tied with tenure changes, recent policies aimed at settling herders and a lack of appreciation of how traditional systems can maintain sustainable grazing and ensure other values such as wildlife and sustainable watershed management.

Traditional pastoral systems are likely to have provided the formal and/or informal institutions and norms for controlling animal numbers or pasture access. It is well known, however, that in these western China rangelands a consequence of these mobile systems was often large livestock losses ('natural regulation') under severe weather conditions. The settling of herders will decrease livestock losses associated with weather events, at least initially, because of improved supplemental feeds and shelters for livestock; however, this will come at a cost of increased overgrazing, initially around shelters and feeding pastures, and possibly greater future losses of livestock with increased overgrazing. Policy-makers should also consider that traditional pastoral production systems generate multiple uses and outputs that help to reduce risk. These systems often support more people and more livelihood opportunities in a given area compared to a 'ranching' system based on more intensive production, an important consideration with the growing populations of these areas.

Williams (1996a: 686) found that Mongolian herders had become apathetic about their ability to control livestock and herd dynamics, following policy

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initiatives to turn the former extensive system of open grazing into an intensive production regime. He suggests that the visual landscape cues that once guided local herders as they made daily and seasonal resource management decisions no longer provide the same information – herders became less confident about reading the landscape for purposes of production. In Kurti, herding abilities and traditional ecological knowledge are threatened by similar policies to settle herders as well as the weak control of livestock numbers by pastoral communities. In Jianshe, the situation has already moved beyond this, with most contract herders having no traditional herding experience and now only herding because of a lack of other livelihood alternatives.

We are also concerned that herders and government officials do not understand the impacts of settlement on future rangeland productivity and biodiversity and certainly seem to ignore some of the failures of these policies (Williams 1996a and 1996b, Sheehy in press). Recent forced closures of grazing lands will disenfranchise people from their lifestyle, are likely to reduce their future ability to engage in group decision-making with regards to those lands, and thus create strong feelings of resentment and dissatisfaction. We suggest from the examples of Kurti and Jianshe that rangeland enclosure should only be considered as a last resort where all other controls have failed to conserve natural resources. Enclosures may well have negative consequences as grazing intensity is increased in surrounding zones, thus fuelling resentment of neighbouring people. Coordinated plans are greatly needed, developed with rangeland users to initiate change and to begin the process of rangeland rehabilitation.

Notes

1. Chinese use the term 'grassland' to cover all types of vegetation that are exploited for forage for grazing or browsing animals (National Research Council 1992: 2) which is synonymous with the term 'rangeland' as used in the US.
2. The causes of overgrazing are often attributed to improper policies and 'free-access' as a heritage of China's collective past (Ho 2000: 386).
3. The Yugur originated from the Huigu people who were nomads around the Erhui River during the Tang Dynasty. In the middle of ninth century a group of Huigu migrated to the areas around Dunhuang, Zhangye and Wuwei in the Hexi Corridor in central-western Gansu Province and they gradually developed into a distinct ethnic group, the Yugur (Yang 1993, Ma 1994).
4. Shan means 'mountains' in Chinese.
5. Income per capita for herders was 4,096 Yuan compared to 1,256 Yuan for farmers in Kurti in 2000 (Personal communication with Xinjiang AHB officials, July 2002).
6. Personal communication with Xinjiang AHB officials, July 2002.
7. In Jianshe, there were no nearby weather stations. Monthly precipitation records for 1993, for 7 weather stations surrounding the study area, were obtained from Tao et al. (1997) (<http://cdiac.esd.ornl.gov/ftp/ndp039>). For stations at Jiuquan and Dulan, years 1994–1998 were obtained from National Data Center of NOAA at

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<http://cdo.ncdc.noaa.gov/cgi-bin/cdo/cdoprod>. Mean precipitation was 107 mm (16.4 mm to 286.3 mm) and an average coefficient of variation (SD/mean) of precipitation between years was 0.40 (from 0.59 to 0.16). As would be expected, data from weather stations in drier areas had higher coefficients of variations compared to weather stations that received higher precipitation. Much of the southern areas of Kurti, especially in the Jungar basin, are likely to have a similar high coefficient of variation in annual precipitation but data were not available. The more northern portions of Kurti have higher mean annual precipitation and probably a lower CV of annual precipitation.

8. Also see Scoones (1999) for an overview of non-equilibrium dynamics and how this new paradigm offers opportunities for interactions between social and natural sciences.
9. In Kurti Township, important species include red deer (*Cervus elaphus*), argali (*Ovis ammon*), Asiatic wild ass (*Equus hemionus*) and a newly reintroduced group of Przewalski's horse (*Equus ferus przewalskii*); see Fox and Jiao (2002). Wild ungulates of special concern in Jianshe include argali, wild yak (*Bos grunniens*), blue sheep (*Pseudois nayaur*), white-lipped deer (*Cervus albirostris*) and Tibetan wild ass (*Equus kiang*); see Harris (2000) and Harris and Pletscher (2002). Large predators in both areas include wolves (*Canis lupus*), Eurasian lynx (*Lynx lynx*), dholes (*Cuon alpinus*), brown bears (*Ursus arctos*), snow leopards (*Uncia uncia*) and eagles. Fox and Jiao (2002:10) suggest that the area of Kurti provides habitat for musk deer (*Moschus moschiferus*), and this species is found further to the west in the Altai. These species are variously categorised by both CITES (Convention on International Trade in Endangered Species) and the IUCN (International Union for the Conservation of Nature and Natural Resources or World Conservation Union) Red List.
10. Often, the owners would help at critical times such as lambing.
11. Most of the Kazak herders who met specified criteria were allowed by Chinese government authorities to emigrate to the newly independent state of Kazakhstan.
12. It will be shown later that there has been a large increase in Han in Xinjiang, but they were not part of the pastoral brigades as they were in Jianshe. The rate of population increase between 1949 and 2000 for Gansu and Xinjiang were almost identical with a 4.1- and 4.2-fold increase, respectively. Thus, the large increase in Han in Jianshe was not associated with a greater rate of population pressure from outside and as stated previously the total population actually declined. In Gansu, Han have been the majority throughout the twentieth century and presently make up 91 percent of the population.
13. Personal communication with Xinjiang AHB staff and county officials, July 2002.
14. A further risk from new irrigation developments and inefficient irrigation water use is the reduction in environmental flows to support the wetland and aquatic ecosystems of Ulungur Hu – the lake into which the Ulungur River flows. This lake is an important habitat for many species and as a terminal wetland it is extremely vulnerable to changes in environmental flows.
15. Banks (1997: 62) found a similar decrease in 1966 in Altay at the beginning of the Cultural Revolution, when severe restrictions on private herd ownership were reintroduced and pastoralists slaughtered their private herds to prevent their transfer to communal ownership.
16. The pastoral production brigades or livestock collectives became pastoral villages with the disbanding of communes in Xinjiang in 1984 (Banks 1999: 299).
17. These rights are now in the form of long-term leases (fifty years) to the households.

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18. Ho's study in three counties in western China did not support non-equilibrium rangeland theory that the herbivore population would fluctuate according to rainfall and evapotranspiration conditions. This was largely theorised to be associated with the ability of natural disasters being buffered by local and state groups. He states, however, that the non-equilibrium theory has made a major contribution by drawing attention to the practical value of carrying capacity as a guiding principle for rangeland policy and management, and stresses that in both Africa and China, rangeland management on the basis of carrying capacities has proven to be unfeasible, or to involve very high enforcement costs.
19. As stated previously, the degree of variability in these systems is still in question, but there is no doubt that much of the drier areas have high temporal and spatial precipitation variability.
20. We note that the low priority given to wildlife habitat persists despite the presence in both townships of hunting areas managed by county-level Forestry bureaux for international (i.e., trophy) hunters; see Harris and Pletscher (2002).
21. We considered the desert, semidesert, and possibly steppe areas were probable non-equilibrium environments (a high coefficient of variation in annual precipitation) as mean precipitation was low and both herders and officials mentioned that annual production often varied by 50 percent.
22. Personal communication with AHB staff, July 2002.
23. Both species were recently introduced again.
24. A wild camel reserve was recently established in Xinjiang to conserve the remaining wild herds.
25. www.xify.gov.cn/news/75/2005624183319.htm. Because of its remoteness, implementation of this programme has been modest in Jianshe. However, fencing is being erected in other Kazak townships in Aksai County, and the nearby Kazak Township of Heping, also in Aksai County, appears headed from a traditional pastoralist system toward the absentee landowner model seen in Jianshe.
26. <http://www.china.org.cn/english/environment/46807.htm>

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