
Property Rights and the Environment in Pastoral China: Evidence from the Field

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ABSTRACT

It is widely perceived that the degradation of China's rangelands has accelerated since the introduction of rural reforms in the late 1970s. The popular explanation for this phenomenon has been that a 'tragedy of the commons' exists, as privately-owned livestock are being grazed on 'common' land. Since the passing of the Rangeland Law in 1985, Chinese pastoral tenure policy has emphasized the establishment of individual household tenure as a necessary condition for improving incentives for sustainable rangeland management. Yet household tenure has yet to be effectively established in many pastoral regions. The first objective of this article is to describe pastoral tenure arrangements in northern Xinjiang-Uygur Autonomous Region. Its second objective is to explain pastoral tenure arrangements, particularly the observed persistence of collective action. It is argued that there is no 'tragedy of the commons' and that it is characteristics of rangeland resources and the social environment that give rise to the particular types of institutional arrangements found.

THE CONVENTIONAL PERSPECTIVE ON CHINESE PASTORAL TENURE AND THE ENVIRONMENT

China's rural reforms, initiated in its cropland regions in the late 1970s, spread to its pastoral regions by the mid-1980s. Central to the initial reforms was the replacement of the commune system with the Household Responsibility System, under which households were granted greater autonomy with respect to farm management. In pastoral regions, former commune livestock were distributed in ownership to households, on the basis of their total population and labour force. Production quotas were reduced and livestock product marketing channels liberalized. After the payment of government taxes and fees, households were entitled to residual income. The reforms have had a positive impact on pastoral household incomes but it is widely perceived by Chinese policy-makers and researchers that the

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sustainability of these gains is being threatened by accelerating rangeland degradation. They have estimated that some 90 per cent of China's rangelands, which account for 40 per cent of its total territory, are now degraded to some degree, including 42 per cent moderately to seriously (SDPC, 1996: 82–94; SEPA, 1998). Furthermore, policy-makers and researchers perceive overstocking to be the principal proximate cause of rangeland degradation. The extent and scientific causes of rangeland degradation in China are contested (Ho, 2001). However, this paper does not attempt to engage in that debate but instead focuses on the institutional dimension of rangeland management.

Policy-makers and researchers commonly attribute 'overstocking' to a lack of clearly defined property rights in rangelands. The prevailing interpretation of government officials and researchers is that, to the extent that household tenure has not been established, there are virtually no institutional arrangements for the management of pastures (Li and Duo, 1995; Longworth, 1990, 1993; NRC, 1992; Tuoman, 1993; Yu et al., 1996; Wang, 1995). Thus it is widely believed that a classic 'tragedy of the commons' situation, of privately owned livestock grazing on 'common' land, exists. Government policy has sought to remove perceived property rights ambiguities through assigning long-term use rights to rangelands to individual households. This policy is predicated on the assumption that the establishment of individual household tenure will give pastoralists the incentive to stock pasture within carrying capacity and invest in pasture improvement. Paralleling the establishment of household tenure is the government's endeavour to assign stocking rates to each household pasture and establish sanctions to deter overstocking. According to official statistics, the contracting of rangeland use rights to individual households is almost complete in most of the major pastoral provinces.¹ However, these official statistics need to be interpreted with caution. As the field study from northern Xinjiang will highlight, the issuance of rangeland use contracts to households is not necessarily synonymous with the establishment of individual household boundaries in rangelands. This failure to effectively establish household tenure in China's extensive rangelands over two decades since the initiation of rural reforms, contrasts sharply with the case of cropland areas, where household tenure was virtually established overnight.

Drawing on the literature on property rights and the environment, it is hypothesized that household tenure has been difficult to establish because it is not congruent with the Chinese pastoral context. The relative efficiency of an institutional arrangement for natural resource management will depend

1. Use rights to some 79 per cent of total useable rangeland in Inner Mongolia (1990 data from the Animal Husbandry Bureau), and 94 per cent of total useable rangeland in Xinjiang (1999 data from Xinjiang Animal Husbandry Bureau) have been assigned to individual households. See Ho (2000a: 242) for other provinces.

on the characteristics of the natural resource, the social norms and values of the resource users and the broader institutional environment. These factors all impact on the transaction costs — the costs of co-ordination, information gathering and monitoring and enforcement — associated with a given institutional arrangement (Eggertsson, 1990: 15; Hanna et al., 1995: 18). Thus household tenure cannot be assumed, a priori, to represent the most effective and efficient institutional arrangement for natural resource management. This proposition is examined in the context of pastoralism in northern Xinjiang-Uygur Autonomous Region (hereafter referred to as Xinjiang).

A CONCEPTUAL FRAMEWORK

There is growing recognition of the regional diversity of property rights in rural China. Moreover, this diversity has been construed as the outcome of a decentralized process of institutional innovation that enables local conditions to shape institutional arrangements (Kung, 2000; Liu et al., 1998). This article adopts this general approach. However, the aforementioned papers and other recent literature on property rights reform and land tenure in rural China (for example, Li et al., 1998; Oi, 1999) have an almost exclusive focus on arable land tenure. The literature considers certain aspects of arable land tenure, such as land tenure security and the transferability of land use rights, and uses variables such as land scarcity, the availability of off-farm work opportunities and the importance of the area for national grain production to explain variation in them. This article, in contrast, focuses on pastoral land tenure and, in particular, a certain aspect that distinguishes it from the arable sector: the persistence of group tenure.² The distinct tenure arrangements found in pastoral regions are largely explained in terms of the resource characteristics of extensive rangelands.

Rangelands in the context of pastoral China and other developing areas can be construed as a type of common pool resource. A common pool resource has two defining characteristics, those of being non-excludable and subtractable, in the sense that one person's use of the resource reduces the availability of the resource to others (Ostrom et al., 1999: 278–79). Rangelands have certain resource characteristics that make the exclusion of other users difficult. They are expansive in nature and used on a seasonal basis,

2. The establishment of household tenure in cropland areas during the early 1980s is unanimously accepted in the literature as improving economic incentives at the household level (see, for example, Lin et al., 1996; Putterman, 1993). The literature thus does not focus on the issue of household (versus group) tenure, but rather the efficiency and equity implications of certain other characteristics of the cropland tenure system, including the periodic re-allocation of household land use rights (see, for example, Kung, 2000; Li et al., 1998).

which makes the monitoring and enforcement of boundaries potentially problematic. Exclusion via fencing can be costly relative to benefits, given the low productivity of rangeland resources (Anderson and Hill, 1975: 171–2), or households may simply lack the financial resources to invest in it. Fencing may also impose other costs, including the prolongation of routes between different seasonal pastures and reduced access to watering points. In regions where fencing conflicts with social conventions, the fences themselves may need to be monitored and enforced or face the risk of destruction or expropriation by others. Exclusion is thus the first of two fundamental challenges facing common pool resources: the second is the challenge of creating incentives for legitimate users to invest in resources and utilize them within biophysical constraints.

Another pertinent characteristic of rangeland resources, other than their expansiveness and the related difficulty of exclusion, is their variability. In arid and semi-arid environments, where rangelands are usually located, variability in the temporal and spatial distribution of rainfall induces similar variability in rangeland resources. There is a growing literature, falling under the general rubric of the ‘new range ecology’ and to date mostly concerned with savannas in Africa, that focuses on rangeland ecology and management in highly variable environments (Behnke et al., 1993; Scoones, 1995). According to the theory, rangelands in such environments are in perpetual ecological disequilibrium rather than gravitating towards an equilibrium state. New range ecology has implications for the twin challenges posed by common pool resources, of exclusion and internal regulation. The implication for exclusion is that flexible boundaries that facilitate mobility are needed, rather than fixed boundaries that establish strict exclusion. The implication for internal regulation is that the standard concepts and tools of conventional rangeland management, including carrying capacity and stocking rates, may have little relevance to rangelands in highly variable environments. Rainfall, rather than past or present livestock numbers, is the major determinant of grassland productivity in any given year. The new range ecology thus challenges conventional wisdom about the link between livestock numbers and rangeland degradation, and even whether long-term rangeland degradation processes are actually evident. New range ecology theory is starting to be belatedly applied to China’s rangelands (Ho, 2001).

Common pool resources can be governed under four broad types of property rights systems: open access, common (or group) property, private (or individual) property and government property (Bromley, 1991; Ostrom et al., 1999). These represent ideal types and actual property rights systems do not exist in these pure forms, but represent different combinations of them along a spectrum from open access to private property (Hanna et al., 1995: 19). No single type of property rights system can be prescribed as an optimal solution to the challenges of exclusion and regulation posed by common pool resources (*ibid.*). However, for any property rights system to

be effective, it will need to be well specified, appropriate to the local context and enforceable (ibid.).

Open Access

Open access is the absence of any enforced property rights. As Hardin's classic paper 'The Tragedy of the Commons' (1968) demonstrated, in such a situation there is an inherent tendency for individuals to overexploit the natural resource base. Using the situation of private animals being grazed on common land, Hardin showed that an individual had the incentive to overexploit the commons because the benefits of him using the commons accrued wholly to himself but the costs were borne by all users. The major implication of the 'Tragedy of the Commons' is that common pool resources need to be privatized (Hanna et al., 1995: 18) or brought under centralized state regulation (Ostrom et al., 1999: 278) to ensure their sustainable management. The 'Tragedy of the Commons' implicitly informs the popular view of the Chinese pastoral situation, which seemingly exhibits the right ingredients of privately-owned livestock, 'common' lands and significant resource degradation. Hardin's paper helped raise critical awareness of the distinction between open access, the situation that he was really referring to, and common property, a situation in which property is owned by a group and its members' rights and duties are specified and enforced (Bromley and Cernea, 1989). To the degree to which property rights are not well specified or enforced, there may be an element of open access under any property rights system. Internal open access captures the situation where access to a common pool resource is restricted to a clearly defined group (the first challenge of CPRs is overcome) but the group has no enforced rules for regulating their members' use of the resource (the second challenge of CPRs is not).

Private Property

Private property is the case of resource use rights being held by private individuals or firms. Private property is often regarded as both a solution to the challenges posed by common pool resources and the lowest-cost institutional arrangement available. The theoretical foundations for natural resource privatization can most directly be traced to the Property Rights School (PRS), whose founding contributors included Demsetz (1967), Furubotn and Pejovich (1972) and Posner (1977). According to the PRS, changing factor prices caused by increasing population pressure on natural resources, or the development of new technologies or markets, induces institutional change. The PRS typically predicts an evolutionary path of

institutional change, from open access to common property to private property. The PRS has been used to explain the evolution of property rights in the North American West (Anderson and Hill, 1975). Population pressure and commercialization increased the benefits of exclusion, whilst the introduction of barbed wire decreased the cost of exclusion, inducing a shift from open access to common property then private property.

Private property is seen as embodying the efficiency-enhancing characteristics of completeness, exclusivity, transferability, and enforceability (Posner, 1977: 10–13; Randall, 1975: 157–8). Exclusivity ensures that users have the incentive to invest in land improvements and adopt sustainable land management practices. Transferability provides owners with access to credit, since land is an important form of collateral in rural developing areas, and also ensures that resources gravitate to their highest-value use. The PRS has provided the theoretical underpinnings for rangeland privatization programmes in Africa and Central Asia, as well as contemporary Chinese pastoral tenure policy. In practice, however, the establishment of household tenure in extensive rangeland areas has frequently been associated with adverse equity and environmental consequences (Baland and Platteau, 1996; Lane, 1998: 13–15; Lane and Moorehead, 1995; Williams, 1996: 680). For example, the private enclosure of rangeland has been observed to put pressure on the remaining commons through displacing farmers to these areas. In Inner Mongolia, pressure on the commons has also been exacerbated by the tendency of households that enclose first to continue to utilize the commons, in effect keeping their new private pastures as contingency reserves (Williams, *ibid.*).

The efficiency of any particular institutional arrangement depends on the wider institutional environment in which it is embedded. The case for the superiority of private property assumes perfect information and complete markets. In the real world, these are never found and this seriously limits the use of institutional arrangements and outcomes associated with hypothetical Pareto optimality as a benchmark for evaluating real institutions (Baland and Platteau, 1996; Furubotn and Richter, 1997: 458–62;). Rural China is no exception, with its grain markets still being regulated by the state (Oi, 1999) and its markets for credit and labour being characterized by considerable imperfections (Lin, 1995; Nyberg and Rozelle, 1999). In short, the broader institutional environment that is necessary for the optimality of private property in rural land to be confidently asserted is not even nearly present in rural China (Dong, 1996: 915–16). Thus in summary, the transition to private property may be a costly and lengthy process that will, even in the best-case scenario, aggravate property rights ambiguities and resulting degradation problems in the short to medium term. Furthermore, given the fundamental nature of rangelands as common pool resources as well as the broader institutional environment, the transaction costs associated with household tenure may be greater than those associated with alternative tenure arrangements.

Common Property

Common property is the case where resource rights are held by a group and members' rights and duties are specified (Bromley and Cernea, 1989). There is increasing evidence that common property regimes can be successful at overcoming the challenges posed by common pool resources (Baland and Platteau, 1996; McCay and Acheson, 1987; Ostrom, 1990). Furthermore, common property may represent a lower-cost institutional arrangement than private property in some contexts (Eggertsson, 1990: 123). One potential benefit of common property is that it can facilitate the realization of economies of size with respect to herding labour (Dahlman, 1980; Stevenson, 1991). This could be particularly so if the best strategy for grazing management entails the maintenance of specialized herds in different locations at any one time. Households' pooling of livestock into specialized herds and sharing of herding tasks will reduce an individual household's herding labour requirements.

Another potential advantage of common property relates to its essential embeddedness in social relationships, structures and norms (Baland and Platteau, 1996; Ostrom, 1990). Bilateral and multilateral reputation mechanisms can be effective in ensuring members' adherence to group norms and rules. This constrains individual opportunism, and thus the likelihood of free-riding behaviour, and lowers monitoring and enforcement costs. Common property regimes can also provide low-cost arenas for the resolution of property rights disputes. Private property regimes, in contrast, require considerable social overhead investment in structures for the recording and administering of property rights, and the adjudication of disputes. Social norms can not only lower the potential cost of collective action but, more fundamentally, influence people's preferences. Kung (1995: 106) finds that Chinese agricultural households are in favour of retaining collective ownership of land and the associated periodic adjustment of household holdings in response to demographic change, particularly in areas where there are few off-farm employment opportunities. Such institutional arrangements may reflect embedded socio-cultural preferences in favour of equity coupled with the importance of access to land for providing basic livelihoods. A final benefit of common property, particularly in the context of arid and semi-arid environments that are subject to high variability in the temporal and spatial distribution of rangeland resources, is that it aids the management of environmental risk, through facilitating mobility and flexible access, at lower cost than alternative arrangements (Scoones, 1995).

However, the potential for mutual benefits through co-operation is not sufficient to ensure co-operation. Rather, individuals require assurance that, if they adopt co-operative strategies, others will follow suit rather than free ride. This has been called the 'problem of assurance' (Lane and Moorehead, 1995; Runge, 1984, 1986). Group homogeneity in terms of mutual dependence on and shared interests in the resource, and small group size, appear to

be conducive to the resolution of the assurance problem (Baland and Platteau, 1996: 298–302; Ostrom, 1990). Evidence that individuals are able to overcome the assurance problem is provided by the many cases of successful collective action for common pool resource management (Baland and Platteau, 1996; McCay and Acheson, 1987; Ostrom, 1990).

Co-Management

The relatively recent literature on co-management reflects the increasing level of awareness of the potentially complementary roles of state and rural communities in natural resource management (Baland and Platteau, 1996: 346–7). The state plays a critical role in governing institutional arrangements. At a macro level, it determines the general institutional environment and, more specifically, the range of possible institutional arrangements that resource users can adopt. Even endogenously evolved common property regimes have to be ‘nested’ in a supportive external institutional and political environment, lest lack of state recognition undermines their existence. The state is also required to act as enforcer of last resort when community mechanisms fail to solve property rights disputes, whether they be internal or relate to the expropriation of common pool resources by external users (Baland and Platteau, 1996; Johnston, 1997; Ostrom, 1990). States may also be relatively better than communities at processing information on ecological dynamics over time. Rural communities have to offer knowledge about local ecological, social and economic conditions, which is instrumental in the design of appropriate institutional arrangements. They also may possess low-cost arenas for the quick resolution of disputes and more effective mechanisms for the monitoring and enforcement of rules.

The co-management framework is also useful in another sense. The four types of property rights systems commonly identified in theory — open access (non-property), private property, state property and common property — are ideal-types. Property rights systems in practice are much more complex, and no more so than in rural China. Although most rural land is ‘collectively owned’, this is not synonymous with ideal typical common property. For a start, collective ownership is not well defined in Chinese law (Ho, 2000a). There is ambiguity regarding the position of the village (or ‘collective’) leaders: are they representatives of the community or the lowest echelon of the state administrative apparatus? The state exerts significant influence over decision-making via its policies on land allocation and land use. To further complicate the situation, arable land has been contracted out to households for relatively long periods of time (now thirty years) and land-use rights can be inherited. Such long-term and exclusive use rights to land are a feature of private property, though private property does not strictly exist because of formal restrictions on transferability and alienability, and the informal village practice, now not as widespread as

originally assumed (Kung, 2000), of periodically reallocating land in accordance with demographic changes. The co-management framework is thus useful, given the difficulty of conceptualizing the Chinese rural situation in terms of standard property rights typologies and because the framework enables a focus on empirical realities.

PASTORAL TENURE IN NORTHERN XINJIANG

This article is based on a study conducted in Altay Prefecture in northern Xinjiang. Pastoralism still forms an important source of livelihood in Altay, with the pastoral population constituting some 22 per cent of its total population of 550,000 people.³ Most pastoral communities are Kazak by ethnicity, their descendants having migrated east from present-day Kazakhstan as early as the mid-eighteenth century. Despite a rapid increase in the Han population since 1949, Kazaks still account for some 50 per cent of Altay's total population.⁴ Pastoralism is the predominant form of land use, with rangeland accounting for some 81 per cent of Altay's total area compared with cropland's 2 per cent.⁵

Pastoralists are semi-nomadic, migrating between summer pasture in the Altay mountains and winter pasture in the Junggar Basin, up to 160 km away. In the foothills in between and on the edge of the Junggar basin lies spring–autumn pasture. The winter base of most households is also located at the edge of the basin, next to the natural flood plain of rivers where hay is harvested or, in the case of officially 'settled' households, alongside their irrigated plots. Pastoral household settlement constitutes the core of the state's current pastoral development strategy. Settlement entails the construction of irrigated land for pastoral households, on which they grow fodder (principally perennial grasses) and food crops. By the end of 1997, over 60 per cent of the pastoral households in Altay had been 'settled'.⁶ World Food Programme (WFP) Project 2817, which lasted from 1989 to 1994, was responsible for the settlement of over half of these. Settlement has generally reduced the demands on, and duration of use of, winter pasture, but the livestock of most settled households still utilize summer and spring–autumn pasture, if not winter pasture as well. Less than 1 per cent of all pasture is fenced, with hayfields and perennial grasses accounting for the major proportion of this area.⁷

3. Statistics Division, Altay Prefecture, 1995 data.

4. The Han population increased from 1000 to 237,000 between 1949 and 1995, with their proportion of the total population increasing from 2 per cent to 43 per cent over the same period (Statistics Division, Altay Prefecture).

5. Land Division, Altay Prefecture. Figures based on a 1991 land-use survey.

6. Animal Husbandry Bureau (AHB), Altay Prefecture.

7. AHB, Altay Prefecture.

Although summer pasture is the smallest in terms of area, accounting for only 14 per cent of Altay's total pasture, it is also the most productive, some four times more productive than the much larger winter and spring–autumn pastures (Zhang, 1992: 114–15). This is partly related to differences in rainfall, with the Altay mountains receiving an average of 630mm of rainfall per annum, whereas the lower regions where spring–autumn and winter pasture are located only receive on average 126mm and 210mm respectively.⁸ Although annual rainfall and grassland productivity is quite variable in spring–autumn pasture (the driest), the coefficient of variation in annual rainfall is some 26 per cent,⁹ putting it below the 33 per cent threshold that is commonly regarded as a definitive indicator of rangeland ecology in disequilibrium. There is considerable variation in seasonal temperatures, which in spring–autumn pasture average -16°C in January, the coldest month, and $+22^{\circ}\text{C}$ in July.¹⁰ Minimum temperatures of -45°C and maximum temperatures of $+38^{\circ}\text{C}$ have been recorded in the Altay region.

The critical feed constraint for pastoralists is winter and early spring, a constraint that pastoral household settlement is designed to help alleviate. Grazing pressure on all pastures has increased considerably over the last half century, with livestock numbers and sheep-equivalents rising some seven- and six-fold respectively between 1949 and 1997.¹¹ Rangeland degradation is perceived by prefecture and county officials to be an increasing problem, particularly in spring–autumn pasture, where urban populations and agricultural settlements also tend to be concentrated. Degradation in the vicinity of agricultural settlements is in part attributed to the increased number of livestock being raised by agricultural households, which now account for some 28 per cent of Altay's total 4.4 million livestock.¹²

Xinjiang's *de jure* pastoral tenure, provided by its 1989 regional variant of the 1985 Rangeland Law and subsequent regulations,¹³ is based on national policy. It recognizes, in a somewhat vague way, that rangelands and hayfields are collectively owned and emphasizes that use rights to them should be contracted to individual households. Land use rights were originally to remain stable for a 'long period of time'. A thirty-year term was then introduced in the early 1990s and this was superseded by a fifty-year term in

8. Data for Buerqin County from the Buerqin County Weather Office.
9. The coefficient of variation was calculated on the basis of annual rainfall data (1960–97) acquired from the Buerqin County Weather Office.
10. Average of daily maximum and minimum temperatures; based on 1960–90 data acquired from the Buerqin County Weather Office.
11. Based on data from AHB, Altay Prefecture.
12. AHB, Altay Prefecture, June 1997 data, excluding pigs and donkeys. Pastoral households account for the remaining 72 per cent of livestock.
13. Principal regulations include 'Regulation on the Rangeland Contract in Xinjiang Uygur Autonomous Region', Government Regulation No.88 (June 1996), and 'Regulation on the Collection and Use of Rangeland Management Fees in Xinjiang Uygur Autonomous Region', Government Regulation No.247 (1992).

1996. Land use rights are assigned to the household as a corporate entity and are inheritable. The question of women's rights is not explicitly addressed in the legal and regulatory framework, though the prevalent practice is for use rights to be inherited through the male line. Use rights are not saleable and their transfer requires the administrative approval of the local Animal Husbandry Bureau, which has formal responsibility for implementing and monitoring the rangeland contract system.

For the purpose of this study, three case study communities in Altay were chosen. The communities represent the three different types of pastoral communities found in the region (see Table 1). Ak Tubeq and Sarkum are both typical in the sense of having their winter bases at the edge of the Junggar basin and being Kazak by ethnicity. Both communities have extensive summer, spring–autumn and winter rangelands. The major difference between them is that whilst Ak Tubeq is not yet officially settled, Sarkum was completely settled between 1989 and 1994 under the aforementioned World Food Programme project. Thus Sarkum has irrigated fodder land, whereas Ak Tubeq is still wholly dependent upon 'natural' hayfields around the vicinity of its winter base. The third case study, Kom, is one of the three mountain-based Tuvan pastoral communities in the region. These communities have much shorter migration patterns than the basin-based Kazak communities, travelling a maximum of 25 km between their winter bases on the valley floors, where their natural hayfields are located, and summer rangelands at higher elevations. The settled community, Sarkum, is the wealthiest, followed closely by Ak Tubeq, the most populous. Kom is one of the poorest communities in Altay, its poverty in part being associated with the length and severity of winter in the mountains. Animal husbandry is the major source of livelihood for virtually all households in the three communities.

The findings that follow are largely based on five months of fieldwork undertaken in the three case study communities in the second half of 1998. Fieldwork methodology included both rapid rural appraisal and a semi-structured survey of a random sample of 30 per cent of the households in each of the three case study communities (200 households in total).

Table 1. Background Data on Case Study Communities (1997)

Case Study Community	Ak Tubeq	Sarkum	Kom
Ethnicity	Kazak	Kazak	Tuvan
Winter base location	Plateau	Plateau	Mountains
Population	1580	1045	946
Livestock per person	23	29	5
Income per person (yuan)	1657	1955	< 899
Total pasture (ha)	37,291	40,023	–

Source: Buerqin County Animal Husbandry Bureau

Role of the Community

The community plays a significant role in the protection of community pastures from encroachment, regulation of seasonal movements between pastures and arbitration of disputes in all three case studies. Village boundaries in rangelands are clearly defined, usually by natural formations such as streams and forests, and have been relatively stable for at least half a century. During the season of use, pastoralists, particularly those with pasture close to their village's boundaries, are able to monitor and enforce village boundaries with little effort. The greatest potential threat is the out-of-season use of village spring–autumn and winter pastures by pastoralists or agriculturists from other villages.¹⁴ However, villages have derived a simple but effective way of dealing with such threats. They pay one or several of their households to remain in such pastures all year round to 'protect' them from encroachment. The protection of village pasture is not an issue for Kom, given its remote northern location. The only place where the borders of Kom's pastures adjoin the pastures of other villages is in summer pasture. Here the rule (discussed below) of allowing large livestock to wander across boundaries and the practice of herding small livestock within boundaries was generally adhered to by both Kom herders and their neighbours from other villages.

For all three case study villages, general time-bands for the movement of livestock between different major seasonal pastures have been set by the local Animal Husbandry Bureau (AHB). This ensures inter-village and intra-village co-ordination in the utilization of the seasonal pastures. However, village committees have some discretionary power to vary movement times in accordance with weather conditions. A village committee typically comprises a Communist Party secretary, the village leader and (sometimes) one or more deputy village leaders. In each major village pasture, during its season of use, a leader or deputy leader is typically present and provides governance in the field. In Kom no such arrangements are necessary because of the close proximity of all pastures, including summer pasture, to the village. The most critical, and closely monitored and enforced, seasonal movement is the departure of livestock from their winter base during spring. Their timely departure is required for the protection of village hayfields and croplands, which are unfenced. The timing of other movements between pastures is generally dependent on climatic and snow conditions and is ultimately governed by the leader in the field. There is village-wide co-ordination in movements, the most noticeable exception being the timing of the shift of Sarkum's herders from winter pasture back to Sarkum. This ranges from early January to late March, depending on whether or not the household has switched to an early lambing season.

14. Climate and location prevent the out-of-season use of summer pasture.

Village leaders are ultimately responsible for monitoring and enforcing rules relating to the timing of seasonal movements. Some allowance is made for exceptional family circumstances, such as sickness or death, but otherwise village leaders will warn non-complying households and, if this is not successful, impose fines on them. Household compliance to movement regulations is in fact very high, there being only a few households in each community each year that do not comply. Pastoralists noted that it was virtually impossible for a household to move its livestock without being detected by its neighbours or other villagers. The ease of monitoring movement rules, coupled with the threat of social sanctions, probably contributes to the high degree of household compliance. Another role of village leaders is the arbitration of disputes. In all three case study communities, disputes between households or groups of households over use rights to hayfields or pasture are uncommon. When a dispute does occur, and the parties involved cannot themselves resolve the matter, village leaders will mediate. Given that their mediation nearly always leads to the satisfactory resolution of disputes, pastoralists' recourse to more formal arbitration processes provided for by law, such as the presentation of the case to the local AHB or People's Court, is very rare.

Unit of Tenure

The case study communities, like all pastoral communities in the Altay region, have two different types of pastoral resources: hayfields, which are within the vicinity of the communities' winter bases, and rangelands. Whereas hayfields have been allocated to individual households, rangelands have tended to be allocated to groups of households. Hayfields were originally distributed to households in 1985, on the basis of household livestock numbers. Commune livestock were distributed to households in the same year, on the basis of population and 'labour force', or number of males between the ages of eighteen and fifty-five years, so this formula also indirectly determined the allocation of hayfields. Each household tended to receive just one hayfield, except in the case of Kom where households sometimes received two or three different fields. During Sarkum's settlement between 1989 and 1994, an irrigated plot for the cultivation of crops was assigned to every male aged between eighteen and fifty-five years old.

Household boundaries in hayfields in both Ak Tubeq and Kom have essentially remained the same since 1985, with the proviso that new families since 1985 have usually shared, or received a share of, the hayfield of the husband's parents. Tenure in Sarkum's irrigated project land has also remained stable but there have been periodic re-allocations of the village's original hayfields along the Ertix River, principally in favour of households that were settled on poor land. Boundaries in hayfields are clearly demarcated by natural or man-made formations, such as stands of trees,

large rocks or ditches. In Sarkum's settlement area, irrigation ditches clearly define household boundaries.

When communes were disestablished in 1985, usufruct rights to pasture in Ak Tubeq and Sarkum were assigned to small groups of households. Under the instruction of the production brigade and village leaders, the households organized themselves into groups to receive usufruct rights to pasture. In Ak Tubeq, 44 pasture groups emerged from its 214 households and in Sarkum, 27 pasture groups emerged from its 104 households. Each group was allocated a parcel in every major seasonal pasture. Some basic data on these 'pasture groups' is presented in Table 2. There was a strong kinship basis to the groups, with 89 and 90 per cent of the sample households in Ak Tubeq and Sarkum respectively being related to all or some of the other households in their group. Furthermore, the nature of the kin relationship was usually very immediate. This factor, coupled with Ak Tubeq's greater average household size of six people versus Sarkum's five, may help explain why pasture groups formed in Ak Tubeq were larger than those formed in Sarkum.

In Kom village, no pasture groups were formed to receive usufruct rights to pasture. Usufruct rights to pasture were initially ambiguous but informal tenure based on proximity to households' hayfields and prior use rapidly developed. Many of the households allocated hayfields far from Kom village proper built their houses in close proximity to their hayfields and utilized summer pasture at the top of the nearest mountains. Sometimes small numbers of households, often related and neighbours in the valley floors below, shared the same mountain pastures. However, the composition of these 'groups' and the delineation of their boundaries was more a product of the rugged and forested terrain than any conscious effort at pasture group formation. The lack of premeditated pasture groups in Kom clearly distinguishes it from the cases of Ak Tubeq and Sarkum.

The groups that were established in Ak Tubeq and Sarkum in 1985 in order to receive usufruct rights to pasture have persisted to varying degrees. This persistence is most notable in the case of Ak Tubeq where, between

Table 2. Pasture Groups

	Number of households in group		Kinship relationship of sample household to other households in group (%)			Original groups that have subdivided (%)
	Range	Mean	All related	Some related	None related	
Ak Tubeq						
1985	3-6	4.6	74	15	11	6
1998	3-12	6.0				
Sarkum						
1985	1-5	2.7	84	6	10	36
1998	1-8	3.2				

Source: survey data ($n = 143$)

1985 and 1998, the total number of pasture groups increased only slightly, from forty-four to forty-eight. This was due to the subdivision of several of the larger groups. Over the same period, the upper range and mean number of households in the groups increased due to new households constituted since 1985 (see Table 2). These new households follow patri-local residence patterns and thus become automatic members of their patriarch's group. Group membership has remained stable across the different seasonal pastures. Pasture groups in Sarkum have persisted to a lesser degree. In part this relates to changing resource endowments and demands associated with settlement. A sizeable portion of spring–autumn pasture was lost, leading to the opening up of all the remaining spring–autumn pasture to the whole village and the virtual dissolution of pasture groups in spring. There have also been reduced demands on winter pasture, which is now allocated on an annual basis by village leaders in accordance with group or household needs. Thus boundaries in winter pasture are re-delineated each year. Pasture groups have been the most stable and persistent in summer pasture, but even there, the number of rangeland allocation groups fluctuated, increasing from twenty-seven to forty-two between 1985 and 1998, largely as a result of the subdivision of many of the original groups. Over one third of sample households belonged to groups that had subdivided sometime during this period (compared with 6 per cent in Ak Tubeq, see Table 2). Many of the subdivisions coincided with the issuing of rangeland use certificates in 1989. The groups usually subdivided along close kin lines with, for example, the families of a father and his married sons staying together but more distantly related families separating to form their own groups. The upper range and mean number of households in the groups has nevertheless increased due to population growth (see Table 2).

The major instruments used in the implementation of China's formal pastoral tenure system have been rangeland use certificates and rangeland use contracts. Rangeland use certificates were issued to pastoral households in Xinjiang in 1989, and rangeland use contracts in 1995–96. The rangeland use certificates formalized the 1985 allocation of hayfields to households, clearly demarcating the household's individual boundaries, by way of sketch map, and the users of neighbouring fields. They also defined the general location of the seasonal pastures of the group that the household belonged to. Rangeland use contracts essentially complement rangeland use certificates. They are more specific than the certificates, setting out the area of different seasonal pastures that have been assigned to the household. However, they do not specifically define individual household pasture boundaries. The primary purpose of the government in hypothetically calculating the area of each seasonal pasture used by households was to enable the derivation of rangeland use fees, which are based on this. The contracts also specify the maximum stocking rates for the seasonal pastures assigned to households and clearly state that households must ensure that rangeland productivity is sustained or improved over time. The issuance of rangeland

use contracts to households has not, as central policy-makers intended, led to the establishment of individual household tenure, formal or otherwise, and pasture groups have continued. How this was able to happen is explained elsewhere (Banks, 1999) but essentially it relates to flexibility provided in Xinjiang's legal and regulatory framework, coupled with the dependence of Animal Husbandry Bureau officials on local leaders and communities for support during policy implementation. This created sufficient 'political space' for pastoral communities to significantly influence policy implementation.

Monitoring and Enforcement of Boundaries

Informal rules allow the temporary herding of livestock, big and small, over other villages' and groups' pastures during movements between seasonal pastures or in order to access watering points. These rules aside, the degree to which boundaries are monitored and enforced in all three case study communities varies according to the type of livestock and the type of seasonal pasture. Informal rules allow large livestock to graze freely irrespective of village or group pasture boundaries. Large livestock are not usually herded but cows in particular tend to stay within the vicinity of the herding household's yurt or house anyway. Thus the use of a village's or group's pasture by large livestock belonging to another village or group tends to be concentrated in border areas and operate on an implicit reciprocal basis. This contrasts with the case of small livestock, which tend to be herded, or at least regularly watched, throughout the day, and brought back to the herder's residence at night. Neglected sheep and goats can be stolen, attacked by wolves, or simply go missing.

The degree to which small livestock are herded within group and household boundaries varies significantly across different seasonal pastures. In summer pasture, small livestock are generally herded within such boundaries, though with some 'mixing' taking place in the vicinity of border areas. In spring–autumn pastures, although group boundaries are delineated and well known, they are totally ignored. A form of internal open access prevails, with only village boundaries being adhered to. In winter pasture, group and household boundaries in pastures are strictly adhered to. Even the reciprocal sharing of pasture in boundary areas is not common. Furthermore, not only is grazing confined within group or household boundaries, but even within these boundaries grazing is regulated to a degree not encountered in other seasonal pastures. This is to minimize the mashing up of snow and subsequent icing over of pasture. By the beginning of February, when most winter pasture has been depleted and some households (particularly from settled villages such as Sarkum) have vacated winter pasture, both village and group/individual boundaries are less adhered to. The seasonal variations described above can also be observed in the case

of Sarkum's pasture of Qeherstaw, which has the unusual status of serving as both a spring and winter pasture. During spring, an internal open access situation prevails, whilst during winter only those groups or households with winter pasture allocated in Qeherstaw are allowed to use it and internal boundaries are strictly monitored and enforced.

In hayfields, there is a seasonal 'switching' of tenure regimes. Hayfields serve both as a source of hay and winter pasture for large livestock. During spring and summer, no grazing is allowed and households observe their individual boundaries when cutting hay. From autumn, once the hay is cut and households' large livestock have returned, there is a switch in tenure to limited open access. Access is limited in the sense that non-community members are excluded and households graze their livestock within the general vicinity of their winter houses. Grazing is most restricted in Sarkum, where irrigation ditches surrounding a household's plot provide physical, though not impenetrable, barriers to livestock movement, and households generally ensure that their large livestock do not venture far beyond these. The rules relating to boundaries in pasture and hayfields are monitored through the direct observation of herders and households in the field. There is a very high degree of conformity to the rules but in the event of any grazing dispute, community leaders that are represented in the field provide mediation.

Interlinking Herding and Tenure Arrangements

Households make a variety of arrangements for the herding of their small livestock. These range from households directly herding their own livestock, to arrangements involving relatives, to the contracting of commercial herders from outside the village. The herding arrangements of sample households for small livestock are given by village and seasonal pasture in Table 3. Some common characteristics across different villages and seasonal pastures are evident. Firstly, forms of group herding arrangements are common. The converse of this, the case of a household herding its own livestock and only its own livestock (category 1.1), is not a standard arrangement in any of the case study villages. The incidence of this arrangement varies from a low of 8 per cent in the case of Sarkum's summer pasture, to (an atypical) 46 per cent in the case of Ak Tubeq's spring pasture.¹⁵ The relatively low incidence of such arrangements is not consistent with the rangeland contract system, which is premised on the basis of individual households herding their own livestock on their own pastures.

15. The high spring figure for Ak Tubeq reflects the high demand for household herding labour during the critical lambing season. The relatively high incidence in Kom is related to the close proximity between a household's summer pasture and its winter base.

Table 3. Household Herding Arrangements (% of surveyed households)

Herder(s) of household livestock	Summer			Autumn	Winter		Spring
	AT	SAR	KOM	AT	AT	SAR	AT
1. Household only:							
1.1 only own livestock	23	8	39	24	20	10	46
1.2 also relatives' livestock	27	18	8	12	16	20	10
Total	49	26	47	36	36	29	56
2. Relatives only	33	52	28	19	16	35	15
3. Household and relatives (jointly herding together)	13	5	6	42	44	18	26
4. Friends only	5	0	11	3	4	0	3
5. Commercial labour	0	16	8	0	0	18	0
Households using pasture	100	98	62	99	95	82	99

Source: survey data (n = 200)

Secondly, group herding arrangements have a strong kinship basis and are frequently exclusive to members of the same pasture groups. The percentage of households that utilize only their own labour and/or kin labour (the total of categories 1–3 in Table 3) ranges from a low of 83 per cent in the case of Sarkum's winter pasture, to a high of 98 per cent in the case of Ak Tubeq's autumn pasture. Herding groups are largest during seasons when a household's livestock needs to be subdivided according to type and grazed simultaneously in distant pastures, as in the case of Ak Tubeq and Sarkum during winter and Ak Tubeq in summer. A typical group herding arrangement involves a young family from the pasture group and young males from other households in the group jointly herding all of the group's small livestock together. The rest of the households take care of the large livestock in another pasture or at their winter base. Group herding arrangements are also common in Sarkum over summer, though for different reasons. Although all livestock are grazed in the same, rather than different, summer pastures, households have to simultaneously make provision for the management of their irrigated cropland in Sarkum proper. Thus it is common to find the arrangement whereby some households herd all of the pasture group's livestock in summer pasture and the other households reciprocate by managing the herding households' cropland in Sarkum.

A final characteristic of herding arrangements is the relatively low use of commercial labour. The use of such labour ranges from virtually nil in the case of Ak Tubeq to 16 and 18 per cent in the case of Sarkum's summer and winter pastures respectively. There is a difference between commercial herders in Sarkum and Kom. In Sarkum, herders typically come from outside the village (or even district or county), are employed on the basis of a written contract, and do not simultaneously herd their own livestock. In Kom, in contrast, commercial herders are usually from the same village, are employed on the basis of an oral rather than written contract, and usually

simultaneously herd their own livestock. Commercial herders have the incentive to herd the maximum number of livestock possible, as they are paid on a per livestock basis, until the risk of livestock loss (for which they are liable) increases sharply. In Sarkum, this occurs at around the 350–500 livestock mark, equivalent to about three to four households' livestock. Thus commercial herding has not undermined the practice of the herding together of more than one household's livestock. The advent of commercial herding in Sarkum coincided with the community's settlement from 1989 onwards and, as with other herding arrangements, it is interlinked with tenure. In summer pasture, tenure is relatively fixed and so commercial herders usually herd the livestock of households belonging to the same pasture group or neighbouring pasture groups. In winter pasture, where tenure can be flexible from year to year, commercial herders have relatively more freedom regarding the choice of households that they work for. Even, then, however, members of the same summer pasture group often have a preference for employing the same commercial herder over winter.

EXPLAINING INSTITUTIONAL ARRANGEMENTS

The Property Rights School offers some explanations for the pattern of institutional arrangements that have been observed in Altay. A basic hypothesis of the PRS is that there is a correlation between resource scarcity and more exclusive forms of property rights. This explains the observed evolution of individual tenure in hayfields and cropland, which constitute the scarcest of all pastoral resources as they provide critical winter feed. In contrast, group tenure rather than individual tenure has persisted in rangelands, which are less critical and of lower productivity than hayfields and cropland. Nevertheless, household tenure was found to be firmly nested in community-based arrangements: to ensure that household hayfields and croplands, which are unfenced, are protected over the summer period, the communities have the rule that all livestock have to be taken to summer pasture. Thus exclusion is ensured by institutional means rather than private investment in fencing. The relationship between resource scarcity and exclusion is also evident in seasonal variations in the monitoring and enforcement of group pasture boundaries. Group pasture boundaries are most strictly monitored and enforced during winter, when feed is scarcest.

Some of the central tenets of common property and co-management theory are also supported by the field observations. The case study communities have socially-embedded and low-cost mechanisms for the management of their natural resources, such as pasture groups. Pasture groups are of small size and are based on close kin relationships, which in turn makes it relatively easy to overcome the 'problem of assurance' inherent in collective action. One of the benefits of group tenure, it has been argued, is that it facilitates group herding arrangements and this in turn enables the

realization of economies of size with respect to herding labour. Households are able to re-deploy their labour from herding to other tasks, such as the cultivation of fodder crops, care of household dependants and pursuit of non-pastoral livelihood opportunities. The development of a market for herding labour has not significantly undermined this rationale for group tenure, given that the remuneration system for commercial herders also creates incentives for them to capture economies of scale through the herding of several households' livestock together.

The case study communities have other socially-embedded and low-cost mechanisms for the management of their natural resources. Communities monitor and enforce their pasture boundaries, throughout the year if necessary, through the stationing of rangeland protector households in pastures susceptible to encroachment. These arrangements are somewhat akin to what Ho (2000b) found in the context of agro-pastoral villages in Ningxia. Community leaders, with the support of community members, also effectively monitor and enforce rules concerning the timing of movements between different seasonal pastures. In addition, the leaders provide a low-cost channel for the resolution of the majority of pastoral tenure disputes. The state, in turn, helps to regulate the movement of livestock between different pastures, solve disputes between different communities and make fodder available during periods of drought or snowstorms. These, along with the community roles summarized above, give validity to the co-management hypothesis. The state has also been effective in ensuring a relatively even distribution of pastoral resources in Altay, as it has done with respect to arable land in other parts of China where off-farm livelihood opportunities are similarly limited (Kung, 1995; Liu et al., 1998).

There are externalities associated with any type of institutional arrangement and the observed situation in northern Xinjiang is no exception. Externalities can be expected to arise because of the lack of strict exclusion and the lack of internal regulation. The lack of strict exclusion is especially apparent in spring–autumn pasture, where internal open access prevails. Nevertheless, open access in spring–autumn pasture fulfils certain functions, including the facilitation of movement between winter and summer pastures and access to the few water sources available in this zone. It also enables equitable access to pasture, given the spatially patchy nature of spring–autumn pasture and the associated difficulty of dividing it fairly between different pasture groups. A lack of strict exclusion is also associated with fuzzy boundaries for large livestock in all pastures and for all livestock in summer pasture, both of which serve to reduce herding labour requirements. Externalities may also arise because of the lack of internal regulation. The state lacks the resources necessary to monitor and enforce the stocking rates enshrined in the rangeland contract system. The ignoring of official stocking rates by pastoralists cannot be attributed to a collective action problem at the pasture group level, given that the small size and social closeness of such groups provides a fertile environment for the overcoming of the problem of

assurance. However, the lack of strict exclusion transforms the assurance problem into a complex multi-tiered one that needs to be simultaneously solved at the inter-group and inter-community levels. As group or community internal self-regulation is not likely to evolve endogenously there is thus a need for the state to play a proactive role.

New range ecology potentially offers a different interpretation of the field findings. Exclusive boundaries are seen to be a problem rather than a solution to rangeland management in highly variable environments because they create immobility and inflexibility whereas the opposite are required. However, even assuming that rangeland productivity in Altay is highly variable, there is limited scope for using flexible boundaries as a means to manage environmental risk. This is because, according to government officials and pastoralists, there is a high covariance of environmental risk right across the Altay region. Thus, for example, in a dry year all pastoral communities are faced with similar conditions and, if anything, are even more protective of their pasture boundaries. Instead of using flexible boundaries to manage environmental risk, pastoral communities adjust the timing of their movements between the different seasonal pastures, and buy in additional feed. In terms of the challenge of internal regulation, new range ecology theory suggests that the conventional concept of carrying capacity and the use of stocking rates is inappropriate. To the extent that rangeland productivity is highly variable, this makes the non-observation of official stocking rates, which are fixed year-on-year and are thus unable to accommodate temporal variability, good management practice. Nevertheless, until such time that the degree of disequilibria in Altay's rangeland ecology has been definitively established, questions relating to the need for internal regulation and the appropriateness of different tools for internal regulation will remain unanswered.

CONCLUSIONS

The recent literature on property rights in rural China has recognized the regional diversity of property rights and explains this diversity as the outcome of a decentralized process of institutional innovation that enables local conditions to shape institutional arrangements. This study makes a contribution to this literature by documenting the property rights situation in an extensive rangeland area. The property rights in rangelands have been found to differ from those of arable areas and this difference has been in part attributed to the resource characteristics of rangelands, principally their expansiveness and seasonality of use, that make exclusion difficult. Previous analyses have not considered resource characteristics, perhaps because of their almost exclusive focus on arable areas.

This study also provides further evidence of the blurred property rights system in rural China. Private property is present in the sense that pastoral

households have individual, long-term (fifty-year) and inheritable use rights to hayfields and croplands. Furthermore, with the exception of winter pasture in Sarkum, there have been no periodic re-allocations of land use rights as has occurred in some arable regions of China. Group tenure arrangements have elements of both private and common property. They are private because they typically involve very close kin and inheritable and long-term (fifty-year) use rights. They are common in the sense that they involve multiple households. Common property is also present in the form of community-based institutional arrangements for the monitoring and enforcement of community boundaries and seasonal movements, and arbitration of disputes. The state is an influential actor too, establishing the rules for seasonal movement and acting as an arbitrator and enforcer of last resort.

It can be concluded that there is no ‘tragedy of the commons’ in the rangelands of Altay. A significant degree of exclusion and regulation of resource use was found in all three case study communities. Variations in the degree of exclusion relate in part to relative resource scarcities and in part to the benefits of limited open access in some pastures, including the facilitation of mobility and equal access. It has been argued that one of the principal reasons for group tenure is that it enables the capturing of economies of size with respect to herding labour. Although pasture groups lack any explicit mechanism for regulating their members’ stocking rates, this cannot be attributed to a collective action problem. The small size and strong kinship basis of pasture groups constitute solid foundations for overcoming the problem of assurance. Furthermore, their long-standing practice of group herding provides evidence of their capacity to act collectively. The activities of pasture groups are also nested in supportive community-based institutional arrangements for rangeland management. Thus the groups’ lack of adherence to stocking rate rules is more likely to stem from the inappropriateness of such rules than from any problem of collective action.

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