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Stream: Governance

Spatial and Social Scales and Boundaries: Implications for Managing Pastoral Land-use in Mongolia

Rangelands

I. Introduction

The goal of this paper is to examine the roles of spatial and social scales and boundaries as they apply to changing land-use patterns and tenure regimes in post-socialist Mongolia. In this paper I make two contentions. First, the spatial (ecological) and social scales at which the dynamics of land-use change are observed profoundly affect our perceptions of the processes at work, and hence the policy responses we propose. Second, the vagueness, permeability, and overlap of boundaries around pastoral resources and user groups (rights-holders) pose significant difficulties for implementation of formal tenure regimes designed to address insecure pastoral tenures and unsustainable land-use patterns. Alternative approaches to solving land-use and tenure problems must be developed for nomadic pastoral societies, where many of the assumptions of common property theory do not hold. One such approach, which may be suitable to Mongolia, is the local regulation of seasonal nomadic movements.

Before delving into the problems of scales and boundaries, I first provide a brief overview of the Mongolian pastoral production system and to the current situation in Mongolia.

II. Mongolia's Pastoral Production System

Sixteen percent of the Mongolia's 2.5 million inhabitants are pastoralists who herd some 28 million head of livestock. Half of the nation's population depends directly or indirectly on the pastoral economy for its livelihood, which accounts for over 30 percent of Mongolia's gross domestic product (Mongolian Business Development Agency and Tacis 1996). Herders use their animals for subsistence, relying on meat and dairy products for most of their calories; using wool, hair and hides to make their own clothing and equipment; burning dung for fuel; and using horses, camels and cattle for transportation. Herders also sell or barter a significant portion of their livestock products, especially wool, hair, cashmere and hides, as well as live animals and in some areas dairy products. These products are exchanged for additional food, cloth, clothing, household implements, and occasionally luxuries such as televisions, gasoline

generators and motorcycles.

Over 70% of Mongolia's 1.56 million square kilometers are grasslands or shrublands, most of them arid to semi-arid (Danagro 1992). The low mean precipitation and high interannual variability in rainfall, together with frequent droughts in the arid regions and periodic severe winter storms throughout the nation, give rise to the nomadic land-use strategy Mongolian pastoralists have used for centuries. Herders have traditionally moved their herds a minimum of 4 times yearly with the seasons to obtain the necessary nutrients, water and shelter for their animals according to the seasonal resources available and the nutritional and reproductive status of their livestock. Within this basic pattern there is great geographic diversity, depending on the productivity of the land, the diversity of local resources and topography, and the species of animals herded. Mongols traditionally kept 5 types of livestock (camels, cattle, horses, sheep and goats), although the proportion of each type in a herd varies among geographic regions, and to a lesser extent among wealthy and poor households of the same region.

Despite a long-term decline in nomadic mobility over the past 100 years, seasonal movement and nomadic flexibility remain the basic herd and resource management strategies of Mongolian pastoralists, who readily articulate the ecological rationales for their mobile lifestyles. Herders adhere to two basic norms of pasture use. First, they set aside pasture for use in the harsh, non-growing seasons of winter and spring. Grazing of these reserve pastures out of season, whether by their customary user or by a trespasser, is discouraged. Second, in case of a climatic disaster such as a drought or severe winter storm, herders in a less affected area allow outsiders from the disaster-struck locale access to their local pastures, including reserves, with the expectation of reciprocal treatment if circumstances are reversed in the future.

III. Study Communities and Methods

The argument presented in this paper is based on research conducted in two districts or *sums* in Bayankhongor Aimag (province) in west-central Mongolia, approximately 700 km from Mongolia's capital city, Ulaanbaatar (Figure 1). Jinst Sum (5,002 km²) is located in the desert-steppe ecological zone some 100 km south of the provincial capital. Bayan-Ovoo Sum (3,213 km²) encompasses steppe and mountain-steppe ecosystems and is located about 25 km northwest of the provincial capital. In each *sum* one administrative sub-district or *bag* was selected as a study community. Jinst's second *bag* included a total of 113 households, while Bayan-Ovoo's third *bag* was comprised of 224 households. During 1994-1995, I spent 10 months living with herding camps in these two communities as a participant observer. In addition, 215 formal and semi-structured interviews were conducted with herders and local officials in these communities and others in Arkhangai Aimag between 1993-1995. A formal household survey (N=102) covering land-use behavior, land tenure, and household production, consumption and demographics was undertaken in Jinst and Bayan-Ovoo in 1995.

IV. Privatization and the Transition to a Market Economy (1990-1995)

Following 70 years of Soviet-influenced communist rule, Mongolia held its first democratic elections in 1990. The political transition was followed by rapid liberalization of economic policies. Primary among these was the privatization of livestock and many state-run enterprises, including herding collectives. These national level structural changes had five direct effects on the pastoral economy and the welfare of herders:

1. Herders are responsible for all production inputs, risks and decisions.
2. Loss of the formal regulatory institution for pasture use (the collective).
3. An increase in the number of herding households.
4. A reduction in quality and availability of social services to herders.
5. Poor access to markets and terms of trade.

The opportunity to acquire livestock through privatization combined with increasing unemployment and inflation in urban areas led many urban Mongols to leave towns and cities and return to their native districts to claim a share of collective livestock. Some households with no claim to collective livestock, but no alternative means of support, also left the city, purchased livestock and took up a herding livelihood. Collective members who were employed in non-herding occupations received livestock through privatization, and many became full time herders following the collapse of the collectives. In Bayakhongor Aimag, the number of rural households increased from 8,510 in 1989 to 14,903 in 1993¹.

Poverty, which was virtually unknown in Mongolia during the collective era, rose sharply following privatization, with 27% of the national population falling below the official poverty line in 1994 (Griffin 1995). Growing disparities in household well-being between rich and poor herders have been documented (Cooper 1995), along with the changing status of health and education among herders (Griffin 1995, Hortsman and Tsetsegee 1995). Terms of trade for herders declined, due in part to the timing of economic reforms, which lifted price controls on many consumer goods while livestock prices remained under government control.

What have these changes meant for pastoral land-use and land tenure at the local level? First, despite the significant influx of "new" herders from towns and cities, herders overall continue to articulate the basic norms of pasture use. Most herders attempt to set aside reserve pasture and understand the negative ecological consequences of grazing out of season. Nonetheless, rates of out-of-season grazing and trespassing are high, especially in areas with many new herders. In addition, nomadic mobility has declined and year-round use of certain types of pastures has increased. These key pasture areas--desert riparian pastures in Jinst Sum, and winter

¹Some of the increase in rural households was due to the creation of "fictitious" households, such as the premature establishment of unmarried children in their own households in order to procure more livestock through privatization. Despite such abuses, there is little doubt the urban-rural migration contributed significantly to the increase in herding households.

and spring mountain pastures in Bayan-Ovoo Sum--were formerly grazed during only one or two seasons each year. Lack of access to services and markets and an increase in part-time herders and town-dwelling livestock owners, coupled with the loss of the regulatory function of the collective, have led to high concentrations of livestock near settlements and roads and an underuse of more remote pastures.

These changes in pastoral land-use patterns appear to be due in large part to increasing wealth differentiation among herders and the influx of new herders, combined with the lack of a strong formal or informal system of tenure or land-use regulation. Wealthy and poor herders differ significantly in access to livestock, transportation and labor, which in turn influence the ability of households to make seasonal movements. In addition, both poor herders and new herders are more likely to gain access to essential pasture resources indirectly, through association with wealthier and/or well-established kin or acquaintances who hold strong hereditary rights to particular campsites and pastures. This means that their rights to pasture are more tenuous, they are more reluctant to defend them, and may be more prone to trespass on the pasture of others.

Privatization also introduced a new element into local tenure systems by providing herders the opportunity to purchase formerly collective-owned animal shelters, usually located at winter or spring campsites. Many herders also built their own shelters from scratch. Purchased or built by hand, these shelters are *de jure* private property. Although the land on which shelters stand is still technically state property used in common by local herders, the possession of a visible structure on the landscape renders a campsite quasi-private property and significantly strengthens claims to the surrounding pastures, including the ability to defend them from out-of-season grazing. On the other hand, shelters are vulnerable to theft and vandalism, which has discouraged some herders from moving far from their winter and spring pastures during summer and autumn, contributing the decline in mobility and poor spatial distribution of livestock in relation to available resources.

Overall, the current pattern of pastoral land use in the study sites can be described as a downward spiral of decreasing pastoral mobility, and increasing trespass and out-of-season grazing. Declines in mobility lead to increased out-of-season grazing and trespass, while increases in trespassing and out-of-season grazing discourage herders from moving, in order to protect their reserve pastures and shelters from trespassers, even if this means they inadvertently end up grazing them out of season themselves.

V. Scale

Our understanding of the ecological and social causes and consequences of land-use change depends on the scale at which we observe ecological and social phenomena. I argue that a spatially extensive, community-level observational scale is necessary to understand the dynamics of social and ecological change in Jinst and Bayan-Ovoo Sums. Observations at a landscape and human community scale lead to conclusions about the nature of ecological and social change different from those

fostered by observations at the level of ecological patches and individual herding households. To illustrate this point, I show how two different observational scales promote contrasting perceptions of the ecological effects of grazing, the social causes of land-use change, and the possible solutions to unsustainable land-use patterns. In this discussion, a "pasture" is a homogeneous patch of land on the order of 10-100 ha. A "landscape" is an area of 100-1000 km² composed of a mosaic of different pastures, waterways, roads and settlements (Table 1).

First, let us look at ecological impacts. The effects of grazing are scale-dependent. At a pasture scale, livestock impacts tend to dominate ecological processes. Ecological dynamics at this scale appear unstable. High intensities of grazing may cause the disappearance of some plant species, as well as other changes in vegetation and soils from which a site cannot recover rapidly. Without controls on pasture-scale livestock populations, the likelihood that vegetation and livestock populations will be harmed is high, since at this spatial scale the livestock population is likely to be limited by forage constraints before density-independent mortality events occur. Thus, observed at the pasture scale, degradation is perceived to be caused by excessive stocking rates. To prevent undesirable impacts, the number of livestock per unit area, or the amount of time per livestock unit in the pasture must be reduced.

A landscape-scale perspective on ecological impacts is somewhat different. At a landscape scale, degradation is not ubiquitous, but rather confined to patches within the landscape. Plant populations that go extinct at a patch scale persist at a landscape scale. Abiotic processes limit livestock populations at a landscape scale and play a relatively greater role in determining plant productivity and species composition. The cause of degraded patches is perceived as poor spatial and temporal distributions of livestock rather than landscape-scale overstocking. The landscape-scale perspective reveals what ecologists have pointed out: locally unstable ecological dynamics may be stabilized by incorporating them into a larger spatial (or temporal) context (DeAngelis and Waterhouse 1987, Wiens 1989, Ellis and Swift 1988).

A spatial scale of observation implies a social scale. Decisions made about the use of a particular pasture are usually made by an individual herding unit such as a household or herding camp. At the pasture scale, such decisions appear to be made independently of other households and camps. Patterns of land-use within the broader landscape can be seen as the cumulative impacts of individual household decisions, or as the collective decisions of a community of users (usually embodied in formal or informal institutions and norms), or as the outcomes of a combination of individual and collective decisions. In some instances, government regulations formulated at regional or national scales constrain landscape-scale land-use decisions. Observational scale influences who an observer perceives to be the relevant actors and decision-makers, as well as the assumed interactions among these players. A larger observational scale facilitates a better understanding of the tensions among decisions made by individuals, norms and expectations for group behavior, and constraints imposed by larger or external forces, such as the state.

The major changes in pastoral land-use since privatization are 1) increased

year-round grazing of key resources that were previously used in only one or two seasons, and 2) localized increased stocking densities and resource shortages. The perceived social causes of these land-use changes vary with observational scale. From the observational scale of the pasture, the causes of overstocking and year-round grazing appear to be 1) resource scarcity and competition, 2) inability to exclude trespassers from reserve pastures, and 3) perceived insecurity of tenure. The inability to exclude trespassers suggests a lack of clearly defined and enforced property rights. The perceived lack of tenure security may lead herders to occupy a pasture or campsite for long periods of time (in order to establish and/or defend their right to possession), leading to inadvertent overuse.

From a landscape observational scale, poor spatial and temporal distributions of livestock and the resulting patchy patterns of degradation occur because 1) herders fail to move among seasonal pasture areas, 2) herders fail to use remote and underused pasture areas, and 3) the physical or spatial separation between seasonal pasture areas is inadequate in some areas. Poor livestock distribution and the failure of herders to move among seasonal pasture areas stem from a community-scale inability to organize and coordinate seasonal movements among distinct seasonal pasture areas. The social cause of land-use change at this scale is an assurance problem rather than a problem of defining and enforcing property rights. Herders lack confidence that a critical mass of other herders will move at the same time to the same seasonal pasture area. Viewed at a landscape/community observational scale, herders' actions are strongly interdependent, and sustainable patterns of land-use depend upon coordinated mutual expectations of behavior.

Lack of assurance among community members arises from at least three sources locally, which in turn are related to national scale economic and political change. The three proximate causes are institutional failings, lack of means to move, and qualitatively and quantitatively unequal access to pasture resources. First, in the absence of strong formal or informal regulatory institutions and shared expectations, herders have been unable effectively to regulate the timing and destination of seasonal movements since privatization. Second, poor herders lack the material means of mobility: labor and packstock or other transportation. The immobility of the poor further contributes to the overall lack of assurance among herders that a critical mass of livestock will migrate along predictable spatial and temporal patterns. Third, unequal access to key resources such as winter and spring pastures, shelters and water sources also influences mobility. Access to these resources is determined not only by wealth but also by status as a new or old herders--new and poor herders relying on more indirect and tenuous sources or pasture rights. Some herders have nowhere to move to a particular times of year, and others may be reluctant to move away from valuable key resources. Thus access to resources influences the mobility of individual households and camps, and further undermines mutual expectations about the timing and location of seasonal movements. The problem of key resource access superficially resembles that of resource scarcity and lack of defined and enforced property rights that I described from a pasture-scale perspective. It differs from this view in that

shortages of and competition for key resources are seen here in the context of the larger landscape, where different types of resources can be differentiated and the rights and land-use patterns associated with each distinguished. A landscape perspective is needed to grasp the interrelated and contingent nature of rights to different resources and patterns of resource use.

The two observational scales also have implications for the policy options we perceive and select. At a pasture observational scale, the problems appear to be overstocking and lack of enforcement and definition of property rights. Policy solutions in response to these problems will logically focus on regulating livestock numbers and developing more effective property institutions. Perceived from a landscape-scale perspective, the problems are poor livestock distributions, lack of institutions to organize and coordinate movement, and unequal access to resources within the community. Possible policy solutions to these problems include developing community-level institutions to coordinate and regulate seasonal movements, and addressing the practical obstacles to mobility (access to transport and labor) and social and economic counterincentives to mobility (lack of access to social services and markets). Additionally, this view encourages policy-makers to recognize the dynamics of access to multiple, distinct pasture resources and their consequences for land-use patterns, instead of accepting an oversimplified scenario of resource scarcity and overexploitation.

VI. Boundaries

Clear delineation of spatial boundaries around resources and social boundaries around groups of rights-holders have been proposed as essential prerequisites of successful common property regimes (Ostrum 1990 and 1992, Bruce 1996, Swallow 1994, Lane and Moorehead 1995, Shanmugaratnam et al 1992). However, spatial and social boundaries are difficult to define for rangeland resources used by nomadic pastoralists. First, the resources that nomadic herders rely on are multiple and overlapping, representing a corresponding multiplicity of associated use rights, which are often contingent upon one another (see Table 2). For example, rights to reserve winter pasture depend largely on rights to an adjacent campsite, the rights to which, in turn, are most effectively secured by ownership of a shelter at the campsite. Second, among these multiple resources are many that are difficult or impossible to delineate spatially, except at very large spatial scales, due to inherently flexible or fuzzy resource boundaries. These indistinct and flexible boundaries are the result of the spatial and temporal variability in resource quality and abundance that characterize non-equilibrium rangelands, and the mobile and flexible nomadic strategy of resource-use (Turner forthcoming). Third, the groups of resource-users who exploit these multiple resources are also overlapping, constantly shifting in composition, and consequently difficult to define. For example, the composition of a herding camp often changes from season to season, as does the composition of the herding "neighborhood." A poor herder may rely on kinship to gain access to a winter campsite and pasture, but can more easily find a summer campsite on her own. The same herder may have rights to

a water source that her more wealthy relative does not. As Turner (forthcoming) argues, this flexibility in social composition may be seen as an adaptive strategy to cope with uncertain economic and political as well as environmental conditions (Also see Sneath 1993 on Mongolia, Björkland 1990 on Saami reindeer pastoralists). In the Mongolian context households rely on a variety of different social relationships to gain access to different types of resources, including essential goods and services from towns as well as pasture resources. Further, the nature of the relationship may determine the quality and security of resource access. Depending on the relative availability of different key resources as well as other social and economic factors, herders may need to shift alliances or tap into alternative sources of resources or rights, trading material or social capital for resource access. Finally, the "open access" ideal of pasture use espoused by Mongols and other pastoralists (Mearns 1996, Gilles 1988), makes it difficult to arrive at a finite membership list. Many people have at least some claim to use rights, even if these claims are not strong, and the principle of reciprocity that underlies the moral economy of the steppe discourages herders from expelling those with legitimate if weak claims.

These characteristics of rangelands and nomadic pastoral societies raise questions about the viability of common property resource management institutions in arid and environmentally variable rangelands. Are there ways to achieve tenure security that don't require strict social and spatial boundary delineation? Can self-regulation be successful in the absence of tenure security? I have suggested that part of the difficulty in describing the problem of joint use and conceptualizing solutions to it arises from overly restrictive spatial and social scales of observation. One advantage of adopting extensive spatial and social scales of observation is that it frees us to consider both the resource base and the social system as dynamic and hierarchically structured wholes, accepting the tensions between individual and collective choice in the social arena, and the structural and functional interactions between point resources, patches and landscapes in the ecological domain.

VII. An Alternative to Tenure Formalization

Runge (1984, 1992) outlines an approach to conceptualizing the commons that he terms "the assurance problem." Runge argues that the intrinsically interdependent nature of individual resource-use decisions in developing economies makes maximizing (free-riding) behavior unlikely. In these socio-economic contexts individual decisions are influenced not only by the actual cumulative actions of other group members, but also by expectations about those actions (Runge 1992). "If the use of common resources is conditional on these expectations, this interdependence places a premium on mechanisms that coordinate community decisions. The key observation that bears emphasis is that such mechanisms tend to arise from many different rules, customs, or conventions, of which private exclusive property is only one example." (Runge 1992, p.27-28) I suggest that common exclusive property is also only one possible mechanism among others for achieving coordinated resource-use. "The key

element that determines the success or failure of institutions is therefore the extent to which the institutions foster coordinated expectations in relation to a particular physical and social environment." (Runge 1992, p.30) Achieving security of tenure over common property resources can be seen as an assurance problem. In this instance lack of assurance arises from uncertainty about the enforcement of social and spatial boundaries, and is solved by clear delineation of boundaries and exclusion of outsiders. Property institutions are thus one solution to the assurance problem because they provide coordinated expectations about other herders' behavior. They are not necessarily the only solution. I propose that there is another way to look at the assurance problem in a rangeland context that does not invoke property directly, and thus avoids the necessity of rigid definitions of user groups and resource boundaries.

In the discussion of scale, I showed that sources of uncertainty about resource-use in Mongolia are scale-dependent. Take the example of winter reserve pastures in Bayan-Ovoo Sum. At a pasture scale the problem appears to be uncertainty as to whether herders other than the customary users of a given winter reserve area will respect the usufruct rights of the customary users or violate them, and local pasture use norms, by grazing reserve areas out of season. At a landscape/community scale, the problem is uncertainty as to whether all herders will move away from traditional winter use areas during other seasons. If the entire community abides by this coordinating norm relating to the timing and location of pasture use, uncertainty about trespass of smaller-scale resources is eliminated without the need to delineate exact boundaries of individual (household/herding camp) customary use areas. If rules about movement were revived and enforced, these would create coordinated expectations about resource-use behavior within the community, providing an institutional mechanism to overcome current unstable and unsustainable grazing patterns. The historical record indicates that this type of coordination norm coupled with informal and formal enforcement mechanisms existed in some parts of Mongolia, including the study areas, in both pre-revolutionary and collective times (Simukov 1935, Batnasan 1972). A number of investigators have documented self-regulation of seasonal movements by pastoralists in other societies (Gilles 1988, Gilles et al. 1992, Artz et al. 1986, Sheddick 1954 cited in Swallow 1994). Placing the institutional emphasis on the regulation of pastoral land-use rather than enforcement of land tenure preserves the social and spatial flexibility essential to the ecological and economic sustainability of pastoral livelihoods in Mongolia, without abandoning the possibility of self-regulated joint use of common resources.

In conclusion, I suggest that local self-regulation of seasonal nomadic movements be considered as an alternative to tenure formalization to address the current increase in unsustainable grazing practices linked to the social and economic changes in post-Socialist Mongolia (Table 3). Regulation of seasonal movement allows for flexibility in the timing and destination of movements from year to year, as long as there is an effective mechanism for such decision-making and enforcement. This solution also offers greater opportunities for involvement by local herders in designing, monitoring and enforcing regulations than a formal tenure system, and requires little

outside intervention, except perhaps at its inception. The regulation of movement has the advantages of costing far less to implement than a formal tenure system, while retaining greater flexibility, and avoiding the cementing of existing inequalities in resource access. Although it does not necessarily assure tenure security at a small scale, the patterns of resource use that currently threaten tenure security in key resources would largely be eliminated by regulating seasonal movements. Endogenous tenure systems could evolve at their own pace within this system. Although seasonal use areas must be clearly defined, ambiguity in social and physical boundaries is tolerated to a larger extent by this solution than by a formal tenure system, again allowing herders greater flexibility.

The disadvantages of this proposed solution include potential difficulties in delineating seasonal use areas in places such as Bayan-Ovoo, where there is currently little spatial separation among seasonal pasture areas. Herders may resist the imposition of a system of seasonal zones that differ from current use patterns, if it required them to abandon areas they now use. Herders may also object to the notion of regulation. Fixed dates and zones for movement may run counter to herders' new experience of independence since privatization, and any formal regulation of movement may be associated with the authoritarian system of the collective.

Tenure formalization is costly, relatively inflexible, and potentially inequitable, and Mongolian herders generally oppose the concept of land privatization. On the other hand, non-intervention (a "hands off" approach) runs the risk of irreversible ecological degradation or social disintegration. In contrast, regulation of seasonal movement represents a revitalization of an historical institution in Mongolia, and allows for a high degree of local involvement while preserving the social and spatial flexibility essential to the success of a nomadic lifestyle in a highly variable natural and ever-shifting political-economic environment.

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Table 1. Comparison of perceived ecological and social problems and causes at two

different observational scales.

	Pasture Observational Scale (10-100 ha)	Landscape Observational Scale (100-1000 km ²)
Ecological problem	Pasture degradation	Degraded patches in landscape
Ecological causes	Too many livestock/unit area/unit time	Livestock poorly distributed in space and time 1. Increased year-round grazing 2. Localized increased stocking
Social scale	Individual households or herding camps acting independently	Community of resource-users (<i>bag, sum</i>) acting interdependently
Land-use behavior	1. Trespassing 2. Overstocking	1. Failure to move among seasonal pasture areas 2. Failure to use remote and underused pastures 3. Lack of adequate physical separation among seasonal pastures
Social causes	1. Resource scarcity, competition and overexploitation 2. Inability to exclude trespassers 3. Perceived insecurity of tenure 4. Lack of definition and enforcement of property rights	1. Lack of institutions to organize and coordinate nomadic movement 2. Lack of mutual assurance that critical mass of herders will move in coordinated fashion 3. Lack of access to material means of mobility (labor and transport) among poor herders 4. Unequal access to key resources due to differences in wealth and migrant status
Policy solutions	1. Regulate livestock numbers 2. Define and enforce property rights	1. Regulate pastoral land-use: timing and location of seasonal moves 2. Address material obstacles to mobility (labor and transportation) 3. Address social and economic disincentives to mobility (access to markets)

and services)

4. Approach tenure reform
cautiously, differentiating
among the many distinct but
often overlapping resources
and user groups

Table 2. Summary of pastoral resources, rights and rights-holders in Jinst and Bayan-Ovoo Sums, Mongolia

Resource	Rights	Spatial Boundary	Rights-holders	Basis of rights
shelters & corrals	" <i>de jure</i> private property " saleable	clear and obvious	individual or group (herding camp)	" purchase with privatization " build with own materials " historic use (during collectivization) " 2ary use-rights through affiliation with "owner"
winter & spring campsites	" approximate private property " heritable " not saleable	somewhat clear, marked by structures, accumulated dung and fuel stores	herding camp (usually vested in owner of structures or senior head of household in camp)	" historic use: continuity and proximity " recent appropriation of unregistered land " 2ary use-rights through affiliation with permission of camp leader " presence of structure strengthens claim
winter & spring pasture	" common property?	vague "sphere of influence," strongest near campsite	herding camp, groups of neighboring camps	" proximity to campsite " historic use
summer & autumn pasture	" quasi open-access	vague (anything that is not reserved for winter and spring)	all residents in <i>sum</i> ; some outsiders	" residence in <i>sum</i> " affiliation with kin/friends in <i>sum</i> " ethic of access
large rivers & lakes	" <i>de jure</i> open access	clear	all herders	" 1994 Land Use Law
small streams & springs	" common property	varies	herding camp, groups of neighboring camps	" historic use " tacit approval of existing users
hand wells	" private property " common property	clear	individual, herding camp, groups of neighboring camps	" if well-digger or descendant of well-digger, hand well is their private property " if well-digger not known, common property of well-using group
motorized wells	" state property	clear	defined group of herding camps	" permission of well-master " payment of fees

Table 3. Comparison of policy options to address unsustainable pastoral land-use trends.

	Formalize Land Tenure	"Hands Off"	Regulate Seasonal Movements
Regulatory institutions	formal legal tenure instruments and organizational framework to enforce them	wait for customary and/or new endogenous institutions to emerge	locally agreed upon formal and informal regulation of seasonal movement (timing and destination)
Land-use patterns	! may allow for flexible movement or may not	?	! spatial segregation of seasonal pastures ! 4 moves/ year; ! provisions for flexibility in emergencies
Land-use regulation	! tenure arrangements determine timing, location and type of use;	?	! flexible/adaptive enforcement of movement time and location
Land tenure	! formal ! eliminates ambiguity in group members and physical boundaries	?	! allow to evolve at own pace ! ! endogenous/customary ! ambiguity OK ! regulation of movement eliminates or reduces trespass and out of season grazing, reducing perceived insecurity of use rights and incentives for formalization of tenure