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Nomadic Peoples, Number 33, 1993

Nomadic Peoples 33:1993, Mearns, pp. 73–103

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This article considers to what extent variations in the broad character of territorial behaviour between pastoralists in different ecological zones of Mongolia at any given point in time can be attributed to ecological constraints. The precise form of land tenure arrangements and their continuity or change over time, however, is determined by changing political and economic conditions, and the public policy environment. The insights of theories of human territoriality into institutional mechanisms for controlling access to depletable natural resources are evaluated in this light.

This article is concerned with institutional mechanisms for controlling access to depletable natural resources on which groups depend for their livelihood, with reference to pastoralism in Mongolia. The relevant literature which may be brought to bear on this problem is wide, based in several disciplines, and divided by differences in terminology. The study of human territoriality has been based principally in the disciplines of sociobiology, geography and anthropology, and applied in the context of hunter-gatherers, pastoralists and other peripatetic peoples (Dyson-Hudson and Smith 1978, Sack 1986, Casimir and Rao 1992). Definitions of territoriality in this literature vary according to the relative weight given to the determinants of human behaviour other than narrowly ecological or material ones[1]. The question of access to material resources is embedded in cultural conceptions of space that have broader significance, including ritual and religious dimensions. Nevertheless, the principal insight of this literature has been to show how "territoriality in humans is at least in part an adaptive response to environmental factors and, as such, is to be expected when critical resources are distributed so that exclusive use and defense of a resource area produces a net benefit in resource capture" (Dyson-Hudson and Smith 1978: 36). Human territoriality, then, refers to cognitive and behavioural practices on the part of individuals or groups in optimising access to temporarily or permanently localised resources, so as to satisfy material needs and wants, while at the same time minimising the probability of conflicts over those resources[2].

What is referred to as 'territoriality' in the study of nomadic and other peripatetic peoples is commonly understood in the context of agriculturalists as 'land tenure'. This refers to the conditions under which land is operated, given by rules sets that specify which groups of people have what rights over what resources and at what times. Rights may include those of access, usufruct, inheritance and disposal, but need not necessarily imply ownership. They may cover specific parcels of land and the resources associated with them, or valued natural resources such as trees or water sources separately from the surrounding land (Fortmann and Bruce 1988). With increasing scarcity, or a declining land/person ratio, resources come to be valued more highly, and/or claims to them are more

contested. Relative scarcity of natural resources is taken to be the primary motivation for formal property relations to be adopted so as to ensure that the rightholder(s) will be able to reap exclusive benefits from the conservation of those resources, to invest in them, and/or to contain conflicts over access to them. It is only when the value of those resources rises relative to other factors that the economic gains from adopting formal property rights merit the costs involved in doing so. The literature on land tenure is derived principally from the disciplines of economics and law, much of it rooted in the property rights school (Demsetz 1967, Wargo 1988, Bromley 1991).

There is continuing debate within this literature as to whether or not indigenous land tenure systems represent a constraint on land productivity and economic development (Wachter 1992). For those who regard property rights as an independent variable in economic development, indigenous land tenure systems are assumed to provide insufficient security to induce land users to make land-improving investments or to gain access to credit to finance such investments, and therefore the introduction of formal property rights (codified in statutory law) is considered to be an essential precondition for economic development (North 1990). Others view property rights over land as a dependent variable, in which indigenous tenure arrangements are dynamic and adapt in response to a declining land/person ratio and other changes in factor prices (Boserup 1965, Hesse 1992)[3].

One can take this argument a stage further in the context of pastoral land tenure systems, as many have done drawing on detailed ecological and anthropological evidence particularly from sub-Saharan Africa. In dryland environments in which ecological production is highly variable over time and heterogeneous in space, indigenous land tenure systems rest on maintaining flexibility of access to critical grazing, browse and other resources by means of mobility over a large grazing resource which is held in common. The grazing commons is effectively indivisible, since risks are pooled at the level of the social group as a hedge against individual failure. Not only are they not a constraint on development but, compared with alternative (eg. private) forms of grazing land tenure, indigenous tenure arrangements represent the best guarantee of sustained optimal resource exploitation by herding communities under unpredictably varying ecological conditions (Sandford 1983, Dyson-Hudson and McCabe 1985, Swift 1988, McCabe 1990, Niamir 1990). The implications of this line of reasoning are of profound significance for pastoral development and land policy in general, suggesting that they should start from and build on indigenous land tenure arrangements that are adapted to ecological variability. This is explored elsewhere for the Mongolian case (PALD 1993).

A major body of literature which seeks to explain the endogenous development of institutional arrangements to regulate access to scarce natural resources is that on the management of common property resources (Wade 1987, Berkes 1989, Ostrom 1990, Bromley 1992). This literature spans economics, anthropology and political science. Common-pool resources (such as grazing commons, village forests and ponds, inland and marine fisheries, and irrigation systems) are a class of resources which lie in the mid-range of a continuum between public goods and private goods. They are like public goods in that they are jointly consumed and it is difficult, though by no means impossible, to deny access to non-authorised users. However, they are also like private goods (and unlike public goods) in the sense that their exploitation by one user precludes another user from simultaneously exploiting the resource; that is, they are rivalrous. Most common-pool natural resources are renewable resources, over which there are limits to the rate of exploitation that can be sustained.

These twin difficulties—of user-exclusion and of depletion in use—can be approached theoretically as a collective action

problem for the users of the common-pool resource: namely, how to control access in such a way as to regulate the rate of resource exploitation. The literature on common-property resource management and collective action suggests that a user group is more likely to solve this collective action problem endogenously where members depend heavily on the resource or resources in question for their livelihoods; and where sets of social norms and sanctions are mutually reinforcing within a relatively cohesive community group (Runge 1986)[4]. Collective action in the sphere of natural resource management may only be one among several, interlocking forms of collective action among a group of individuals who expect to continue interacting with one another for some considerable time to come. Trends that favour or hinder collective action in other spheres besides natural resource management—such as livestock and livestock product marketing, and mutual assistance in herding and livestock product processing tasks—may as a result indirectly support or tend to undermine successful collective action in natural resource management. This argument is examined in detail elsewhere, drawing on empirical material from Mongolia, including consideration of how the conditions for successful collective action at the local level may be undermined by processes at the level of the external polity (Mearns 1993b, 1993c).

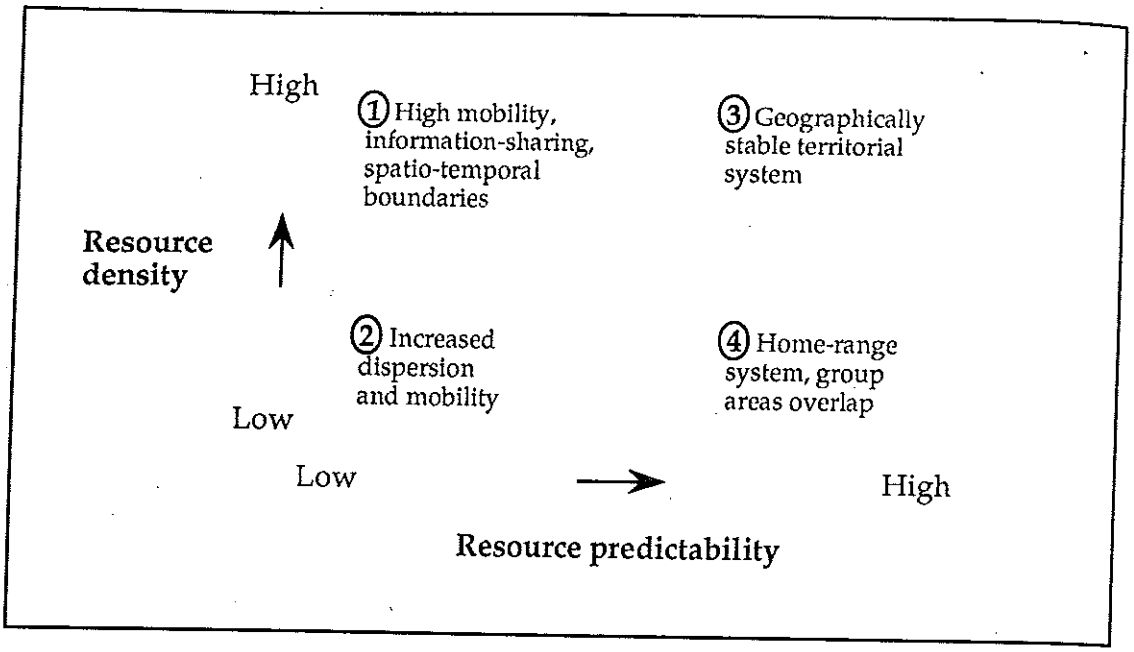
Territoriality: the economic defendability model

We return now to the notion of territoriality to investigate how far it helps shed light on variations in land tenure arrangements among pastoralists in different ecological zones of Mongolia. Dyson-Hudson and Smith have constructed a generalised model (Figure 1) based on the notion of 'economic defendability' of resources, which relates the wide variety of possible forms of human territorial behaviour to variations in the density and predictability of the resources in question (Dyson-Hudson and Smith 1978). Resource predictability refers to the likelihood of its incidence either in a particular location or at a particular moment in time. Resource density or abundance refers to productivity per unit area, either averaged over a broad area, or within a specific resource patch. It is not an absolute concept, but needs to be specified in relation to the number of potential users.

There is a clear parallel between the hypothesis underlying this model and that of the property rights school within economics; both suggest that institutional mechanisms ('territorial behaviour') to 'defend' resources will be adopted where the benefits from doing so warrant the costs involved: "increased average density of critical resources make a territorial system more economically defendable, simply by reducing the area that needs to be defended and thus reducing defense costs" (Dyson-Hudson and Smith 1978:25). It is important to view this model as capable only of making general predictions about territorial behaviour at the level of particular groups of people, given certain ecological constraints. It cannot be expected to explain the precise form of land tenure arrangements in particular places, still less their change over time.

Where resources critical to local livelihoods are relatively abundant and predictable in incidence (but not so abundant that their availability is not a limiting factor), it is hypothesised that territorial behaviour will take the form of 'spatial boundary defence' (Casimir 1992a). In this case, territories may be defined for particular groups of people, and territorial boundaries are more or less stable over time (quadrant 3 in Figure 1). Where resources are relatively scarce but still predictable, large home ranges with some degree of overlap between groups of users would be expected (quadrant 4).

Figure 1. *General predictions of the economic defendability model for spatial organisation*



Source: Dyson-Hudson and Smith (1978).

Where resources are unpredictably variable in incidence above a certain threshold, strategies to secure them will depend in the first instance on increased mobility over a large area. The physical boundaries of the resource unit used by any particular group of people, where they can be identified at all, are likely to vary over time (between years, for example). If resources are abundant relative to the number of potential users, there is no need to restrict access and groups may even share information as to their incidence (quadrant 1). Institutionalised reciprocal access between neighbouring groups may arise as a form of insurance against uncertainty. If unpredictable resources are also scarce relative to demand for them, resource users are likely to be much more dispersed (quadrant 2). In the latter case, it is hypothesised that strategies to secure access to localised resources will be more likely to focus on 'social boundary defence', or control over access to group membership as a means of limiting the rate of resource exploitation (Cashdan 1983, Casimir 1992a)[5].

However, strategies of spatial and social boundary defence are not mutually exclusive, a point which has also been well made in the common property literature. It is not possible to characterise the territorial behaviour of entire groups in blanket terms. Rather, one must examine territorial behaviour in relation to each of the critical resources exploited by users within a given group; and at different times, both during different seasons and between years of varying ecological production. For example, in a dryland environment of low average resource density, certain microhabitats (such as moist depressions in the landscape or groves of valued trees) may be especially valued by local resource users during years of low rainfall and therefore low base resource yield, because their yield is relatively more predictable than the average for resources in that area (Scoones 1992, Behnke *et al.* 1993). While territorial behaviour towards basic forage resources in such an environment would be expected to fall into quadrant 2 in Figure 1, territorial behaviour towards these key resource patches

would be more likely to fall into quadrant 4. It may take various forms such as time-partitioning between groups (different groups using the same key resource at different times) as well as within-group social boundary defence.

In practice, there is a high degree of observed covariance between low resource density and low resource predictability. In arid environments precipitation is the major limiting factor on plant growth, and is generally characterised by a high interannual coefficient of variation (CV). This is one of the cornerstones of the recent literature on 'new' ecological thinking as applied in the context of range ecology and management in dryland Africa (Ellis and Swift 1988, Westoby *et al.* 1989, Behnke *et al.* 1993, Walker 1993, Scoones 1993). In this literature attention is drawn to a continuum between equilibrial and non-equilibrial systems, according to the degree to which the biotic components of the grazing ecosystem (net primary productivity of forage, wild and domestic herbivore populations) achieve stability such that their dynamics have a significant influence over one another by means of internal feedbacks. In non-equilibrial systems, which evidence suggests are those in which precipitation CVs exceed about 33 percent, it is unlikely that there will be sufficient ecosystem stability for the density of grazing animals to influence significantly long-run forage availability, since this is determined primarily by variability in the external factor of precipitation itself.

Variations in territorial behaviour by ecological zone

In this section we consider the influence of ecological constraints over the broad patterns of territorial behaviour between pastoralists in different ecological zones, effectively holding other (political-administrative, economic) factors constant for the purposes of analysis. We are concerned to show the extent and relative importance under different ecological conditions of spatial and social boundary defence among Mongolian pastoralists as mechanisms to control access to basic forage resources.

The analysis is guided by a simple hypothesis: that Mongolian grazing systems can be ranged along a continuum from those that exhibit relatively equilibrial ecosystem dynamics to those whose dynamics are relatively non-equilibrial[6]. This broadly corresponds with the axis in Figure 1 between quadrant 3 and quadrant 2 (from high resource density/predictability to low resource density/predictability). Patterns of territorial behaviour among pastoralists in relation to basic forage resources would therefore be expected to vary in terms of their relative emphasis on spatial boundary defence (relatively equilibrial systems/quadrant 3) or social boundary defence (relatively non-equilibrial systems/quadrant 2). Key resources other than basic forage, such as grazing reserves set aside for emergencies, saltlicks, and groves of browse trees, may be expected to occupy an intermediate category, in which strategies of both spatial and social boundary defence play an equally important role.

Empirical models developed from global precipitation data suggest that at the latitude of Mongolia, CVs of 33 percent or greater are likely to be found where annual mean precipitation totals are 250 mm or below[7]. In a preliminary survey to investigate the applicability of non-equilibrial concepts under Mongolian pastoral conditions, Ellis and Chuluun obtained precipitation data for five recording stations in different ecological zones for which at least a 20-year time series was available[8], and which may be taken as broadly representative of the diverse range in Mongolian grazing systems (Table 1) (Ellis and Chuluun 1993). The three stations with mean annual precipitation totals of 266 mm or below all have CVs well above 33 percent, the theoretical threshold for non-equilibrial ecosystem dynamics. It seems possible that such conditions could therefore prevail in regions of Mongolia with mean precipitation totals of around

265 mm or below, which would include the drier parts of the steppe zone, and all drier ecological zones including shortgrass steppe, desert-steppe and desert, and those mountain areas within desert zones where precipitation is below 265 mm. It is estimated that non-equilibrial ecosystem dynamics could characterise almost half the area of Mongolia.

Apart from total precipitation and its distribution, the type of precipitation during severe winter weather is also a limiting factor in Mongolian grazing systems, unless there is timely provision of prepared animal fodder. Most serious in terms of preventing access to forage is snowcover (see Table 1), and various other meteorological events known collectively as *dzud*. The latter range from severe frosts, ice crusts

Table 1. *Climate data for five stations across Mongolia*

Station (ecological zone)	Location	Annual precipitation	CV (%)	Snowcover (days/year)
Zamiin Uud, Dornogov' (desert steppe)	43.44N, 111.54E	125 mm	52	44
Saikhan, Ömnögov' (desert/mountain steppe)	44.05N, 103.33E	116 mm	47	43
Khujirt, Övörkhangai (typical steppe/forest steppe)	46.54N, 102.46E	307 mm	30	141
Tariat, Arkhangai (forest/mountain steppe)	48.09N, 99.53E	266 mm	41	131
Sukhbaatar, Selenge (typical steppe)	50.14N, 106.11E	286 mm	30	116

Source: Ellis & Chuluun (1993).

covering pastures, blizzards, and combinations of these events, all of which carry separate names (Meserve 1990). Pastoralists and livestock in the wetter, northern parts of the country are more likely to be stressed by such weather events than those in the South of the country where droughts are most frequent[9]. Some mid-latitude locations within typical or shortgrass steppes may be afflicted by both drought and *dzud* (Ellis and Chuluun 1993). The consequences of all but the most extreme winter weather events for territorial behaviour would be expected to correspond with strategies given in quadrant 1 of Figure 1 (low resource predictability, relatively high density); namely, a high degree of mobility to seek alternative forage resources lying outside the area affected by the weather event, by means of institutionalised reciprocal access to resources controlled mainly by other groups.

To understand territorial behaviour among pastoralists two important issues need to be considered: the nature of local group organisation, and the manner in which pasture use is coordinated between users. Territorial behaviour towards forage resources needs to be viewed in the context of other grounds for local group formation. There is considerable variation across Mongolia in the extent to which local groups have economic or social functions in addition to temporarily or semi-permanently sharing a place of residence. The degree of stability in group membership over time also varies. Table 2 summarises the major characteristics of the types of community and other functional groups that will be

referred to. Detailed consideration of these questions lies beyond the scope of this article, and is dealt with elsewhere (Mearns 1993b, 1993c).

The choice by individual herders of general areas of pasture for use at any one time is usually determined in the following way[10]. Before making a move, the herder makes a reconnaissance visit to one or more pasture sites to assess forage quantity and quality and water availability, usually in that order of priority. Water availability is more of an issue in the Gobi desert and desert-steppe and eastern steppe regions than in the central and Khangai forest/mountain steppes where there are more surface water courses. Water availability for both human and animal use needs to be considered; some wells are suitable only for watering animals. Of primary importance everywhere, however, is forage quantity and quality. A less important but still significant consideration is the location of the pasture site in relation to the next expected destination, on an approximate route leading back to the winter pasture area.

Mongolian pastoralists espouse an ideal of open access to grazing land. The general right of all herders to obtain enough forage and water for their animals is broadly respected. Priority is generally given to customary users, and otherwise to first-comers. However, the availability of suitable pasture sites at a given moment is ultimately limited, so that in practice, neighbouring herders need to agree between themselves on a set of 'coordination norms' (Runge 1986) that set ground rules over who uses what pastures, at what times, and in what manner. These norms regarding pasture use

Table 2. *Relevant groups in local-level pastoral organisation*

Type	Name	Approximate size (households)	Functions, characteristics
Camp	*khot ail*	2–12	Social and economic (eg. pooling of labour resources in herding tasks, livestock product processing, etc.); usually strong kinship relations between member households
Neighbourhood	*neg usnykhan, neg khamrynkhan*	5–20	Residence-based group; may have limited economic functions (eg. pooled use of vehicle, looking for lost animals, hay-making); may be extensive kinship relations between members; name often taken from landscape features (eg. people of one water source, mountain, etc)
Community (or cluster of neighbourhoods)	neg nutgiinkhan (eg. neg jalgynkhan)	20–80	Residence-based community of herders or aggregation of neighbourhoods; lit. 'people of one place' (eg. of one valley); not necessarily any economic functions, but may cooperate, for example in marketing activities; weak kinship ties except within component neighbourhoods
Sub-district	*bag*	50–250	Lowest-level administrative unit of the State; membership stable in principle and formalised by administration; may have economic functions in some areas (eg. arable cropping)

have generally evolved within particular neighbourhood or community groups over many generations, although they vary considerably by region, owing to variations in how binding are the ecological constraints.

For example, in some areas a neighbourhood group may agree the approximate dates on which they will move as a group to the next pasture area to control the rate of exploitation by season ('time-partitioning'). In other areas forage availability is too unpredictable for this to be possible. In virtually all areas there has been widespread respect for the customary rights of a particular family over particular winter pastures. If the customary owner of a winter shelter (or designated user during the period of collectivised production) intends to return the following year, some mark will usually be left at the site to indicate this. The dung pile left at the site is considered the property of the herder who left it. However, if no such mark is left, or if it is known (through word of mouth) that the customary user does not intend to return, another herder may use the site on a first-comer basis (Vreeland 1962).

As with many social norms, these informal rules have become largely internalised in herders' everyday patterns of behaviour, so that they are rarely acknowledged explicitly. When they are successful (in terms of avoiding friction between pasture users) such coordination norms are 'transparent'; it is only when conflicts arise that go beyond the capacity of internalised norms to coordinate pasture use, making it necessary to seek recourse in conscious forms of arbitration, that evidence of coordination norms themselves becomes manifest. Since herders often camp relatively close to their neighbours it is not difficult to detect those who are not following local customs of grazing land use. The desire to be respected by one's neighbours and the need to cooperate with them in other activities such as herding, haymaking and the like, are sufficiently strong most of the time that herders tend to abide by local norms of pasture use (Chong 1992, Mearns 1993b, 1993c).

When such incentives are not sufficient, it is quite common for a certain level of free-riding to go unpunished. The Mongolian tradition of non-violence leads to a strong reluctance to impose overt sanctions on free-riding behaviour (Potkanski and Szynkiewicz 1993). Under collectivised production however, mechanisms were devised to resolve local conflicts over grazing land. For example, in some places a committee of locally respected herders was known to intercede on behalf of the community, and in extreme cases punished those who consistently abused informal customs of grazing land use, for example by imposing a fine of a certain number of animals (Mearns 1991b).

Detailed data have been gathered on the nature of informal pastoral organisation and patterns of territoriality in two contrasting ecological zones: desert-steppe and forest/mountain steppe. The following sub-sections examine these data, and are followed by a less detailed consideration of some of the relevant parameters for other ecological zones. The case study sites for the desert-steppe and forest/mountain steppe zones respectively are Tsagaan Khutul *bag*[11], Erdene district, Dornogov' province; and Booroljuut *bag*, Tariat district, Arkhangai province. Some key climatic indicators for these locations are given in Table 1: Zamiin Uud station for Tsagaan Khutul, and Tariat station for Booroljuut. Both have precipitation CVs of well over 33 percent, and so fall within the theoretical range for non-equilibrial ecosystem dynamics. The mean annual precipitation total for Tariat is close to the theoretical threshold of 265 mm. If the hypotheses put forward earlier are correct, this suggests that territorial behaviour with respect to basic forage among pastoralists in Booroljuut would be more likely to conform to spatial than social boundary defence (quadrant 3 in Figure 1), while the reverse would be expected for Tsagaan Khutul (quadrant 2).

Desert-steppe zone

Residence-based groups of herders were identified by local herders in Tsagaan. Khutul *bag* by means of 'social mapping'[12]. Two significant levels of group were identified: neighbourhoods, and spatial clusters of neighbourhoods. The latter are not considered to be 'communities', since they have no real functional coherence other than the temporary spatial proximity of their members (which, assuming limited forage availability, does imply a certain degree of coordination over pasture use). At the level of individual neighbourhoods, a variety of economic and social functions were performed, including hay-making, organising search parties for lost animals (especially camels), and making felt. A number of these cooperative activities have seen a degree of resurgence following the break-up of the pastoral collective. Only the lower-level neighbourhood groups carried individual names, usually taken from the name of the well that they would use in common at a particular time, or other significant local landscape features. Comparative summary data on these groups are shown in Table 3.

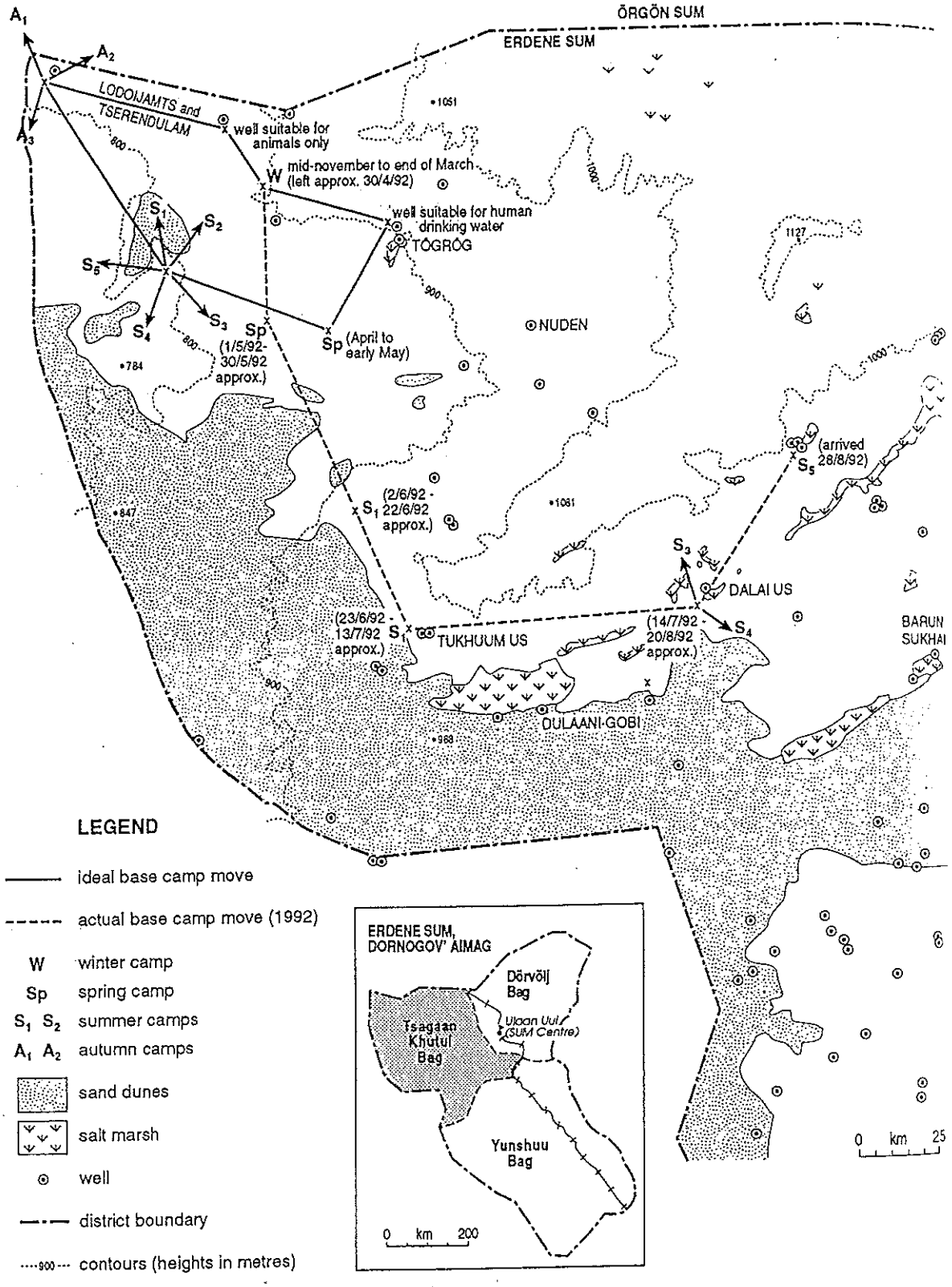
The membership of neighbourhood groups is more or less stable over time. There is normally a common core of households whose preferred *nutag*[13] most often overlap, but other households enter and exit the group from time to time, whether seasonally, from one year to the next, or over longer periods. There is typically a strong kinship basis to each neighbourhood group, including both consanguineal and affinal relations. However, a significant proportion of herding households (say, 10 percent) would not consider themselves to be members of neighbourhood groups and would only very rarely form *khot ail*. The high degree of average dispersal of herders in the desert-steppe zone means *khot ail*, where they exist, tend to be small, with no more than three member households. In the case of *khot ail* in which kinship ties between member households are strong, membership tends to be stable; where kinship ties are weak, membership may change from one year to the next.

Table 3. *Summary data on group composition and wealth differentiation, Tsagaan Khutul*

Neighbourhood 'clusters' (names of individual neighbourhoods)	No. of *khot ail* or separate camps	No. of households	Mean livestock holdings per household (*bod*[14])	Standard deviation of household livestock holdings	Coefficient of variation in livestock holdings
Dalan Usniikhan	n/a	12	37	20	55
Dulaani Gobi Tukhuum	5	13	34	29	86
Sukhai Khundi Bogiin Gashoo Khonkhoryn Us	n/a	14	30	16	51
Nuden Tögrög '18'	n/a	12	29	10	34

Note: Erdene district total area = 10,700 km^2; total human population = 2,550, of which herders = 1,250; mean herding population density 8.6 km^2/person or 0.1 persons/km^2. Population of Tsagaan Khutul *bag* (August 1992) = 106 households, of which 30 were resident in district centre and 6 outside the district.

Figure 2. *Ideal and actual seasonal base camp movements, Tsagaan Khutul*



Data on the composition of and wealth differentiation within individual neighbourhood groups, and kinship ties within and (to a lesser extent) between them, have been analysed in more detail elsewhere (Mearns 1993a). Although mean livestock holdings per household vary little between neighbourhood groups, the range of variation in household wealth within neighbourhoods varies considerably (measured by the coefficient of variation in household livestock holdings). This variation can be explained principally by differences in the rate of absentee herd ownership between neighbourhoods, since absentee herd-owners in the early stages of privatisation tend to have considerably fewer animals than full-time herders.

Figure 2 compares the 'ideal' annual grazing cycle (*nutag*) of a single household in Tsagaan Khutul *bag* with the actual pattern of movement in a particular year[15]. This illustrates certain principles of nomadic movement displayed to a greater or lesser extent by all herders in the desert-steppe zone: a generally high degree of mobility; and flexibility of movement so that actual movements in any one year may diverge considerably from the stated ideal cycle[16]. In this case the male herder was born in this area and describes the ideal grazing pattern as that of his forebears (*törsön nutag*). It is drawn here as a cycle of seasonal base camps, with some 3–5 subsidiary moves at each of the summer and autumn locations. In practice, there are frequently secondary moves of the base camp in all seasons of the year. It is not uncommon for a household to move base camp up to 20 times a year. Most moves are made during the summer and autumn months. Moves may be as short as a few kilometres or as long as 50 km, depending on the availability of forage. Mixed species herds are usually split during the summer and autumn, with long distance moves (*otor*), especially for large stock, to allow animals to put on weight quickly.

The actual location of the base camp within the selected pasture area is chosen largely with respect to water availability (ie. close to wells), especially in the case of the winter camp which is occupied for four months or so each year. Winter shelters are constructed in shallow depressions in the landscape wherever possible, to provide some shelter in the lee of a slope from dessicating winds during the spring. In this case, the herder's preferred winter camp lies equidistant between two wells, one with potable water and the other suitable only for animals. He would normally or ideally stay at the winter shelter from mid-November to the end of March, and at his spring camp during April and early May. During the summer, 4–5 moves, each of not less than 5 km, would be made, over a total distance of 20–60 km; 2–3 similar moves would be made during the autumn.

This ideal grazing cycle however is rarely replicated from one year to the next, given the high degree of inter-annual variation in precipitation distribution and localised forage availability. Whether explained by summer drought or unusually severe winter weather, a household would expect to diverge from its 'ideal' grazing cycle in at least 3 or 4 years out of 10[17]. As an illustration of this, the herder's actual pattern movement between spring and autumn 1992 is marked on Figure 2, which clearly bears little resemblance to the 'ideal' grazing cycle.

Thus far we have considered the case of a single herder. At the group level, the *nutags* of individual herders overlap considerably. The extent to which they coincide, season by season, is determined broadly by rainfall and forage availability. With favourable conditions, a neighbourhood group would appear to display a more stable pattern of territorial behaviour, so that its members would tend to cluster together season by season. With unfavourable conditions, the degree of mobility and dispersal of individual herding households will increase. As a result, given the high degree of inter-annual variability, most areas of pasture cannot rigidly be designated for use in particular seasons. An area of pasture used one spring could just as easily be used during the autumn the following year. This applies

least in the case of winter pastures, especially where there are shelters and stockyards that are used regularly from one year to the next.

While social boundaries (membership) of neighbourhood groups may remain relatively stable then, the actual areas of pasture used by individual herding households within these groups will vary from one year to the next. That is, the territorial boundaries of the group are at best unstable, and in dry years will appear non-existent. The pattern of territoriality among desert-steppe zone pastoralists therefore generally corresponds with quadrant 2 in Figure 1 (high levels of mobility and dispersion), consistent with generally low forage density and predictability. In a run of wetter years, however, in which herders are more able to follow their 'ideal' grazing cycle, territorial behaviour will more closely resemble quadrant 4 (large, overlapping home ranges), consistent with low average forage density but higher predictability.

This characterises the broad pattern of territorial behaviour with regard to basic forage. A different pattern of territorial behaviour applies in the case of resource patches valued for contingency grazing during periods of summer drought or severe winter weather[18]. Two such areas in or bordering Tsagaan Khutul *bag* are Dulaani Gobi (literally, 'warm place') and Argaliin Uul. Dulaani Gobi features a grove of saxaul (Haloxylon ammodendron) trees, valued as browse for camels and as an occasional source of domestic fuel in the absence of sufficient dung[19]; a soda 'lick' (*khojar*), where animals can obtain essential minerals on the ground surface; and an area of sand dunes which provide relative warmth and shelter and many surface water springs which are valued during periods of summer drought. Argaliin Uul, some 120 km northeast of Tsagaan Khutul on the border between Erdene and the neighbouring district of Örgön, lies at a slightly higher altitude, and is known for its taller steppe grass communities rather than the shorter, forb-rich desert-steppe vegetation communities that cover much of Tsagaan Khutul.

By customary practice, Dulaani Gobi and Argaliin Uul have tended to be tacitly reserved for use during emergency periods. Customary land tenure arrangements made possible reciprocal access to such contingency grazing areas between neighbouring groups of herders. Territorial behaviour toward those resources could be viewed as corresponding with quadrant 1 in Figure 1, including high mobility and information sharing between groups to permit access to a resource that is relatively more abundant and predictable than alternative sources of forage at a particular moment. Under collectivised production this was institutionalised and supported by the provision of transport and supplementary feed or water[20].

Given the high degree of inter-annual variability in forage availability in a given location in the desert-steppe zone, what then is the appropriate scale of territorial unit required for sustainable livestock production? The 'ideal' *nutag* or grazing cycle of an individual household, covering an area in the order of 350 sq. km., is too restrictive. The pastoral resource unit cannot be defined at the level of individual households or *khot ail*, since neighbouring camps have overlapping *nutag* and use the same general area. Territorial boundaries are also highly unstable at the level of the neighbourhood group; it is also too small to represent the social equivalent of an ecologically sustainable resource unit.

Only at the level of clusters of neighbourhoods are social boundaries approximately congruent with territorial boundaries, and even then only in years of relatively higher forage density and predictability of distribution. The difficulty with this is that the neighbourhood cluster is neither stable in membership over time, nor a particularly cohesive functional unit. While a territory of this order of magnitude would probably suffice in 6 or 7 years out of 10, it would not provide sufficient flexibility in access to forage as a hedge against the risk of a winter *dzud* or intense summer drought, which according to local herder estimates may

occur 3 or 4 years in 10[21]. Given ecological conditions in the desert-steppe zone then, the appropriate scale of territorial unit for sustainable pastoral livestock production probably corresponds with the *bag* itself. In the case of Tsagaan Khutul, this implies an area of approximately 3,500 sq. km. For the more extreme high magnitude, low frequency weather event (eg. 1 in 10 year snowfall or drought), it is still necessary for herders to gain access to contingency grazing elsewhere in the district, and perhaps even in a neighbouring district[22].

Forest/mountain steppe zone

Residence-based groups of herders within Booroljuut were identified in the same way as those in Tsagaan Khutul. The approximate territory of the *bag* divides into a series of tributary valleys feeding into the main river (see Figure 3). Informants identified community groups known locally as *neg jalgynkhan* ('people of one valley') on the basis of those families who tend to move their respective camps more or less as a group from one seasonal pasture area to another. Each community group took its name from the tributary valley or other areas in which its members customarily camped and pastured their herds. Five such communities were identified at the time of survey for Booroljuut *bag* as a whole. Summary statistics on the composition of and wealth differentiation within four of them are shown in Table 4[23]. The data are analysed in more detail elsewhere (Mearns 1993a)[24]. Compared with the neighbourhood clusters in Tsagaan Khutul, the one-valley communities in Booroljuut are much larger (20–80 households), consistent with the higher average herding population density made possible by the higher average density (availability) of forage; more equal in terms of the range of variation in livestock holdings between their members; and represent cohesive functional groups. Apart from coordinating pasture use at local level, certain economic activities are performed at the level of one-valley communities, including yak butter processing and marketing (Mearns 1993a).

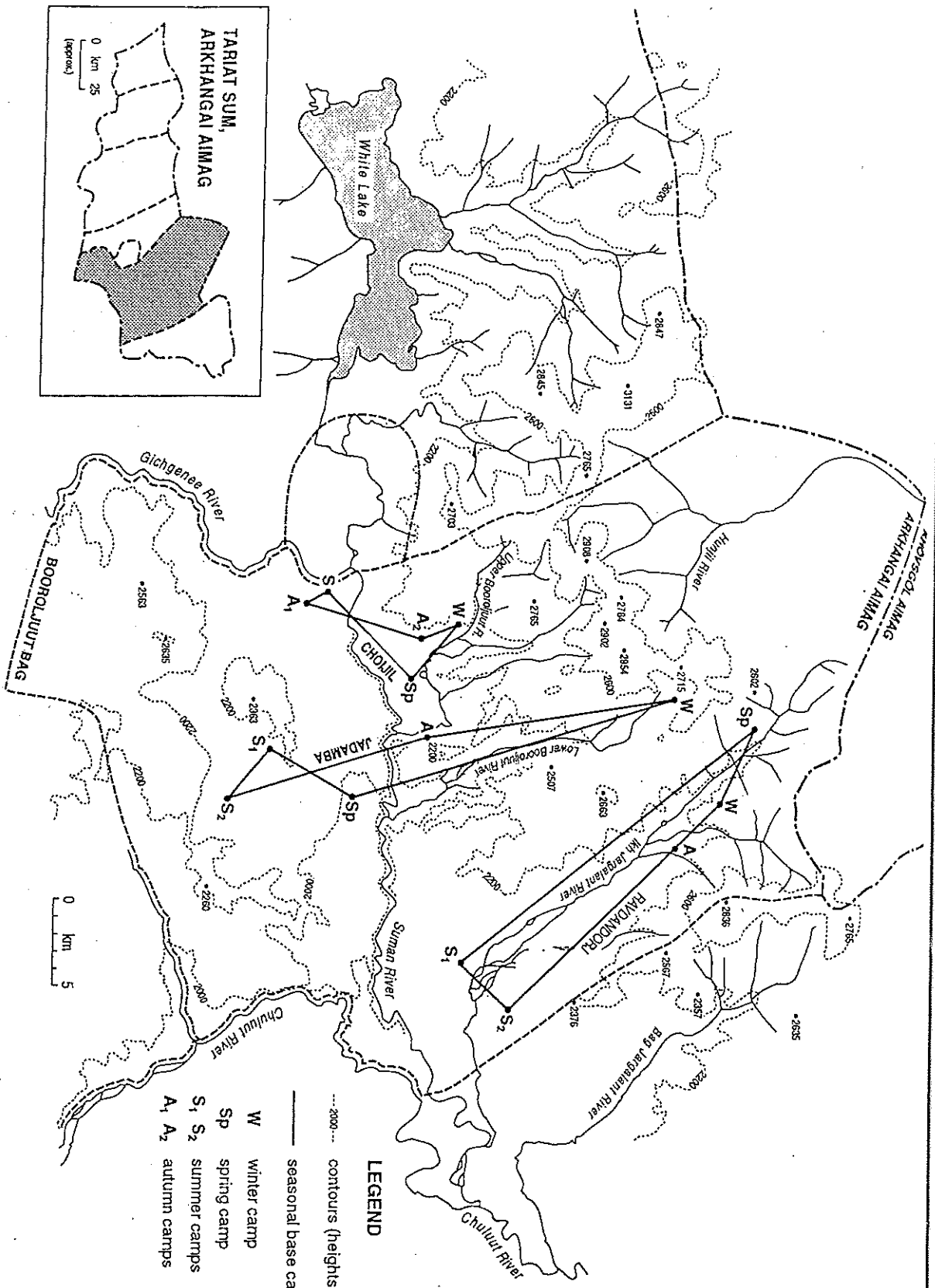
Figure 3 shows the *nutag* of three individual households in Booroljuut, to illustrate the broad pattern of mobility of pastoralists in the forest/mountain steppe zone[25]. The households are each members of different one-valley communities. Most households make between four and six moves of camp per year: one in each season, with perhaps two each during the summer and autumn. These moves tend to be confined within the valley in which the household customarily lives, but in the case

Table 4. *Summary data on community group composition and wealth differentiation, Booroljuut*

Name of community (*neg jalgynkhan*)	Number of *khot ail*	No. of households	Mean livestock holdings per household (*bod*)	Standard deviation of household livestock holdings	Coefficient of variation in livestock holdings
Upper Booroljuut	4	27	26	14	53
Lower Booroljuut	12	58	32	14	44
Ikh Jargalant	14	78	32	16	51
Aralt	n.a.	20	33	20	61

Note: Tariat district total area = 4,650 km^2; total human population = 5,400, of which herders = 3,900; mean herding population density 1.2 km^2/person or 0.8 persons/km^2. Population of Booroljuut *bag* (September 1992) = 236 households, approximately 20% of which were absentee herdowners or part-time herders resident in district centre or outside the district.

Figure 3. *Seasonal base camp movements, Booroljuut*



of the smaller valleys with more restricted grazing, summer and perhaps early autumn pastures lie on the southern side of the main river valley on an open plateau.

In the deep, narrow valleys of the Khangai mountains, seasonal movements have a vertical as well as a lateral dimension. The lower-lying pastures in the valley floor, close to rivers and streams, are used during the summer and late spring when new forage growth is most vigorous. These pasture areas are too exposed for use during the winter and early spring when biting winds pose a serious threat to vulnerable new-born animals. Areas used for autumn pasture are found further up the tributary valleys, at mid-altitude, at the point where the valley begins to narrow and provide some shelter from adverse weather. By this time, the short grasses in the valley floor are already beginning to dry up, while grass further up-valley remains relatively succulent. The winter shelters and pastures are located in the upper reaches of the tributary valleys where maximum shelter can be obtained from snow storms and wind. Great care is taken to reserve these pastures for use only during the winter; certain slopes are particularly valued where snow does not tend to lie to any significant depth, owing to their orientation with respect to prevailing winds. The shelters are constructed on the lee side of steep hillslopes. Pastures used during the early spring may be adjacent to the winter pastures, or may be further down-valley in other sheltered spots with separate spring shelters. Unless they are close to winter shelter sites, pastures used during early spring tend to be slightly lower in altitude than those used in the autumn months. Some moves are as short as 1–2 km, especially between autumn and winter camps, while the longest moves may be up to 20 km. The total distance moved each year varies between about 20 km and 50 km.

Different areas of pasture within the *bag* territory have particular characteristics in addition to the topographic variations described above. The small valley called Usan Zuil, for example, which lies between the valleys of Lower Booroljuut and Ikh Jargalant, is particularly known for its exceptionally low snow cover. It is therefore customarily used as winter pasture. Similarly, Khoorai ('dry place'), immediately adjacent to Usan Zuil, can only be used in winter because it is a dry valley, and can only be used for grazing when animals can obtain water from snow. These small valleys are used for winter pasture by households who normally graze their animals in Lower Booroljuut during the autumn.

Although average density and predictability of basic forage resources are considerably higher in Booroljuut compared with Tsagaan Khutul, average herding population density in Tariat district is also approximately eight times that of Erdene district. Herders have had to develop more elaborate norms of coordination with their immediate neighbours over the use of common pastures, even though these are largely internalised so that they are rarely acknowledged as conscious 'decisions'. Over time, customary patterns of pasture use by season have evolved into a stable and predictable pattern. The individual *nutags* of separate families (around 50–150 sq. km.) overlap to such an extent that they aggregate into a 'group *nutag*', so that an effective system of pasture rotation or deferral operates by season[26]. Territorial behaviour among herders in Booroljuut with respect to basic forage, given relatively more abundant and predictable forage, does appear to correspond with quadrant 3 in Figure 1. It is characterised by spatial boundary 'defence' in the sense that social group boundaries (membership) and territorial boundaries are congruent at the level of the one-valley community (say, up to 200 sq. km.)[27]. This hypothesis needs to be tested against case studies of particular disputes that have arisen recently over pasture. This type of information makes sense only in its historical context, however. We return to this in the final section.

In the forest/mountain steppe zone, it is quite rare for households to be forced to

vary their usual *nutag* as a result of poor pasture conditions. The most common reason for an emergency move is a winter *dzud*. It is estimated that an emergency move owing to adverse weather would be necessary approximately once in 10 years[28]. While the valley territory would probably suffice in 9 out of 10 years, reciprocal rights of access to pasture in neighbouring districts have been the main response to emergencies caused by inclement weather, such as the 1 in 10 year *dzud*.

Other ecological zones

The data for Tsagaan Khutul (Erdene) and Booroljuut (Tariat) illustrate some of the main parameters of territorial behaviour among pastoralists in the desert-steppe and forest /mountain steppe zones respectively. They suggest that in the desert-steppe zone, it is difficult to identify a stable, cohesive community group at a level corresponding to the spatial boundaries of a viable pastoral resource unit. The neighbourhood is the most cohesive level of herder group larger than an individual camp, but is too small to have exclusive control over a particular territory. By contrast, in the forest/mountain steppe zone, the one-valley communities identified in Booroljuut are groups for which spatial (territorial) boundaries and stable social group boundaries more or less coincide. These data are summarised in Table 5 together with comparative data on key parameters of territorial behaviour for pastoralists in eight other districts, representing a total of five ecological zones.

The sample districts are arranged in a rough sequence corresponding to the hypothetical continuum from less equilibrial to more equilibrial grazing systems. The desert-steppe zone sites are most likely to exhibit non-equilibrium ecosystem dynamics, while the typical steppe sites are the least likely. This continuum does not correspond exactly to an increasing precipitation gradient, since pastoralists and livestock in the wetter, forest/mountain sites are more susceptible than those in typical steppe areas to unpredictable climatic stress owing to severe winter weather. Indicative climate data for these zones were given in Table 1.

As an approximate indicator of density and predictability of forage resources, the degree of mobility among pastoral households in each district is compared in Table 5 with the degree of flexibility in nomadic movement. A higher level of mobility is observed where forage density is low; a greater degree of flexibility in movement is observed where forage distribution is unpredictable. These data reflect herders' estimates based on recent experience. In the case of flexibility of movement, measured by frequency of emergency moves, these data need to be interpreted in the light of state policy under collectivised production, and may underestimate the degree of inter-territorial mobility that would be required in the absence of public action. Assuming state policy to have had similar consequences across Mongolia, however, these comparative data still give a useful indication of the relative degree of flexibility in nomadic movement to cope with unpredictable forage distribution during periods of climatic stress, in different ecological zones.

Table 5 gives an indication of the minimum level of pastoral organisation (the smallest group size) that is consistent with a particular territorial unit. This is the social unit at which some degree of 'spatial boundary defence' can be said to operate, even though in many cases, actual 'defence' of the boundary may arise from state policy. In the relatively equilibrial environments of the typical steppe zone, a relatively high degree of territorial stability appears to be found at the level of neighbourhood-level groups, although this supposition requires further confirmation from field data. Towards the non-equilibrium end of the continuum, in the desert-steppe and mountain-desert steppe sites, there is no stable, community group with economic and social functions that is consistent with a particular territorial unit. The *bag*, the administra-

Table 5. *Comparative data on parameters of territoriality for different ecological zones*

District (province)	Ecological zone	Minimum level of pastoral organisation at which social and territorial boundaries are more or less congruent	Degree of mobility (number of moves per household per year)		Flexibility of movement (frequency of emergency moves; appprox. % of years)
			average year	bad year	
Erdene (Dornogov')	desert-steppe	*bag*	10–12	15–20	25–30%
Mandalovoo (Ömnögov')	desert-steppe	none (district only)	8–10	12–15	25–30%
Tsogt (Gov-Altai)	mountain-desert steppe	*bag*	6–10	15–20	25–30%
Erdeneburen (Khovd)	mountain-desert steppe	none (district only)	4–5	10–15	15–20%
Tariat (Arkhangai)	forest/mountain steppe	one-valley community	4–5	10–11	10%
Rinchenlhumbe (Khövsgöl)	forest/mountain steppe	one-valley group (not a cohesive community)	4–5	6–8	<5%
Herlenbayanulaan (Khentii)	typical steppe	neighbourhood (not confirmed)	3–5	4–6	<5%
Yeröö (Selenge)	typical steppe	neighbourhood (not confirmed)	3–4	4–6	<5%
Altanbulag (Töv)	typical steppe	neighbourhood (not confirmed)	2–3	3–4	<5%
Kharkhorin (Övörkhangai)	forest steppe	neighbourhood (not confirmed)	2–3	3–4	<5%

Source: adapted from Batbuyan *et al.* (1993).

tive unit, usually meets the scale criterion (but not always, as in the case of Mandalovoo and Erdeneburen districts), but only very rarely does it have significant economic functions. In the intermediate forest/mountain steppe areas, social and territorial boundaries are more or less congruent at the level of the one-valley community, but in contrast with communities in Booroljuut, those in Rinchenlhumbe district, Khövsgöl do not appear to function as coherent economic and social groups.

Continuity and change in land tenure arrangements

The analysis thus far has attempted to hold constant those factors such as changing political and economic conditions, and the consequences of public policy, in order to isolate the influence of ecological factors over territorial behaviour among pastoralists in different ecological zones. Already we have seen that it may be difficult to disentangle the influences of public policy over territorial behaviour as manifested in, for example, the frequency with which herders need to make emergency moves in search of forage. In this final section, the history of continuity and change

in land tenure arrangements in Mongolia is considered against the backdrop of changing political-administrative and economic conditions.

Pre-revolutionary period (pre-1920s)

The existence of codified pastoral land tenure arrangements in Mongolia dates back to the thirteenth century, when numerous Mongol tribes, occupying territories known as *aimags*[29], were unified under Chinggis Khan (Fletcher 1986). Within each tribal territory, patrilineal descent groups (*töröl*) formed neighbourhood groups known as *bags*, or groups of herders sharing the same broad territory and whose *nutags* overlapped. The customary law of the tribes was consolidated and written down in the Great Yassa or law-code, formally promulgated in 1229 (Butler 1982). Among other things this permitted the rotational use of pastures by individual herding families and *khot ails* as and when required, informally coordinated within each *bag*.

Under imperialist rule by the Manchu Chinese between the seventeenth and nineteenth centuries, Mongolia was divided into political-administrative fiefs known as *khoshuus*. These were of a scale between the then existing *aimag* and the *bag*, although some *khoshuus* were larger than contemporary provinces. The *khoshuus* were introduced at different times in different regions between the 1640s and 1750s, and persisted as territorial units until the 1930s[30]. Each *khoshuu* was controlled by an hereditary overlord (*noyon*) through whom the Manchu dynasty ruled. By this time lamaist Buddhism had already been introduced to Mongolia.

Land allocation and distribution within these territories was entirely at the discretion of the *khoshuu noyon*, and specific areas were designated for grazing, agriculture, military frontier guards, horse relay stations, lamaist monasteries, the use of mineral deposits, and reserves for timber or wild animals (Shirendyb 1976). Some areas were set aside for grazing by the *noyon*'s own herds, which others were forbidden to enter. The highest ranking lamas (*khutukht*) enjoyed equal rights with *khoshuu noyon* and also 'owned' the land within the jurisdiction of their temple territories[31]. Within the rigid feudal-theocratic hierarchy, in which most social positions were ascribed by birth, high-ranking nobles or lamas could be granted individual use rights over certain areas of land. It is significant that "the best pastures were used primarily by the lord himself and his kinsmen, by the [*khutukht*] and their relatives, or by high-born people" (Shirendyb 1976:48). But even the feudal lords, Mongol or Chinese, faced restrictions under Manchu imperial law as to the use to which designated pasture land could be put. The tilling of pasture land for agricultural cropping was expressly forbidden and a punishable offence[32].

Under the high-ranking nobles and lamas were their feudal subjects (*khamjilga* and *shabinar* respectively) who looked after their herds, and who had use rights over particular areas of pasture according to feudal law (Mearns 1991a). The remaining, undesignated areas of the *khoshuu* were used customarily by common herders (*albata*) as serfs of the state, organised informally into neighbourhood groups and whose freedoms were more closely circumscribed than those of *khamjilga* or *shabinar*. Any decisions that needed to be made to coordinate pasture use or settle disputes within these territories were made at the local level within these groups in the first instance. In the case of territories used for monastery or noble families' herds, only if this first level of dispute settlement failed were such decisions referred to a higher authority. By this time, the *bags* had been co-opted as administrative units of the feudal state, and their leaders were answerable to the feudal lords, nobles or lamas.

Feudal subjects were forbidden, on pain of death, to leave the *khoshuu* territory in which they were born (Bawden 1989). However, the relatively large size of the *khoshuus* meant that they often straddled several different ecological zones. In principle, herd-

ers were able to make large-scale nomadic movements from one season to another, usually North-South, for example between Khangai mountain areas and the Gobi desert and desert-steppes, in search of pasture. Although this freedom of movement was enjoyed by some categories of herder (*shabinar*) more than others (*albata*), the *khoshuus* permitted considerable flexibility of movement between different resource patches, from year to year as well as between seasons, and patches of high-quality grazing could be reserved for use during emergencies. As Shirendyb notes of the pre-revolutionary period, "to increase the herds it was necessary to have a flexible form of regulation of pastures" (Shirendyb 1976: 49). He adds that while some feudal lords had attempted to "set up of their own accord marks establishing the pastures not only of [administrative subdivisions] but also of individual households.. these conditions were a rarity in the steppe zones of Mongolia and were never found in the gobi regions.. explained by the relatively dense population of the Khangai" (pp. 49–50).

When Mongolia gained autonomy from the Manchus in 1911, the highest ranking lama or Bogd Khan became head of state and supreme owner of land. Following the Soviet-inspired 1921 revolution, the death of the Bogd Khan and the formation of the Mongolian People's Republic in 1924, all land became state property[33]. The district (*sum*) administrative unit was introduced in the 1920s. The *khoshuu* co-existed with the district through the 1920s[34], and herders continued to make long-distance nomadic movements until the abolition of the *khoshuu* during the 1930s. Additional restrictions on land use began to be introduced however. Land for agriculture was allotted for individual use by the district authority. The *khoshuu* administration was now forbidden from directing the migrations of herders from one *khoshuu* to another, as had previously taken place on occasion, and the rights of *shabinar* to move freely over the pasture in their territory were severely curtailed, effectively reducing their status to that of ordinary herders (now known as *arat*) (Shirendyb 1976).

Collectivised production (1940s–80s)

Under the new territorial-administrative structure, there were significant differences in resource availability and quality between district territories. The possibilities for movement to overcome these disparities and meet animal feed requirements gradually became more restricted and subject to cumbersome bureaucratic regulation, especially by the time collectivisation was completed in 1959. Although all land was state owned, each collective had a perpetual right to occupy the land on which it carried out its activities (Whytock 1992). Over time this territory became synonymous with the district as collectives within districts were amalgamated during the 1960s and 1970s. Officially, herders used only those pastures that lay within their district (and usually their brigade) territory. A request was supposed to be made to move outside the brigade territory, and ultimately the district/collective chairman would decide on pasture allocation.

However, some neighbourhood groups moved outside their district territories regularly, in cases where the district has a shortage of pasture suitable for a particular season. For example, the territory of Ugiinuur district in Arkhangai was made up of the summer grazing lands of five former *khoshuus*. As a result it lacked areas suitable for winter and spring grazing and local herders have had to move out of the district in response to a heavy *dzud* approximately once every five years (Bazargür *et al.* 1992). Nevertheless, while herders continued informally to move across district boundaries to a greater extent than was officially acknowledged, the close identity between the territorial-administrative unit (*sum*) and the production unit (*negdel*) undoubtedly led to a decline in mobility between districts.

The formal procedures for allocating pastures to particular camps introduced by collective administrations often tacitly followed customary practice. In principle, having made his reconnaissance visit(s) and decided which pasture site he would like to move to, a herder would make a bid for the selected site to his brigade chief. In practice, probably the majority of routine moves were made without obtaining formal permission, simply by moving to the site in agreement with other herders of the area according to locally evolved norms of pasture use. With time, and as herding households gained access to larger amounts of furniture and other consumer durables under collectivised production, more and more moves were made with the help of the collective's truck or tractor. In the case of winter pastures, it is common knowledge which winter/spring pasture sites are customarily owned by whom, and priority is given to the holder of those customary rights. Under collectivisation this was formalised by the administrative allocation of shelters. However, this decision was made based on the number and type of collective animals allocated to the camp, and did not necessarily respect customary tenure rights.

In case of poor forage growth owing to a summer drought, or inaccessibility of forage owing to a winter *dzud*, a neighbourhood-level group would request permission from the district/collective chairman to move to inter-district reserve pasture land. The collective in Tariat district, for example, made arrangements for herders from Booroljuut to be moved to Erdenemandal and Ikh Tamir districts within the same province (Arkhangai), usually during severe winter weather. This occurred in consecutive years during the late 1970s, when one small neighbourhood group spent six months of each year outside Tariat district. Snowcover was so deep one year that household effects and hay had to be airlifted by helicopter. Occasionally an entire collective would move to inter-province or state reserve pasture land. One such reserve is Herlenbayanulaan in Khentii province, which has been maintained as a state reserve for centuries. It has customarily been used by herders from as far afield as Dornogov' and Sukhbaatar in southern Mongolia.

It is noteworthy that in the case of Argaliin Uul, the customary refuge grazing area between Erdene and Örgön districts in Dornogov', the sinking of new borehole wells in the locality by the collective in the 1970s led to an increase in the incidence of reported grazing conflicts between herder groups on both sides of the district boundary (Mearns 1991b). By making those pastures accessible for normal grazing use, this investment in water supply effectively raised the value of forage in the area relative to alternative forage resources, and made it more 'economically defendable'. With an increase in the predictability with which the resource could be used, territorial behaviour towards Argaliin Uul therefore changed from quadrant 1-type strategies (use of the area by neighbouring groups as an emergency, refuge area) to quadrant 3-type strategies, with different groups competing over boundary defence (see Figure 1).

Despite a certain continuity of customary land tenure arrangements at local level under collectivisation, significant changes in pastoral mobility and herding practices have taken place over the decades from the 1930s, and may have had adverse consequences for pasture condition in particular localities. First, the district territories were much more restrictive overall than the *khoshuus* had been, and provided less opportunity to make longer distance movements to use complementary sets of ecological resources. There have been over 330 districts from the 1930s onwards which, compared with the 100 or so *khoshuus* that existed prior to collectivisation, implies an average restriction in territory by a factor of at least three.

Second, the increasing provision of services, supplementary livestock feed and other inputs by the collectives tended to lead to a decline in mobility overall, and a ten-

dency to remain closer to the growing district centres. For example, by relying on the collective truck or tractor for moving base camp, herders had little incentive to make more frequent moves (for rotating pasture use) using their own draught animals. Evidence from Övörkhangai *aimag* gathered in the late 1980s showed that camp locations were much closer to roads and tracks than they had been 10–15 years previously[35].

In the early stages of collectivisation during the 1930s and 1940s, the *khashaajuulakh* campaign to construct winter/spring livestock shelters (Bazargür *et al.* 1992) had a powerful impact in winning herders over to the nascent collective movement, as the gains in reduced livestock mortality became obvious. This investment in fixed capital increased the tendency for herders to remain more sedentary during the cold months of the year. It gradually became more common for some herders to remain at their winter camps almost all year round rather than to rotate pasture use season by season, according to customary principles of pasture management. In some areas (especially towards the North of the country) it is common for some households to construct semi-permanent, wooden cabins at their winter camps, or at both winter and summer camps. During the decades of collectivised production, a general weakening of technical knowledge around sound pasture management practice took place (Purev 1991, Bazargür *et al.* 1992). State policy had the effect of relieving herders of the full burden of environmental risk in livestock rearing. As a result, herders' perception of the environment as a threat has been significantly diminished, and territorial behaviour, adapted to respond to environmental uncertainty, has been affected accordingly.

Third, the practice of herd specialisation at the level of individual herder camps, as an attempt to increase labour productivity, led to a decline in the complementary grazing strategies of different animal species on the same pastures (Mearns 1992). It is not clear to what extent this has contributed to long-run pasture degradation, but at least in the short term in certain localities it appears to have resulted in a change in forage species composition away from the preferred vegetation communities for domestic herbivores, owing to heavier grazing pressure on a more limited range of species[36].

Fourth, the state fodder distribution system under collectivisation encouraged a relative shift in the regional distribution of livestock that was probably ecologically as well as economically unsustainable, and which exacerbated pressures on pastures in certain localities. State livestock policy was geared towards at least maintaining, and preferably increasing, the size of the national herd. This involved a substantial increase in the movement of supplementary feed to animals during deficit periods, rather than relying wholly on the nomadic movement of animals to the available forage from natural pasture plus limited local production of hay, as had been the case prior to collectivisation. It therefore differed fundamentally from traditional pasture management, which depended more completely on the opportunistic strategy of moving animals to the available forage and therefore allowing for year-to-year fluctuations in livestock numbers consistent with a dynamic conception of system carrying capacity. The level of economic subsidy in the distribution of winter/spring feed supplements grew considerably during the 1980s as herders began to expect fodder supplements in most years, rather than in times of emergency alone, as the system was originally intended to operate. This is likely to have stabilised aggregate livestock numbers in fodder-deficit regions (the western Altai mountain/Gobi desert ecotone; the Gobi desert and desert-steppe regions of the South) at a level close to the carrying capacity in more productive years, thereby sustaining stocking rates that may have exceeded local carrying capacity in the least productive years (Danagro 1992, Jigjigdsuren 1993).

The fifth change in patterns of mobility and pasture management practices relates to the more general decline in spontaneous forms of collective action among herders under collectivisation (Mearns 1993b, 1993c). In practice, it is likely that the time-honoured customary principles described above surrounding the coordination and use of pastures were observed most of the time within the neighbourhood-level group throughout the period of collectivisation. However, the official truth, at least in the eyes of those whose interests lay with the collectivised state administration, was that pasture allocation was a matter for bureaucrats and technicians employed by the collectives. This included animal husbandry specialists ('zootechnicians') whose acquired technical knowledge was intended to substitute for herders' own experiential technical knowledge in the drive to modernise the pastoral livestock economy[37]. As a result of the tension between these competing 'truths' as to how decisions in the pastoral sector were actually taken, customary mechanisms for settling disputes were inevitably weakened.

The existence of an alternative system of authority to the customary one provided better-'connected' herders (eg. those with friends or relatives in the brigade or collective administration, or those more articulate herders with relatively greater bargaining power) with an opportunity to 'free-ride'—ie. to ignore mutually agreed customary principles of restraint in pasture use—more or less with impunity. In the case of disputes in which the collective administration was brought in to arbitrate, the decision of the district /collective chairman was final, which may have favoured those herders with more power and influence, or who chose to cultivate good relations with the collective personnel. During fieldwork it has frequently been reported by herders that the incidence of disputes over land, water and other natural resources increased during the period of collectivisation, which seems to support the hypothesis that customary mechanisms for resource allocation and dispute settlement had been weakened as a result of the increase in bureaucratic involvement. Alternatively it could be argued that valued natural resources have become more contested as land/livestock ratios have declined; increasing stocking rates under collectivised production cannot be discounted as a contributory factor.

Decollectivisation and economic transition (1990s–)

The generalised set of 'coordination norms' regarding pasture use and allocation continue to exert considerable influence over herder decision-making in contemporary Mongolia, in spite of the countervailing trends of the collectivisation period. In the period of economic and political transition following decollectivisation however, two further trends can be identified: one which threatens to undermine further the breakdown of coordination norms around local pasture use, and one which could potentially strengthen them.

The first of these trends is the atmosphere of uncertainty that prevails during the post-socialist economic transition period. The state of economic, political and social flux that characterises the reform process contrasts markedly with the rigidities and limited individual freedoms of centuries of hierarchical, feudal organisation, followed by seventy years of state-socialist command planning. The feudal state prior to collectivisation interfered relatively little with the day-to-day business of herd management, but provided a stable, ordered social formation within which it could go on. The benefits of collective action among herders in production activities and in land tenure arrangements were realised within this context. Similarly, under collectivisation—despite the existence of parallel structures of authority and legitimation in pastoral livestock production (customary/traditional, and scientific socialist/modernist)—the bounds within which herders operated were clear, known and predictable. It was still possible for neighbouring herders to

form mutual expectations of each others' actions regarding the use of common pastures, and to make decisions on the basis of those expectations, which is a necessary condition for developing local coordination norms so as to overcome a 'tragedy of the commons' (Runge 1986, Wade 1987, Mearns 1993b).

Under present conditions of structural chaos however, the necessary degree of institutional stability required for the upholding of group norms regarding land tenure, and for the potential exercise of sanctions within local groups, is absent. This uncertainty makes it difficult for herders to form mutual expectations of each others' actions. It tends to heighten the assurance problem of not knowing to what extent other herders are likely to stint, or voluntarily exercise restraint, in their use of pasture. Other things being equal, individual herders are likely to perceive a lower threat of sanctions against free-riding behaviour. That is, the opportunity cost of attempting to maximise individual gain from the available pasture is perceived to be lower. While economic and political conditions are changing rapidly, it is difficult to learn from past experience in order to anticipate the behaviour of others, since a particular conjuncture of circumstances influencing one's own and others' decisions may never be repeated[38].

In Booroljuut, Tariat, for example, the orderly system of pasture deferral by season described earlier was beginning to come under threat during 1992, following the dissolution of the collective and the privatisation of its herds. One large group of more than twenty herding households in Lower Booroljuut valley moved to their autumn camps much earlier than usual. Those who moved first claimed at the time that they had moved only to build new shelters and stockyards following privatisation, but remained for several months, during which time they were joined by others. The group included both experienced herders and newcomers who had only recently acquired animals in the privatisation of the local collective's herds. They had moved against the advice of the *bag* leader, who was told that if he wanted them to return he would have to provide transport; they knew he would be unable to do so, given shortages of fuel and vehicle spare parts. Other local herders, normally members of the same community group, regretted not having moved with the renegade group, since they had missed out on the best grazing that year from their autumn pastures, and resolved to join any renegade moves should they happen again in future. However, they did not expect that particular group to take such action the following year, since they would learn from their mistake during 1992, when the autumn pastures became heavily congested and grazed out before the end of the season (Mearns 1993a).

Recent changes in the structure of the rural economy have contributed to this trend favouring individual free-riding behaviour. The large-scale reduction in the size of the public sector has considerably increased unemployment in both urban and rural areas. Technical and support personnel in rural areas such as veterinary officers, animal husbandry specialists, drivers and canteen workers have managed to acquire formerly collective-owned animals in the privatisation programme and, owing to a lack of alternative employment opportunities, have turned to full-time herding for their livelihoods. Many of them may be children of herders but who have never made a living at herding themselves, while others may have some limited experience of herding. Some continue to live in rural towns as absentee herders, in which case herding relatives or friends may care for their newly acquired animals, usually in return for a share of the products. Others look after their own animals, but remain close to rural towns, thereby increasing potential congestion on local pastures there.

In Booroljuut, for example, the situation described above was exacerbated by an influx of newcomers from the district centre following decollectivisation, who were for the most part former employees of the

collective. By autumn 1992 they represented an estimated 20 percent of the total number of herders in Tariat. It remains to be seen whether such urban-to-rural migrants will remain in rural areas over the long term, or whether their move was merely a temporary, opportunistic response to claim their entitlement to collective assets under privatisation. Much will depend on how far they are able to integrate into the local neighbourhood group, and the relative availability of economic opportunities in urban versus rural areas as economic liberalisation proceeds.

Such urban-rural migrants, as relative newcomers to herding, pose particular problems within herder community groups. Their eligibility to acquire animals in the privatisation programme has been a contentious issue in itself, particularly among long-standing herders. The newcomers are 'outsiders' to residence-based local groups within which a degree of coordination in pasture use is customarily practised, even though in many districts, entitlement to shares in collective assets was dependent on being able to demonstrate family ties in the area within recent generations. They have frequently become scapegoats for local discontent around the privatisation of collective assets, and are often held responsible for a perceived increase in grazing pressure on local pastures (Mearns 1991b). It is undeniably true that some of the newcomers are less skilled in pasture and herd management than herders of a number of years standing, and have a greater tendency to remain relatively sedentary. Their presence increases the range of interests represented within the community group, which further reduces the chances of collective action to coordinate and regulate the use of pastures. However, the severity of this problem may decline over time, as some newcomers return to urban areas as part-time or absentee herdowners, and others see it in their interests to comply with locally agreed rules for regulating pasture use.

These relative newcomers to herding have less incentive to observe local coordination norms regarding pasture use, for at least three possible reasons. First, and perhaps least likely, they may be unaware of them. Second, they are less integrated into local neighbourhood communities and therefore the opportunity cost of free-riding is lower than it is for longer-standing herders. Only with time will they begin to benefit from participation in social networks for mutual assistance in labour-intensive tasks, or for local exchange of other goods and services (Mearns 1993b, 1993c). Third, they are disadvantaged as late-comers. They are likely to have been less successful in acquiring winter and spring shelters under privatisation than already established local herders, and therefore more inclined to move early to autumn and winter pastures in anticipation of the potential difficulties they may face in gaining access to grazing once other herders have moved.

In opposition to this trend favouring individual free-riding behaviour is the re-emergence of local customary institutions, notably the *khot ail*, within which herders engage in various forms of mutual assistance. Under collectivisation, the decline of such labour-pooling arrangements, for the reasons enumerated above, was a contributory factor in the decline of customary mechanisms for coordinating and regulating pasture use and the arbitration of land disputes. Conversely, their strong re-emergence in contemporary Mongolia can be expected to increase the incentives for collective action in the management of common pastures. As argued elsewhere, this second, postive trend provides a key opportunity to strengthen pasture land management by building on and strengthening local community institutions as an integral component of land policy reform (Mearns 1993b, PALD 1993).

Conclusion

The hypothesis outlined earlier, based on the economic defendability of resources model, was that territorial behaviour among pastoralists in the more equilibrial grazing ecosystems of Mongolia, characterised by relatively high forage density and predictability, would correspond to a geographically stable territorial system (quadrant 3 in Figure 1), while that in less equilibrial ecosystems, characterised by relatively low resource density and predictability, would be territorially unstable and feature increased mobility and dispersion (quadrant 2). This hypothesis was extended, drawing on Casimir (Casimir 1992a), to suggest that territorial behaviour would vary in its relative emphasis on spatial boundary defence or social boundary defence respectively, depending on the degree to which ecosystem dynamics could be characterised as equilibrial or non-equilibrial. Two case study sub-districts were chosen to test these hypotheses, and cross-checked against comparative data from several other ecological zones.

Territorial behaviour towards basic forage among pastoralists in the more equilibrial forest/mountain steppe environment of Booroljuut does approximate a geographically stable territorial system. In the less equilibrial desert-steppe environment of Tsagaan Khutul, pastoral territoriality is characterised by a high degree of mobility and dispersion, and of flexibility of movement to accommodate the unpredictable distribution of forage in time and space. In drier years, territoriality in Tsagaan Khutul is of the quadrant 2 type; in wetter years it corresponds with quadrant 4 strategies (overlapping home ranges between neighbouring groups of herders). On the basis of the evidence presented here, the economic defendability model is helpful in understanding broad variations between ecological zones of Mongolia in territorial behaviour among pastoralists.

However, it is less straightforward to characterise these forms of territoriality as differing in degree of emphasis on spatial and social boundary defence respectively. Spatial boundary defence is observed to operate more strongly in relatively equilibrial environments, if this is interpreted as being manifested in the congruence of the boundaries of cohesive herding communities with particular geographical territories. Indeed, this appears to operate even where official public policy runs counter to it, as evidenced by the large number of reported cases of groups of herders moving regularly across administrative boundaries throughout the period of collectivised production, where those boundaries dissect the natural pastoral resource units. In such cases, however, social boundary defence also plays an important role, in that herders seem to have been identified with a particular neighbourhood group.

The notion of social boundary defence implies a level of exclusion of potential resource users that is very rare in Mongolian culture, given the ideology of open access to grazing, supported by a cultural predilection for non-violence. Nevertheless, conflicts over access to grazing do appear to be increasing following the dissolution of the pastoral collectives, and in many places resentment is directed towards newcomers. The fact that newcomers frequently justify their entitlement to use common pastures on the grounds that they have family ties in the area suggests that implicit rules of entry to herding communities do exist to some extent. The reported evidence suggests that such concern over social boundaries operates just as strongly in the more equilibrial forest/mountain steppe areas as in the less equilibrial desert-steppe environments. In the latter case, social group boundaries are certainly restricted to a greater extent than are spatial boundaries. Spatial and social boundary defence mechanisms appear to co-exist in most places, probably as a result of the historically unprecedented conditions of institutional upheaval and economic uncertainty that prevail in contemporary Mongolia.

Although the economic defendability model explains a good deal of the variation in territorial behaviour among pastoralists in different ecological zones, a full understanding of pastoral land tenure arrangements and their change or continuity over time also requires that the influence of changing political and economic conditions and public policies be taken into account. The period of collectivised production in Mongolia saw a surprising degree of continuity in land tenure arrangements in particular localities. Public policies during the period often tacitly underwrote customary practice. There were also significant changes however. A range of public policy-related factors, while they led to a general rise in the living standards of herders, had the effect of reducing herder mobility. Territorial behaviour became to some extent delinked from ecological factors, as a result of public action to minimise the impact of environmental stress on individual herders. This included investment in winter shelter construction, water supply, and the subsidised provision of animal feed supplements and transport.

The period of decollectivisation and post-socialist economic transition has seen a partial return to patterns of territorial behaviour more directly influenced by ecological factors and less by public policy. Most obvious have been the responses of individual herders to the dramatic decline in collective provision of transport and animal fodder, including a return to cooperative hay-making within neighbourhood groups, and mutual assistance with base camp moves using draught animals. This transition process has been far from smooth however, and is also far from complete. In the short term at least, there has been an increase in the incidence of abuses of local norms of coordination over pasture use. Several reasons for this have been suggested, including large numbers of newcomers to herding, and the lower opportunity costs of free-riding behaviour by them. The counter-trend of spontaneous collective action may in time come to reinforce coordination norms of pasture use. The long-run implications for land tenure arrangements in practice will reflect the interplay of these factors, which in turn depends on the consequences of the economic transition process for herders in different regions of Mongolia.

Notes

[1] For a review of this debate see Taylor (1988).

[2] This definition is a modification of that given by Casimir (1992a:20).

[3] Indeed, a recent empirical survey of African agricultural systems found that land rights were not a significant factor in determining investments in land improvements, use of inputs, access to credit, or the productivity of land, suggesting that indigenous land tenure arrangements cannot be regarded as a brake on economic development, and therefore casting doubt on the merit of costly programmes of land registration and land titling in the interests of increasing land productivity (Place and Hazell 1993).

[4] The conditions for successful collective action in the management of common-pool resources are more numerous than the two highlighted here. For a summary of the range of other conditions, referring to attributes of the resource, to attributes of the user group, and to relations between the two, see Wade (1987).

[5] In the same volume Casimir tested his hypothesis—that social boundary defence is likely to characterise territoriality among pastoralists under relatively drier, more variable ecological conditions—using data drawn from some 120 case studies of pastoral groups in Africa, Asia, the Middle East, Southern and Central Europe, and Latin America (Casimir 1992b). He used low precipitation totals as a proxy indicator of a high degree of variability in net primary productivity over time, adjusting his basic algorithm to take account of low mean annual temperature in high altitude systems. However, while it is legitimate to try to isolate the influence of ecological variables over territorial behaviour, and for pastoral systems which characterise dryland environments it is reasonable to take precipitation totals as the main limiting factor on forage productivity, it does not seem valid to imply, as Casimir does, that particular forms of land tenure (from generalised rights of access to ownership rights) can be explained in terms of this single ecological variable, particularly in such a large cross-cultural survey of pastoral systems in virtually all continents.

[6] A similar hypothesis was put forward by Cincotta *et al.* (1992) for the case of Qinghai Province, China.

[7] Ellis and Chuluun (1993), drawing on Nicholls and Wong (1990).

8 A 20-year time series is probably the minimum necessary to estimate interannual precipitation CVs. Longer time series of 50 years or more would be expected to increase slightly the CVs of all stations owing to the likelihood that higher magnitude, lower frequency climatic events would be included (Ellis and Chuluun 1993).

9 One such extreme event involving deep snowcover and blizzards during Spring 1993 affected some 20 districts in the three western provinces of Bayankhongor, Zavkhan and Bulgan. Livestock mortality was as high as half the total number of livestock in the affected districts, totalling around 800,000 head of animals.

10 We are not here concerned either with environmental factors in the choice of encampment site (Bazargür *et al.* 1989, cf. Western and Dunne 1979); or with considerations of traditional herd management such as the day-to-day use of specific grazing resource patches for different species and age classes of animal at carefully specified distances from the base camp (Purev 1991).

11 The *bag* is the lowest-level administrative unit of the Mongolian state, but does not have formal territorial boundaries. The boundaries of each *bag* are usually informally recognised by the local district administration however. There are usually between two and eight *bags* in each district.

12 "Social mapping" is one of a repertoire of participatory rural appraisal (PRA) methods (Chambers 1992) used in the field research. Other important PRA methods used included wealth ranking (Grandin 1988) and matrix ranking. These methods and their applications in the Mongolian research are discussed elsewhere (Mearns *et al.* 1992, Mearns 1993a).

13 *Nutag* translates as "family territory" (Szynkiewicz 1982:23), from which the term *neg nutgiinkhan* is derived (see Table 2).

14 The *bod* is a standard Mongolian livestock unit, based on the value of a single cow or horse. Its equivalents for other domestic animals are: 14 goats, 7 sheep, 0.5 camels. It is preferred to alternative, international standard livestock units because the conversion factor is more appropriate to Mongolian breeds of domestic animals.

15 A larger sample of *nutag* have been tracked and mapped by Potkanski and Szynkiewicz (1993) in Dörvölj and Yunshuu, the other two *bags* in Erdene district.

16 This relation between a stated ideal and actual patterns of nomadic movement has also been observed elsewhere, such as Turkana district of Kenya (Dyson-Hudson and McCabe 1985, McCabe 1990).

17 Based on interviews with 9 separate herders in Erdene *sum*, August 1992.

18 Herders frequently state that severe winter weather often follows a summer drought or vice versa. This observation has also been made by Ellis and Chuluun (1993).

19 It should be noted that the use of saxaul wood rather than dung for fuel is frowned on by experienced herders, except where branches and twigs can be picked up off the ground (Mearns 1991b:32).

20 This was reported to have taken place most recently in during the harsh winter of 1986–87. Snow reached a depth of 30–40 cm, covering much of the available pasture in Tsagaan Khutul and elsewhere in the district. A number of households moved to Dulaani Gobi, being provided with fodder by the collective, and others not customarily resident in Tsagaan Khutul were also trucked in by the collective. The following summer was very dry, and the whole group was moved by truck to Argaliin Uul (Mearns 1991b).

21 Moreover, these estimates are based on recent experience when the former pastoral collective (*negdel*) provided livestock feed supplements during the winter/spring season, especially during times of emergency. It is likely that following the decline in state or collective provision of subsidised fodder, even greater flexibility of access to key resources will be necessary.

22 Such reciprocal rights of access were guaranteed during the pre-collective and collectivised periods by means of a higher authority in whose direct economic interest it was to ensure survival of the feudal or collective herds, as discussed in the final section. With decollectivisation and the transition to a market-orientated economy with private herd ownership, it will be necessary to make provision in land policy for such reciprocal rights of access across jurisdictional boundaries in times of emergency (see PALD 1993).

23 It is significant that ownership status of members (private versus cooperative) varied between the *neg jalgynkhan* in Booroljuut. All the herders in a single *neg jalgynkhan* were either private herders or members of the cooperative; there were no mixed-membership neighbourhood groups at the time of the survey. The herders of Lower Booroljuut valley, for example, were all private, while those of Ikh Jargalant valley were all members of the cooperative. There was some evidence that once a significant number of leading herders in one community group had decided to form a cooperative, for whatever reason, or to leave the existing cooperative/company, all the other members of the group would follow suit. This observation seems to confirm the perception that each *neg jalgynkhan* does indeed function as a cohesive and interdependent community group.

24 The second stage in the analysis of local community groups was to identify the individual *khot ail* within each community. This was done for Upper Booroljuut, Lower Booroljuut and Ikh Jargalant. Further analysis was also carried out at this stage, using wealth ranking data, data from district census records on livestock holdings and household age/sex structure, and simple genealogies to investigate kinship relations within and between *khot ail* (Mearns

1993a). As might be expected, kinship ties tend to be stronger within *khot ail* than between neighbouring *khot ail*. There is an association between spatial and social proximity: with increasing physical distance between *khot ail*, the strength of kinship relations between them diminishes.

25 Potkanski and Szynkiewicz mapped a further sample of 18 household *nutags* in Booroljuut *bag*. The seasonal pattern described here is confirmed by their findings (Potkanski and Szynkiewicz 1993). Bazargür and Shiirev-Adiya (Mongolian Institute of Geography and Geocryology) and Chinbat (Department of Geography, Mongolian State University) have described six generalised regional models of pastoral mobility, based on extensive field work over the last 15 years (Bazargür *et al.* 1989, 1992). The pattern described here for Borooljuut *bag* corresponds to their "Khangai-Khentii mountain zone" model.

26 The topographic pattern closely matches that previously identified and mapped for Fourth brigade of Ikh Tamir district, Arkhangai province, which also lies in the forest/mountain steppe zone (Mearns 1991b).

27 This should not be read as implying that the ecologically viable territorial unit is necessarily a single tributary river valley; in some cases, the community territory will take in two or three smaller valleys.

28 Estimate based on interviews with 18 herders in Booroljuut, September 1992.

29 The word now refers to the contemporary "provinces", into which the Mongolian state is administratively divided (18 in total). It is estimated that Chinggis Khan united the *aimags* of some 50 separate Mongolia tribes into 10 or so large *aimags*, in total covering an area considerably larger than that of contemporary Mongolia (Professor C. Dalai, President, Mongolian Association of Historians, personal communication).

30 Dalai (op. cit., fn.29) and Dr G. Purevtseren, Director, Research Institute of Land Policy (personal communication).

31 This has been described as an historical precedent for private land ownership in Mongolia (Purevtseren, op. cit., fn.30).

32 Law-code of Chinese Ministry of External Affairs, St Petersburg, 1828, section 1, par. 9, no.167, cited in Shirendyb (1976).

33 1961 Constitution of the Mongolian People's Republic, p.7, par.10 (Shirendyb 1976).

34 The Mongolian term *sum* originally referred to a military rather than an administrative unit. There was necessarily a close connection between pastoral and military organisation during the period of conflict and instability around the thirteenth and fourteenth centuries. The sum had a clearly defined group membership but no territorial definition. The term was not used to refer to a territorial unit until the 1920s (Dalai, op. cit., fn.29).

35 Mr C Shiirev-Adiya, Institute of Geography and Geocryology, Mongolia, and Mr B Chinbat, Department of Geography, State University of Mongolia (personal communication).

36 In Erdene district, Dornogov', for example, this is true of associations between Stipa gobica grass and the herb species Artemisia frigida. In terms of Clementsian ecological succession theory, the latter is an increaser species, which begins to dominate under selective grazing pressure, and to form a mat-like growth that suppresses the growth of more palatable grasses. Some of the most seriously degraded pastures lie in the ecotone between the eastern steppes and the Gobi desert steppe, notably associations of the protein-rich forb Allium polyrrhizum with shrubs such as Caragana spp. and Salsola spp. Although nutritious for animals, these vegetation communities are fragile and lacking in resilience. A diet of Allium alone is too rich, and needs to be complemented by browse from the fibrous shrubs. Under heavy grazing pressure however, the shrubs tend to decline. This is frequently exacerbated by wind erosion, leading to 'mounding', a condition in which the remaining shrubs stand up some 10–20 cm from the general surface of the ground on pedestals, occasionally exposing their roots.

37 There had always been a tension in Mongolia between an attempt to follow the "party line" in modernising livestock production on the one hand (for example, through selective cross-breeding using non-indigenous livestock breeds to 'upgrade' the gene pool), and a tacit recognition on the other that traditional Mongolian herd management practices and indigenous breeds were in fact most appropriate to Mongolian conditions. This "pragmatism" on the part of Mongolian technical specialists still prevails to a large extent (cf. FAO 1991).

38 Much attention has been paid to refining theoretical models of such "multi-person prisoners' dilemmas" (MPD) (eg. Hardin 1982, Runge 1986, Ostrom 1990). In the language of game theory, contemporary conditions in Mongolia more strongly resemble one-shot MPD games than they do the iterated MPD game in which the players learn from past experience and develop coordination norms as a guide to future action. The relevance of such collective action theory for the case of Mongolian grazing commons is discussed in more detail elsewhere (Mearns 1993b, 1993c).

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Acknowledgements

The research on which this article is based was carried out as part of Policy Alternatives for Livestock Development in Mongolia, a collaborative research and training project between the Institute of Development Studies, University of Sussex, the Research Institute of Animal Husbandry, Ulaanbaatar; the Institute of Agricultural Economics, Ulaanbaatar; and the Institute of Geography and Geocryology of the Mongolian Academy of Sciences. I am indebted to colleagues in these institutions. D. Bayartsogt of the Ministry of Food and Agriculture, Mongolia, acted as field assistant and interpreter. Sue Rowland of the University of Sussex prepared the maps. Financial support was provided by the UK Overseas Development Administration and the John D and Catherine T MacArthur Foundation. I was a Visiting Scholar at the Land Tenure Center, University of Wisconsin-Madison, between July and September 1993, with additional financial assistance from the Nuffield Foundation, and wish to thank John Bruce and colleagues at LTC for their support. I take full responsibility for the views expressed here; they are not necessarily endorsed by any of the above-named institutions or individuals.

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