

# Fragmenting Pastoral Mobility: Changing Grazing Patterns in Post-Soviet Kazakhstan

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**Abstract**—Kazak nomads were seasonally mobile in the pre-Soviet period, in response to climate variability and landscape heterogeneity. The scale of these movements was interrupted during the Soviet period, but some degree of mobility remained. Mobility virtually ceased in the post-Soviet 1990s, but is re-emerging as flock numbers rebound from the mid 1990s population crash.

The paper presents results from a three-year multidisciplinary study in southeast Kazakhstan, from 2000 to 2004. The study areas cover ecological transects of up to 600 km in length, which in some cases are still traversed by pastoral flocks. The transects cover desert, semi-desert, riverine, semi-steppe, foothill and sub-alpine pastures, with precipitation ranging from 150 mm to 650 mm.

Results show the proportions of livestock grazed around villages and those which are seasonally mobile. Animal nutrition and economic factors associated with livestock mobility are presented. Forage assessments indicate discrepancies between available resources and their exploitation, due to decreasing mobility.

Under the current grazing systems, pastures distant from settlement are now mainly unused and former integral grazing circuits have therefore become fragmented. Non-mobile livestock have lowered productivity compared to mobile livestock.

**Keywords:** Kazakhstan, pastoralists, seasonal mobility, economic change

## Introduction

Rangelands in Kazakhstan occupy nearly 70 percent of the country, covering over 180 million hectares, most of which is semi-arid with less than 300 mm annual precipitation.

The rangeland ecology is heterogeneous at a large regional scale (Asanov et al. 2003). Climatic variability in precipitation and temperature occurs spatially and temporally across latitudes and altitudes. Four major rangeland vegetation types are associated with these major transitions in climate and topography: grassland steppe in the north, giving way to semi-steppe and semi-desert in the center, with deserts in the southern regions and alpine meadows in the mountains rimming the plains to south and east. Each of these broad zones contains myriad smaller-scale soil and vegetation complexes (Rachkovskaya et al. 2003). There is a complicated pattern of productivity between intrazonal ecosystems as well as considerable seasonal and interannual fluctuation in biomass (Gilmanov 1995).

Traditional Kazak nomadism knit these distinct zones together through seasonal migration to different pastures (Fedorovich 1973; Zhambakin 1995). There were two characteristic annual cycles, with many variations; latitudinal from south-north-south starting in spring and traversing distances from 200 to 2,000 km, and secondly, vertical, from plains in winter, spring and autumn to mountains in summer, of much shorter distances. Two principals underlay these nomadic movements; firstly that livestock should only stay for short periods in a single place in order not to graze regrowth, and

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secondly, that tracts of pasture were grazed only at the onset of maturity or at their seasonal productivity peak (Alimaev et al. 1986). In addition to meeting livestock feed requirements, other crucial factors underlying nomadism were avoidance of deep snow and severe cold in winter, and providing access to water (Khazanov 1984).

In the last two centuries, the extent of flock mobility has expanded and contracted in response to fundamental changes in national political and economic systems (Alimaev and Behnke 2003; Alimaev and Temirbekov 2003). These changes are first recorded in the period of Russian imperial expansion into Kazak tribal lands during the 19<sup>th</sup> Century. Changes in the 20<sup>th</sup> Century were initiated with the Communist revolution and subsequent collectivization of Kazak livestock into state-managed farms (1920-1935). Further changes encompassed the post-Stalinist state farm expansion and emphasis on high livestock output (up to the end of the USSR in 1991). In the last decade, the pastoral Kazaks had to cope with the immediate post-Soviet economic crisis, dissolution of state farms and loss of 70% of the national flock (1992-1999). The current period is one of rebuilding private livestock holdings starting in 2000.

Seasonal livestock mobility by Kazak pastoralists allowed the efficient exploitation of natural pasture variability (Alimaev 2003). Contraction of mobility leads to ecosystem fragmentation, which has been recently summarized as:

“a diminished ability of large herbivores to access natural heterogeneity in vegetation and topography. As fragmentation occurs, ecosystems are simplified by breaking up interdependent spatial units into separate entities... the result of this simplification is a reduction in the scale over which complex interactions among environment, large herbivores and human management takes place” (Hobbs and Galvin 2003).

This paper examines the processes and consequences of fragmentation in several study sites in southeastern Kazakhstan.

For livestock to make use of large-scale landscape heterogeneity requires a relatively large human scale of social and economic production units. In contrast to wild large herbivores such as the migratory saiga antelope in Kazakhstan, domestic livestock must be accompanied by their human managers, who need to protect, nurture and live off their livestock property.

Historically, Kazak livestock have been shepherded between seasonal pastures under several types of production unit, each considerably larger than the individual family unit. Under the pre-Soviet traditional system, Kazak nomadism was organized around sub-clans, the aul group of up to 100 families who traveled together to share herding and defense, while higher tribal and judicial authorities coordinated inter-clan movements. Clan organization was mostly destroyed under collectivization in the early 1930s, as pastoralists were forced into state-run farms. By the 1940s large groups of animals were once again being herded to remote pastures, this time supplied with technical inputs by the state collective farms. By the end of the Soviet period, state farms with up to 60,000 head of small stock orchestrated a regimented system of seasonal movement, dividing labor into brigades separately responsible for shepherding and other tasks

such as harvesting hay, veterinary inputs, transport, marketing and social infrastructure for the state farm workers.

The immediate aftermath of decollectivisation in the 1990s left most formerly employed pastoralists atomized into nuclear family units, and having obtained very few livestock or capital assets from the privatization of state farms. With neither sub-clans nor state farms to provide support, individual families with their small flocks could not cope with the scale of investment and effort required for long distance migration.

Currently, there is an emergence of large-scale extended family units who can and do undertake longer distance seasonal movements. They were either fortunate enough to have acquired key assets such as vehicles from the disbanded state farms, or have accumulated enough livestock to invest in necessary technical equipment. They are able to operate at a greater social and economic scale through hiring shepherds, deploying dependent family members, and drawing upon kin networks for investment and co-management.

The Kazak government is defining new policies towards livestock and rangeland management, as revenues from the booming mineral economy are released for rural reconstruction and agricultural research. Entirely new systems of private livestock and rangeland management have developed in the past decade, about which there is little information. Urgent and controversial questions about the rangelands have arisen in Kazakhstan including: whether to encourage private rangeland ownership, how to prevent overgrazing on common land, whether to charge fees for grazing on state land, how to prevent livestock mortality during drought and blizzards, what scale of private farm operation is viable and should be given state support. There is a need for contemporary and relevant data to guide policies on extensive livestock management.

## Study Areas

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The areas were selected to represent the major ecological zones of the Kazak rangelands. Six sample villages were selected within two *rayons* (districts) of two *oblasts* (provinces) in the southeast part of the country.

The desert zone selected is the Moinkum district of Jambul province in southern Kazakhstan. Average annual precipitation is 170 mm (highly interannual variability from 20 to 325 mm) and temperatures are extreme, falling to -45 °C in winter with a maximum of 46 °C in summer. Villages are located along the Chu River that runs through the desert, and the reeds around the Chu flood plain are a crucial livestock feed in an otherwise semi-arid environment. The vegetation of the district varies. The area of sand dunes is dominated by perennial *Agropyron* grass species and by suffrutescent *Artemisia* species and by shrubs (*Calligonum*, *Artemisia* and other species). The riverine area contains reeds (*Phragmites*) and *Tamarix* while the plain north of the river has mainly *Artemisia* and *Salsola*.

Three small villages (Sary Uzek, Ulan Bel and Male Kamkale) were selected in this desert zone. A defining feature of the desert villages is their remoteness; these villages are up to 300 km from the nearest urban market, about a seven hour drive on very poor roads.

The semi-desert area is in the northern part of Jambul district of Almaty province, in the south east of the country. The semi-desert covers a precipitation and vegetation gradient ranging from 230 mm in the northern section to 350 mm in the southern section, the latter, which supports rainfed wheat cultivation. Temperatures range from a minimum  $-35^{\circ}\text{C}$  in January to a maximum of  $45^{\circ}\text{C}$  in July. Vegetation is mainly composed of *Artemisia* species, small shrubs of *Salsola* and *Kochia*, and in spring, ephemeral grasses and grass-like plants of which *Carex* is the most important.

One sample village of Ul Gule is 100 km and the other village, Ay Darly, is 200 km from the nearest urban centre, respectively 2 to 4 hours driving on good roads.

The foothills zone lies to the north of the Tien Shan mountain range (called Ala Tau). The study village of Shien lies in the southern part of Jambul District of Almaty province. Precipitation is considerably higher than in the other two study areas, averaging 450 mm, and even more on the grazed slopes above the village. Temperatures are moderated by the mountains and are less extreme than the desert and semi-desert zones. Cereal farming is carried out and crop residues provide an important source of winter fodder for livestock. Vegetation composition varies by altitude, with meadow grasses and forbs in the higher slopes and steppe species (*Artemisia*, *Stipa* and *Ceratocarpus*) in the drier lower plain. The sample village is one hour from the nearest urban centre.

## Methods

A sample of 46 households and their associated flocks were selected from local government records of village livestock, to create a sample representing the distribution of smallstock ownership by households within each survey village.

Surveys were conducted on the households every three months starting in August 2001, for a total of eight rounds. An economic questionnaire was administered to the head of household or flock manager, to obtain data on the costs and returns of livestock owned by the households. Data gathered included: assets owned; type of winter feed given to the flock; amount of labor used for flock management; costs of livestock transport, feed, veterinary inputs and marketing; income from sales of live animals, wool and fibre, and dairy products. In each household up to 30 sheep and goats were ear-tagged and several thousand animals were weighed every 3 months. In a separate survey, the same flock managers were interviewed concerning the breeds, reproduction and winter supplementary feeding of their livestock. In spring 2004, a small follow-up survey was conducted to weigh some 400 sheep and goats in 12 flocks at two of the study villages.

A census of livestock numbers and seasonal movement over an entire year was carried out in autumn 2003, in the same six villages. The census accounted for 40,000 head of sheep and goats, and over 8,000 cattle, horses or camels. Owners or flock managers were asked where their flocks were grazed in each of the previous four seasons (2002 to 2003).

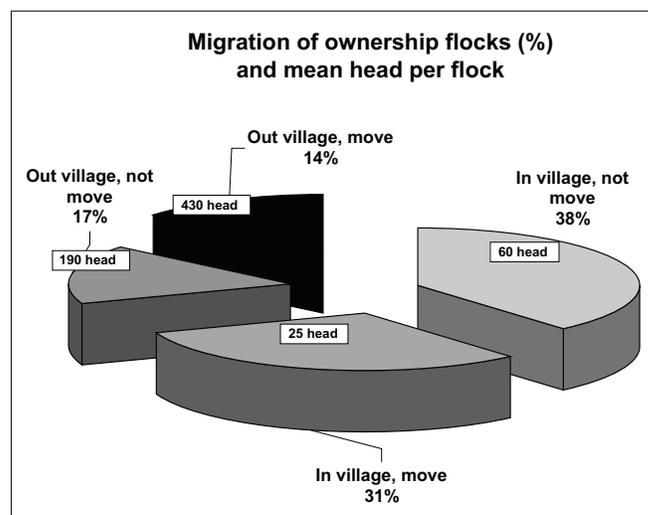
Study methods included a series of in-depth informal interviews with householders, traders in livestock products, officials in villages and district centres, and sellers at livestock markets. Participant observation methods were used for the interviews, entailing periods of temporary residence by the researchers in the sample villages or rangeland grazing areas between 2000 and 2003.

Rangeland sites grazed by livestock from the sampled village were monitored every three months (spring, summer, autumn and winter) from 2001 to 2003. Using methods of line intercept and metre quadrant, vegetation data were obtained at 11 grazing sites in the Moinkum district and 13 in Jambul district. These sites were located at intervals of 1, 2 and 5 km from the village centres, and at remote points grazed by livestock of some households belonging to the sampled villages. The following vegetation characteristics were obtained: plant cover, height, weight, palatable and unpalatable ratios; biomass per hectare and chemical composition of forage plant nutrients was also measured.

## Results

### Current Grazing Patterns

There are four principal grazing management systems (fig. 1). Over a third of livestock owners do not move their animals away from their villages throughout the year. These owners graze their animals within a radius of 5 km around the villages. In winter periods, their animals are stall-fed in barns for several days up to several months, depending on the availability of pasture around the village and the severity of winter conditions, including temperature, wind and depth



**Figure 1**—Migration of livestock among 6 sampled villages, 40 thousand sheep equivalent units in 448 flocks, southeast Kazakhstan 2003.

of snow. Smallstock are continuously shepherded due to the risk of predators (wolves) and thieves. Shepherding is carried out either by the owners or through collective neighbourhood groups that rotate shepherding duties between the group members. The individual holdings of sedentary village flocks are relatively small, with an average of 60 smallstock.

A further third of village residents, however, place their livestock into larger flocks that are taken to different and distant pastures at least once a year. There are several types of arrangements. Some villagers entrust their livestock to larger-scale mobile livestock owners who are often relatives; others pay a monthly rate per head of animal herded, while another arrangement is to group village animals and collectively hire shepherds to manage the animals for one or more seasons. Villagers who practice these forms of management tend to have very small flocks, with a mean of 25 head.

Another group of livestock owners (17 percent) have settled outside of the villages, occupying buildings formerly used by the Soviet state farms. These sites include winter barns, wells, shearing and lambing stations and temporary shepherd houses which were either abandoned, sold off or leased after the state farms were dissolved in the mid 1990s (Behnke 2003). These sites are from 5 to 60 km distant from the villages and always include at least one water point. Owners' families or hired workers stay year-round with the animals, which have less competition for pasture compared to those permanently grazed around the villages. Flock sizes in this group are larger, with an average of 190 smallstock.

The last group of owners (14 percent) are those with the largest flocks (mean 430 head) whose animals are moved to different pastures from three to ten times a year. Moves between pastures can be quite short, of about 10 km for some flocks. A few other large owners with several thousand head move their animals a total of more than 150 km between winter and

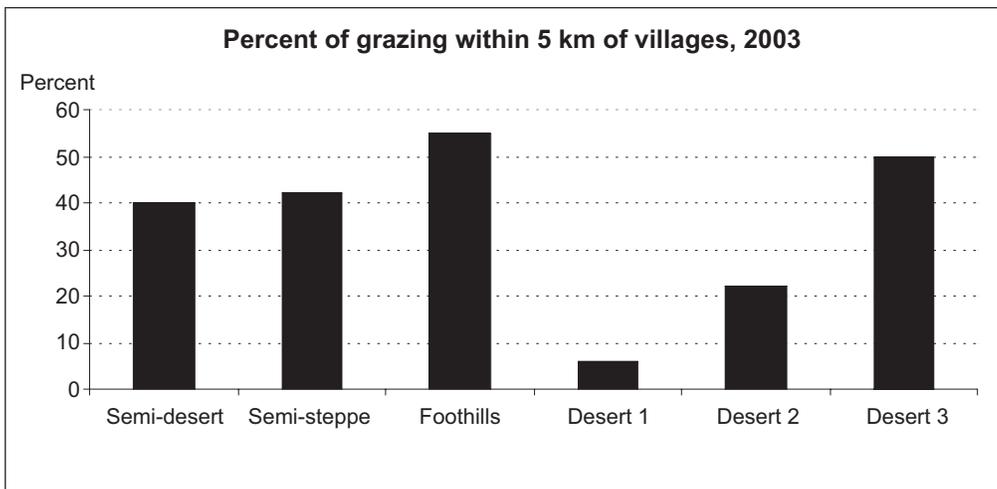
summer pastures, with a number of temporary stops between grazing sites. These very large flock owners have hired shepherds and some owners do not themselves stay with their flocks, depending on younger relatives to supervise their animals.

Overall, 45 percent of owners do now have their animals in flocks that move away from settled areas for some portion of the year. This is a change from the period immediately following the break-up of the state livestock farms in 1996. A study of the same areas in Jambul district in 1998 to 1999 found that all small flocks (less than 40 head) were managed on a sedentary basis (Behnke 2003). Another study in 1997 to 1998 of a region north of the Moinkum district also found that only the few large-scale livestock owners with more than 200 head were still migrating seasonally (Robinson and Milner-Gulland 2003).

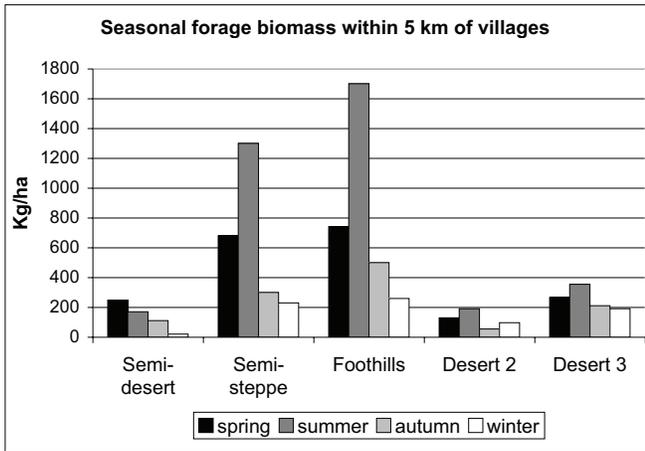
Currently, though seasonal mobility is highly correlated with flock size – bigger flocks are mobile (fig. 1), not all small flocks are managed on a sedentary basis. This is a major positive trend in accessing distant pastures that had been unused for at least five years after the end of the state farms in 1995/96. Keeping animals away from the village areas for some seasons is also alleviating grazing pressure and degradation in these areas.

### Grazing pressure around villages

The intensity of grazing around villages is highly variable between different ecological locations. Depending on the village, figure 2 shows that between a low of 6 percent and a high of 55 percent of annual grazing occurs within a 5 km radius of villages throughout the year. This variability is partly due to the differences in quantity of available forage around villages (fig. 3). Thus, villages in the foothills with higher precipitation have higher available forage and a greater concentration of animals grazing around the village.



**Figure 2**—Annual grazing pressure around 6 sampled villages, 448 flocks in southeast Kazakhstan 2003



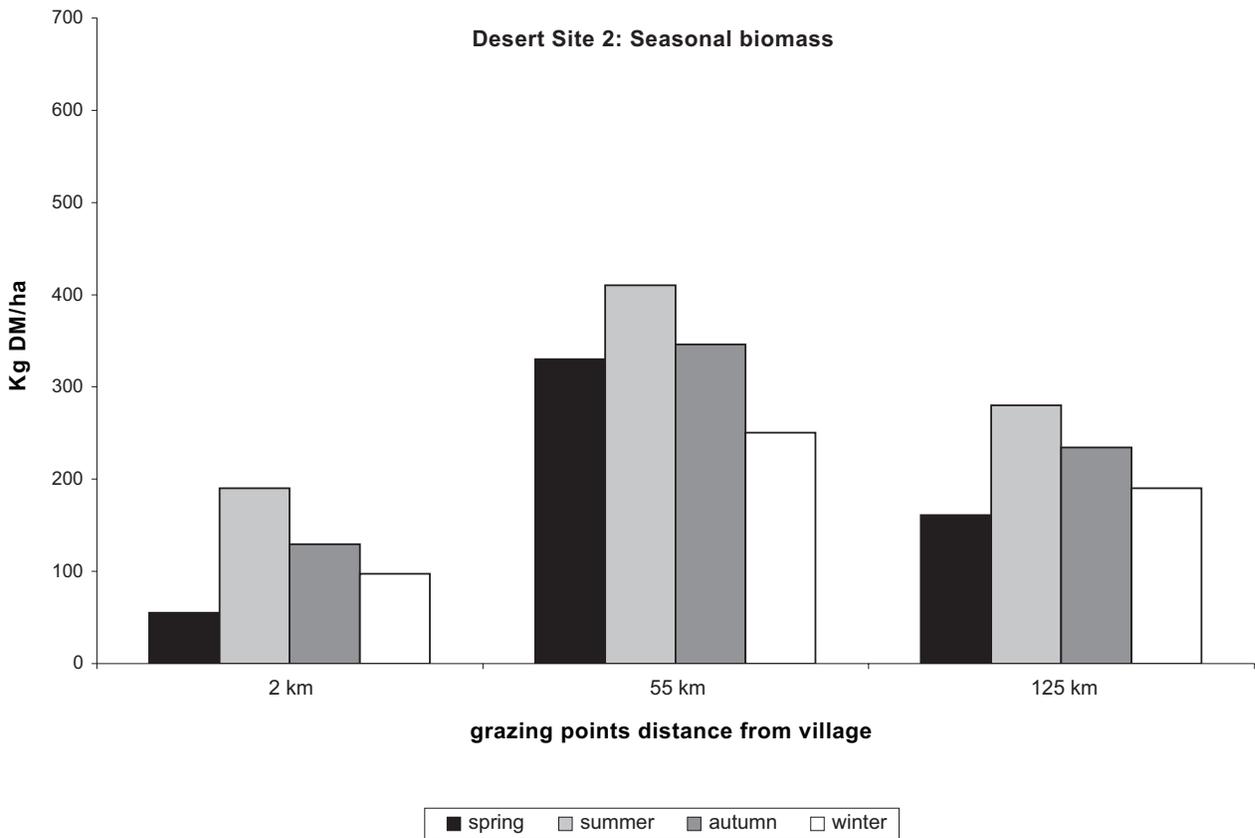
Note: data on biomass is not available for Desert Village 1.

**Figure 3**—Forage biomass available seasonally around 5 sample villages, spring 2002 to autumn 2003.

The source of circum-village grazing pressure is likewise not uniform. Since migratory flocks also return to their owners' villages for some period of time each year, typically for lambing, shearing and mating, up to 40 percent of grazing around villages can be caused by temporarily stationed migratory flocks. Facilities required for these tasks (e.g. electricity to run shearing machines) may only be available in villages, where extra labour can also be obtained to manage animals during peak periods of lambing and shearing. In other cases, permanently resident livestock in the villages causes all the circum-village grazing.

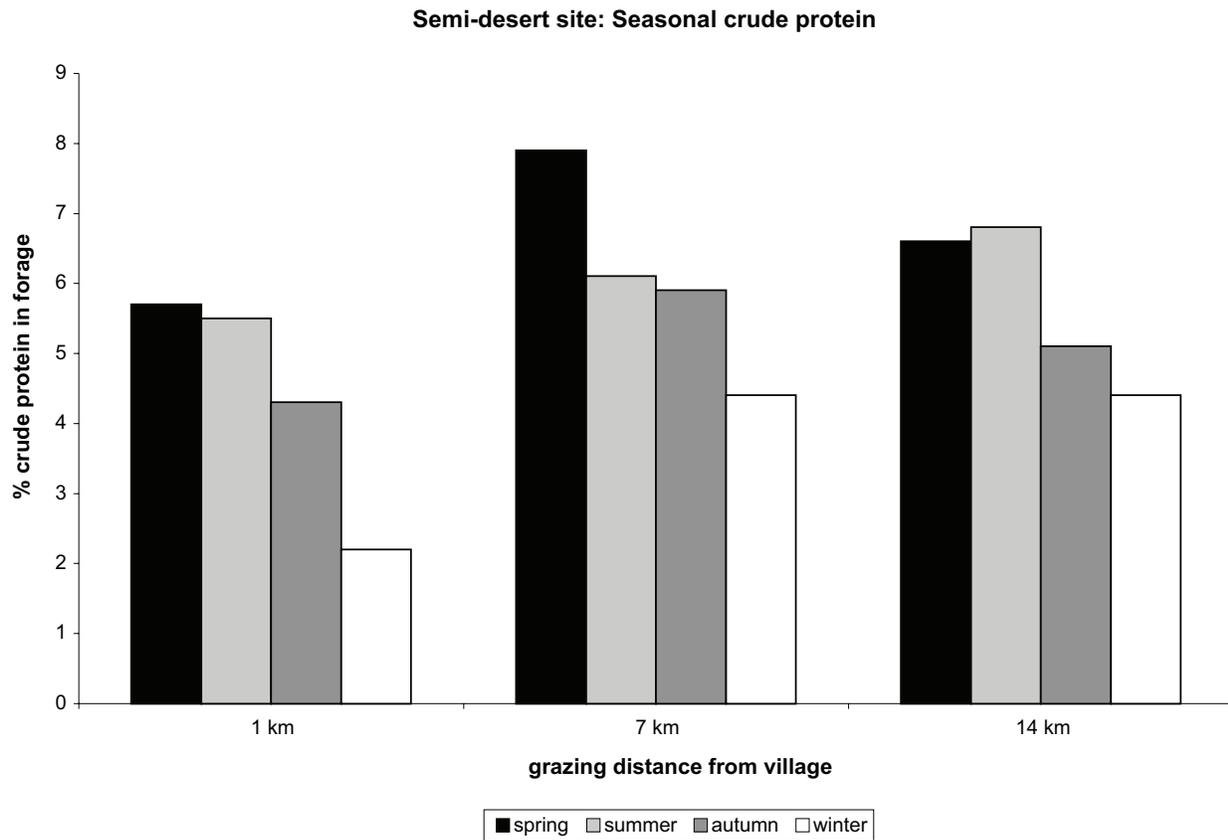
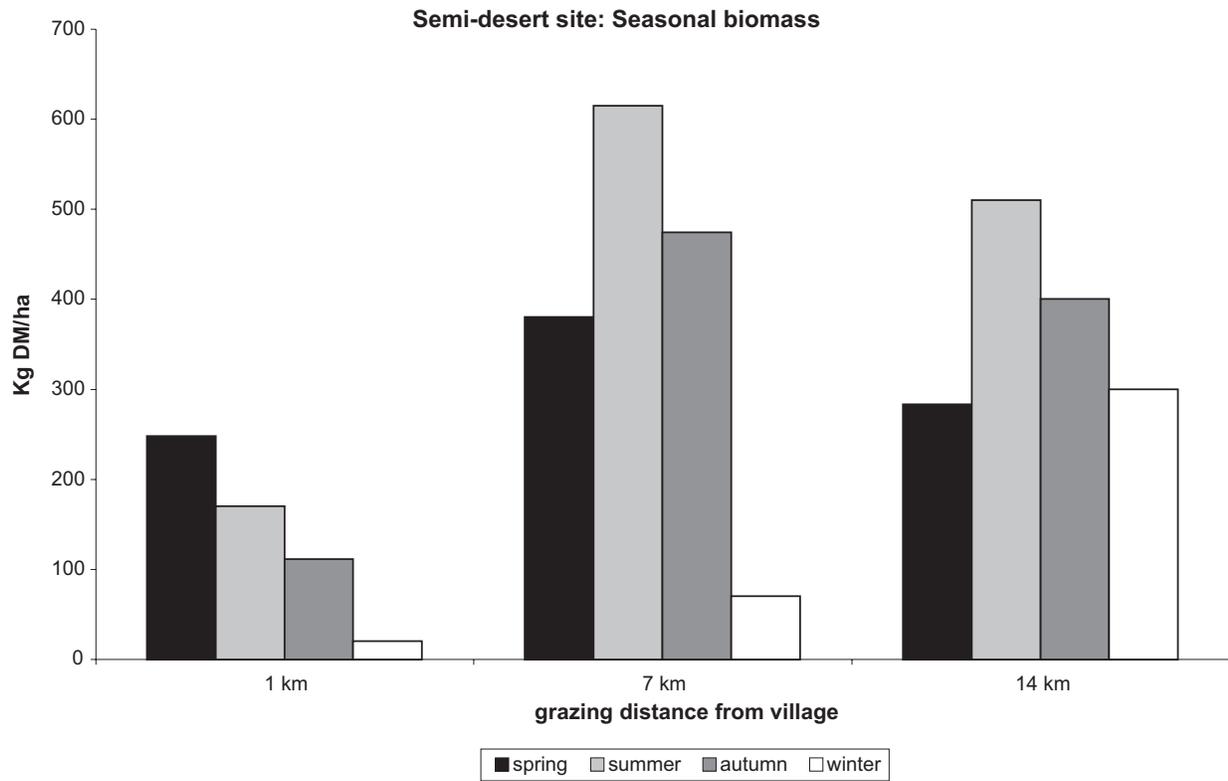
### Degradation and Unused Pasture Resources

The present decline in seasonal mobility has two consequences: overgrazing around villages and under-grazing on remote seasonal pastures. Comparison of vegetation at grazing points around villages and at remote areas still grazed by migratory flocks indicates that livestock at remote pastures have access to higher biomass and more nutritious forage (figs. 4, 5 and 6).

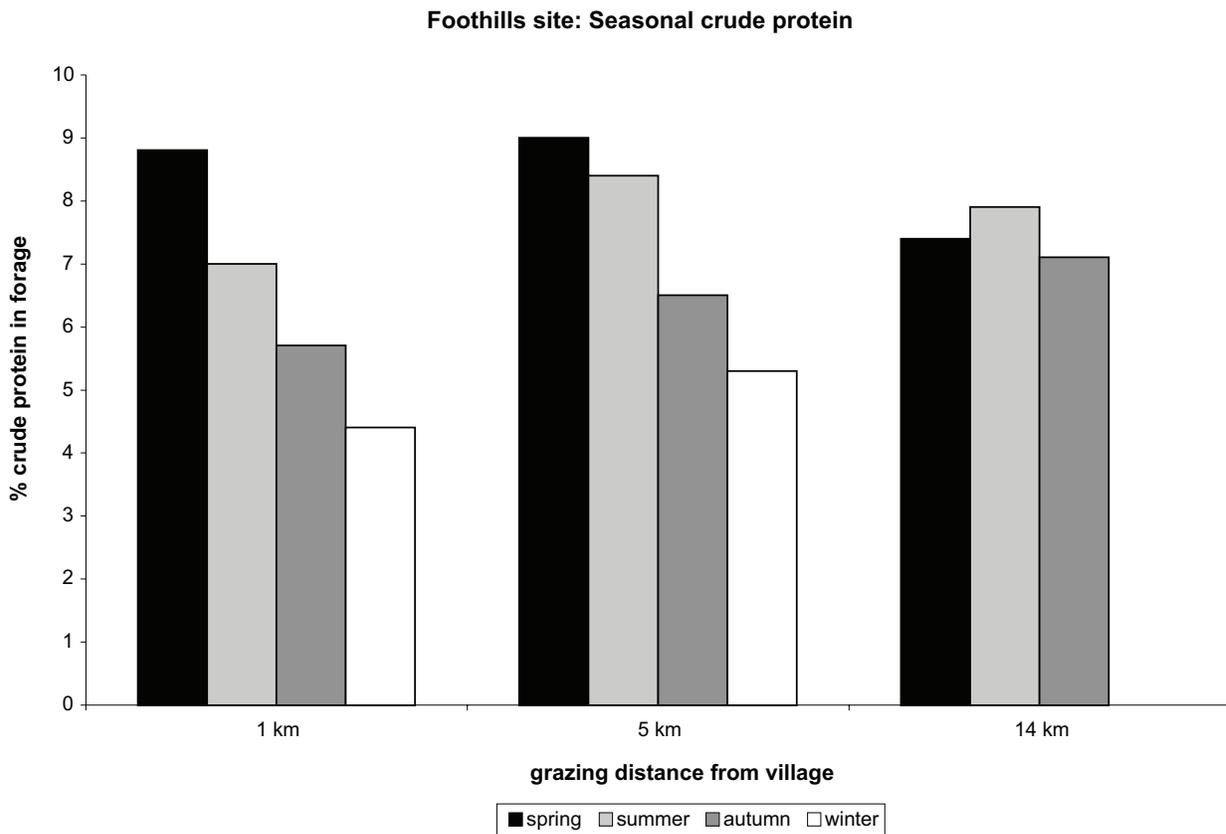
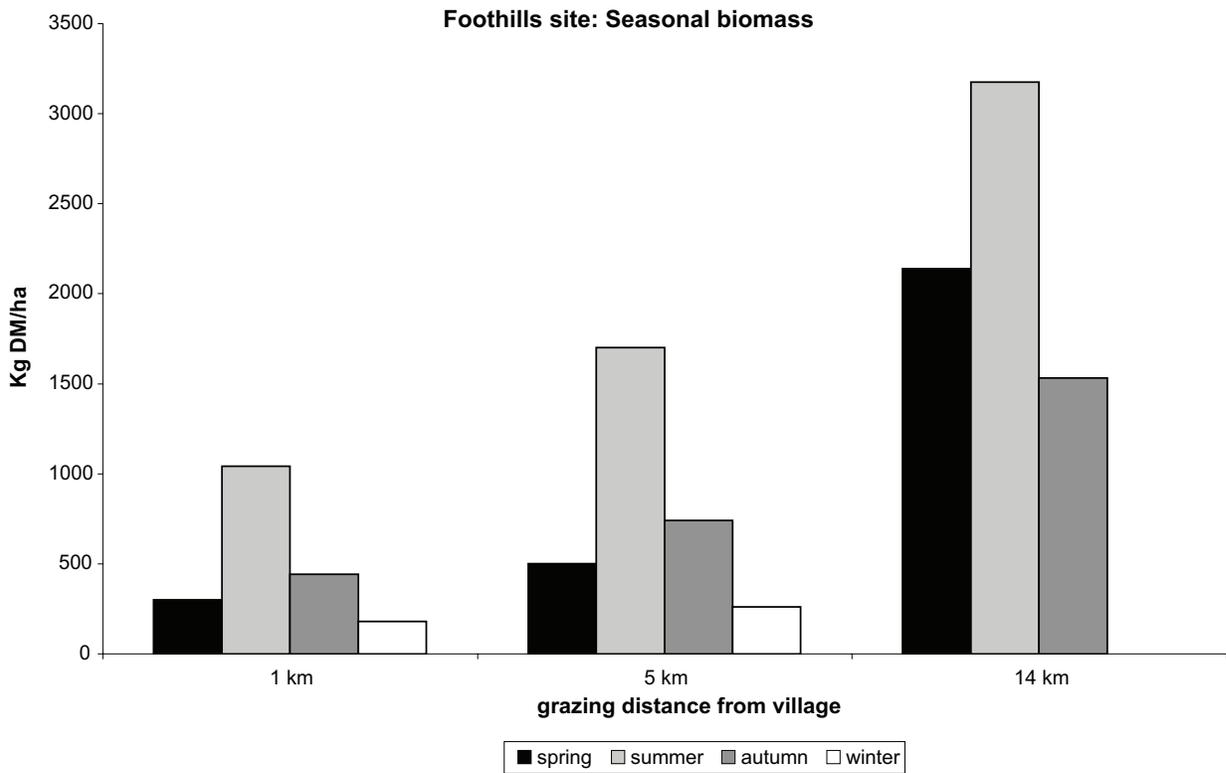


Note: Winter data not available

**Figure 4**—Desert Site 2: Seasonal biomass and crude protein at grazing points around villages and distant areas.



**Figure 5**—Semi-desert site: Seasonal biomass and crude protein at grazing points around villages and distant areas.



**Figure 6**—Foothills site: Seasonal biomass and crude protein at grazing points around villages and distant areas.

At the desert site 2, most animals are kept away from the village due to a very low amount of forage around the village (fig. 3). At one currently used grazing outpost located 55 km from this village, biomass is greater than around the village in all seasons (fig. 4). At a temporary grazing area some 125 km distant, biomass is lower but levels of crude protein are much higher. However, these very remote grazing points are only used by a few flock-owners at the present time.

Village animals considerably overgraze the peri-village area around the semi-desert site (fig. 2), where the percentage of ground covered by vegetation is measured at 10 to 15 percent. Both biomass and crude protein levels improve at 7 and 14 km distant (fig. 5) where some owners now keep their livestock seasonally. Ground cover at these areas is 50 to 60 percent. The higher level of biomass at a temporary grazing point 14 km from the village is particularly noteworthy in winter when there is almost nothing available to graze around the village and animals remaining in the village must be stall-fed.

The foothills with their higher precipitation offer a higher amount of forage year-round, resulting in a relatively high amount of circum-village grazing pressure (fig. 2). But there is still a crucial difference in spring and summer between biomass around the foothills village and at further points 5 km and 14 km distant (fig. 6). In winter the area located 14 km distant cannot be grazed at all, because being in the mountains it is covered with snow.

Not only is biomass lower around villages due to a more sedentary grazing management, but the ratio of palatable to unpalatable plant species has also been affected by overgrazing around villages. This is shown in figure 7 in the case of the semi-desert site 2. The more nutritious and preferred species of *Artemisia* and *Salsola* are in greater abundance at 10 km distance from the village compared to 3 km, while the unpalatable species of *Peganum* and *Ceratocarpus* are much more prevalent closer to the village.

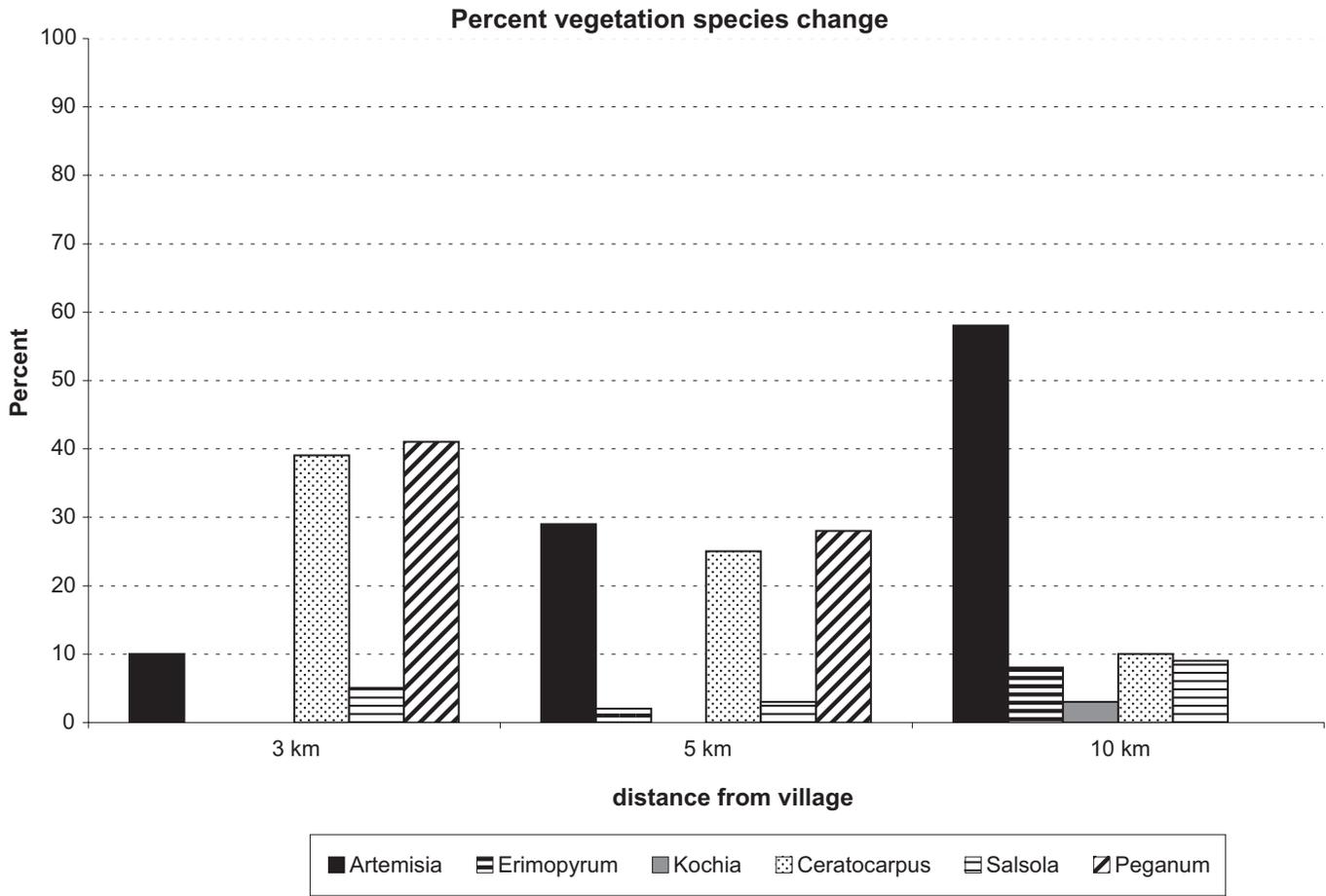


Figure 7—Changes in vegetation species composition with distance from semi-desert village.

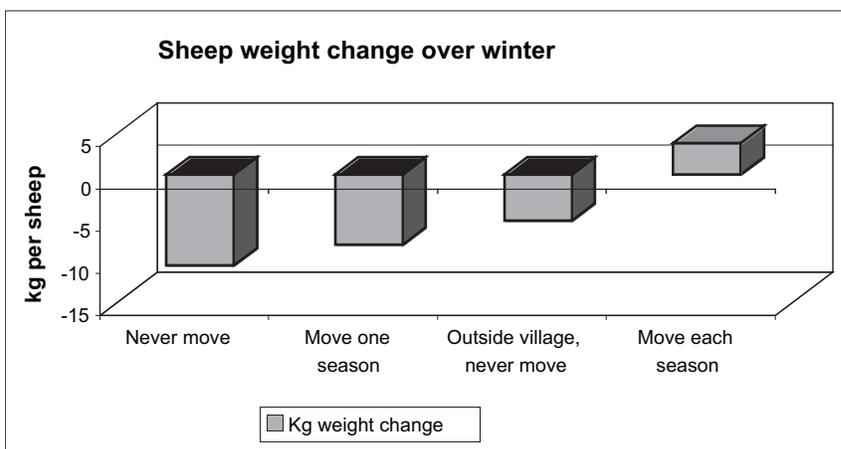
## Mobility and Livestock Weight

Livestock productivity is directly affected by whether animals are moved to seasonal pastures or are grazed all year around settlements. Figure 8 shows the effect of seasonal movement on sheep weights. Sheep that were moved in each of the previous four seasons gained on average 5 kg weight over winter, compared to village-based sheep that lost on average 8 kg, being stall-fed or foraging on over-grazed ranges within 5 km of villages over winter.

In the following year (2003/2004), sheep in flocks that were moved to different seasonal pastures as compared to being grazed around villages weighed on average 7.7 kg more in spring, as shown in table 1. Sheep kept at stationery grazing sites outside of villages did not weigh more. The effect of seasonal movement on goat weights is less significant.

## Seasonal Mobility Requires Capital Assets

Moving animals to seasonal grazing areas requires capital equipment and recurrent expenditure, mainly on hired labour but also on vehicles (fuel, spare parts). Only larger flock owners tend to own the equipment necessary for seasonal movement (fig. 9). The chief item of equipment needed is motorised transport – trucks and/or tractors – not to move animals as they are herded on foot to the different grazing areas, but to bring supplies of fuel, food and fodder to the remote grazing sites. Some form of shelter is also required for mobile shepherds, which includes wagons, yurts (traditional nomadic felt tents) and small permanent winter houses. Due to the extreme cold climate, livestock grazed at remote winter sites also require shelter in the form of barns. Lastly, distant grazing areas are dependent on water from wells, which often require motorised pumps.



**Figure 8**—Changes in live weight of sheep kept under four different grazing systems 2001-2002.

**Table 1**—Mean live weights of sheep and goats in flocks according to seasonal movement, May 2004.

Species	In village, never move	Out of village, never move	Move each season
Sheep	49.5 kg	48 kg	57.2 kg
n	50	71	80
Goats	37.7 kg	41.4 kg	40.1 kg
n	63	59	83

Standard error of a difference ( $p \leq 0.01$ ) = 1.34.

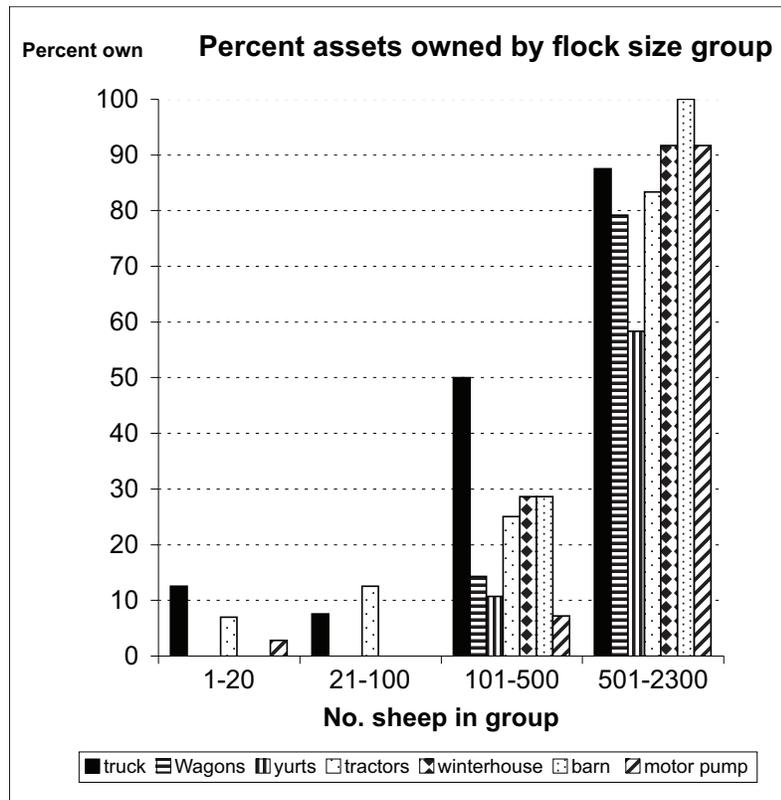


Figure 9—Capital assets required for livestock migration by household flock size.

As indicated in figure 9, small flock owners rarely own these capital assets, and so for them, seasonal livestock mobility is only possible if they combine their livestock into the flocks of large flock-owners or else pay hired shepherds to take their animals to distant pastures.

### Small Flocks have Higher Input Costs per Head

Fodder is the principal input costs for all flocks regardless of size or seasonal movement (fig. 10). During the cold winter period from December to March, village-based flocks all require supplementary stall-feeding. The amount of feed required depends on the severity of each winter, mainly the degree of cold and the depth of snow covering the vegetation. Flock owners try to obtain as much fodder as they can afford in autumn due to the risk of a particularly bad winter when animals would die through lack of accessible pasture or exposure to cold winds. The type of fodder varies by region. In the desert area, reeds and grasses are collected from the river flood plain in autumn. In the foothills area, grain crop residues and natural mountain hay are fed to animals in winter, while in the semi-desert area, planted *Agropyron* and natural hay harvested from the rangelands are common winter feed sources. Additionally, some commercially processed bran is often purchased.

The cost of providing winter feed (whether harvested or purchased) is proportionately much higher for small flocks, which as we have seen tend to be more sedentary (fig. 1 and 10). Large flocks are usually moved to the desert for winter, where sand dunes provide shelter from the worst cold as well as accumulate less snow such that taller woody shrubs can provide browse throughout the winter. Large flock-owners who station their animals at winter grazing sites do not normally provide supplementary feed to their sheep and goats throughout the winter. Although cattle and particularly riding horses will be given some additional feed, only pregnant and lactating sheep and goats will be given feed for a few weeks at the end of winter. The result is that fodder costs per head are much lower in large and mobile flocks and conversely, quite high for small and sedentary flocks. Seasonal movement compensates for winter supplementary fodder.

Labour costs per head of livestock are not significantly linked with flock size (fig. 10). While large flock owners must usually hire labour, small flock owners devote more family labour per head of animal owned. The other main input costs – marketing, veterinary and movement to pastures – are also not closely linked to flock size. There appears to be little evidence of economies of scale in recurrent input costs, apart from fodder.

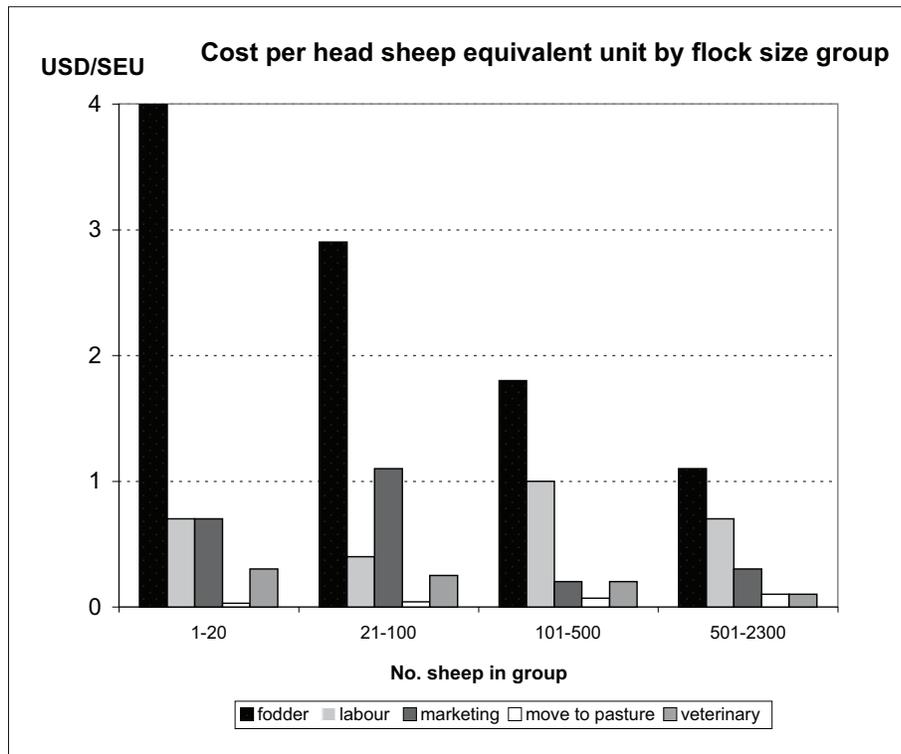


Figure 10—Input costs per sheep equivalent unit by household flock size.

## Conclusions

Currently, rangeland use remains fragmented as few pastoralists can operate at a large enough economic scale to take advantage of the ecological scale in the landscape. An emerging group of wealthier pastoralists is moving their livestock seasonally again.

Smaller scale flock owners are organizing communal grazing at seasonal summer pastures where land around villages is becoming overgrazed. Smaller flock owners are also increasingly trying to place their animals into the flocks of large owners that are moved to seasonal pastures. However, many smaller flock owners will need external assistance or credit if they are to undertake seasonal migrations on their own, as they lack capital equipment needed for movement.

An outstanding issue is whether small, non-mobile flocks can be as productive as large, mobile flocks. Moving animals to temporary seasonal pastures may produce heavier animals, but at what cost to their owners? Are heavier animals more financially rewarding to their owners over the longer term?

Livestock owners must calculate the costs and benefits of having their animals move away seasonally from their settlements to graze on distant pastures. Our results suggest some of the factors that villagers have to consider. Sheep grazed on distant pastures over winter actually gained weight, while

sheep kept in the village sheds for at least part of winter and given fodder lost significant weight. By springtime, the loss of weight will have a negative effect on lambing rates.

A new smaller-scale study, “Biocomplexity, Spatial Scale and Fragmentation: Implications for Arid and Semi-Arid Ecosystems” beginning in 2004 will continue to measure the economic and biological impacts of livestock mobility at several of the previous study areas. This study is funded by the National Science Foundation to the Natural Resources Ecology Laboratory at Colorado State University. The Further analysis will consider whether sedentary small flocks are viable in the longer term, able to continue providing their owners with an income but not capable of expanding due to high off-take. The longer-term profitability of moving animals will be assessed by comparison.

## Acknowledgments

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