



Horseflies, wolves and wells: biophysical and socio-economic factors influencing livestock distribution in Kazakhstan's rangelands



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ABSTRACT

There have been studies on how pastoralists assess and choose the resources required for their livestock, but little research analysing whether livestock are matched to the available resources in a seasonal migratory system by an entire pastoral community over a year. This paper reports a case study of pastoralists in Kazakhstan which shows how the inter-relation of biophysical, institutional and economic factors results in the imperfect matching of livestock numbers to the distribution of forage resources. The research is based on a three-year study using anthropological interviews, formal survey data, and remotely sensed data covering all livestock (25,000 smallstock and approximately 2300 cattle, horses and camels) in a study area of 60,000 km² for an entire annual cycle; a combination of methodologies and geographical coverage that provides a comprehensive estimation of the factors that influence the pastoral exploitation of this human-managed, complex ecosystem. The research finds that the pastoralists are subject to a number of limitations in using biophysical niches which might otherwise provide the best feed and water resources for their animals at a particular season and site. Different ecozones offer seasonally-shifting advantages and disadvantages for the livestock, but livestock owners are also economically differentiated. The interplay between economic and biophysical factors exemplifies the multi-faceted character of pastoralists' decision-making about site selection within a relatively open rangeland tenure system. Only those with the largest livestock holdings distribute their livestock to take advantage of the best seasonal resources. Despite the wide availability of biophysically suitable sites, most livestock owners' choices are compromised and therefore frequently suboptimal, prompting the conclusion that natural resource matching is constrained.

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1. Introduction

Pastoral production systems typically prevail in environments where natural resources are scattered, intermittently productive or unproductive—at extreme latitudes, high altitudes or in semi-arid regions (Ellis et al., 1993). In the attempt to match livestock feed demand to feed supplies in these heterogeneous and harsh environments, pastoral herds track ephemeral and highly seasonal resource concentrations (Ellis and Swift, 1988; Fernandez-Gimenez and Allen-Diaz, 1999; Niamir-Fuller, 1999; McAllister et al., 2006).

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From a biological perspective, this freedom of movement by pastoralists should make optimal use of available resources and sustain larger populations than would be possible if herds were not allowed to track fleeting resource concentrations (Behnke and Scoones, 1993; Niamir-Fuller, 1999; Boone et al., 2005).

The analysis of pastoralism as resource matching by mobile domestic livestock parallels ecological theories with reference to wild animals, of the ideal free distribution (IFD) or density dependent habitat selection (DDHS) which link individual choices to overall population distributions (Fretwell and Lucas, 1970; Sutherland, 1983; Wade, 1987). The fundamental idea behind these theories is that resource consumers respond both to the distribution of resources and to the shifting distributions of other consumers. These spatial ecological models predict that the free movement of individual animals—enabled by open access to resources—results in the optimal distribution of resource con-

sumers in temporally and spatially heterogeneous landscapes, relative to available resources. This matching of animal numbers to resource density enables landscapes to support larger consumer populations than systems in which access is constrained (Pulliam and Danielson, 1991; Jonzen et al., 2004; Hancock and Milner-Gulland, 2006).

Our study examines the proposition that the distribution of domestic livestock in a mobile pastoral system matches the resource concentrations. While this notion is not new, we note that empirical studies on how certain animal species are distributed in relation to food resources and other factors have shown that there is often an imperfect match between the population of consumers and the available food resources, termed by some as “undermatching” (Gray, 1994; Spencer et al., 1996; Houston and Lang, 1998; Shochat et al., 2002; Bai et al., 2009). Some of the main explanations of undermatching from studies of wild animal species is ignorance, poor navigational skills, lack of knowledge, poor cognitive ability or memory on the part of individual animals (Shochat et al., 2002; Hancock and Milner-Gulland, 2006; Bai et al., 2009). Our study seeks evidence on whether undermatching is also occurring in a pastoralist setting in central Kazakhstan, where we have detailed multidisciplinary material from three years of ethnographic research, remotely sensed data and quantitative surveys. If undermatching is occurring, we need to explain why and how the interposition of human managers’ interests alters the expression of optimal resource matching for livestock.

When humans are responsible for the decisions regarding resource use by domestic livestock, there are likely to be trade-offs between the biophysical site attributes and socio-economic and institutional site suitability from the humans’ perspective (e.g., Abernethy et al., 2007 on the distribution of fish stocks and fishing effort). The balancing of these factors in pastoral decision-making regarding herd mobility and resource use has long been recognized by social and ecological anthropologists (Stenning, 1959; Cunnison, 1966; Gulliver, 1975; Dyson-Hudson and Dyson-Hudson, 1980; McCabe and Fratkin, 1994; see also reviews in Coppolillo, 2000). One early scholar of pastoralist livestock management strategies reflects that while “Anthropologists can produce generalised patterns of movements... empirically on the ground irregularity in response to highly variable reality is characteristic of on-going nomadic life” and he emphasizes that “each occasion for movement is for the nomads an occasion for *choice*: the assessment of information and needs, the exercise of opinion, and the making of decision. . . this choice is not in practice simply a matter of reaching a decision through the assembly and assessment of information on resources, for usually there is no obvious single best choice but a variety of possibilities. . . there is a range of opportunities of roughly equal pastoral advantage” (Gulliver, 1975: 371–372; italics in original). We return to this starting point but now with new tools, such as remote sensing, for assessing the variable biophysical environment, which were not available to social anthropologists decades ago.

There have been numerous close studies of how grazing animals (herbivores) disperse over landscapes which vary in space and time at relatively small scales (e.g., an early review in Coughenour, 1991; Bailey and Provenza, 2008). With the advent of digital and remote sensing technology, studies have also been able to record where sentinel herd animals move, and to correlate those movements with environmental features gleaned from remotely sensed data and field interviews with the pastoralist owners of the livestock (Turner and Hiernaux, 2002; Butt, 2010a, 2010b; Moritz et al., 2013).

At the larger scale, rangeland ecologists and modelers have also sought to detect determinants of livestock distribution at the landscape level (see for example McAllister et al., 2006; Behnke et al., 2011). There are recent pastoralist studies which explicitly benefit

from ecological theories to explain how pastoralists perceive, value and use different parts of their available environment for grazing and moving their livestock (e.g., Schareika, 2003; Krätli, 2008; Moritz et al., 2013; Sayre et al., 2013). These studies can explain (often with a great degree of precision) where some groups of a pastoral community’s livestock are at any particular time and why these animals might be there rather than somewhere else, typically in terms of their consumption of forage and water. But such studies rarely indicate why some socio-economic groups of pastoralists make certain decisions in contradistinction to others, but within the same set of environmental options, a limitation noted by Baker and Hoffman (2006: 775) in a South African case study:

“The existence of different herding strategies within the same environmental context suggests that individual herders may consider non-environmental factors more important when choosing a herd management strategy than has been suggested in ecologically focused papers . . .”.

One study which does attempt to comprehend the criteria used by pastoralists with different socio-economic profiles, by Akasbi et al. (2012), tracked flocks over a year in the Atlas Mountains of Morocco, to identify the factors that influence decision-making of herders regarding accessing resources. They concluded that “The transhumant migration decisions of the three studied tribes are dependent on both ecological and socioeconomic conditions. . .”. While it is not surprising that “the key ecological factor that drives decision-making of transhumant pastoralists is fodder availability” they also conclude that “Individual decisions allow for flexible adaptation within the framework of the tribal and ecological settings, taking into account risk control, social networks (proximity to central tribal settlement and larger family), the arrangement of tribal territories and access to local markets” (Akasbi et al., 2012: 318). Similar conclusions on the effects of socio-economic differentiation for herd management decisions have been reached by Hendricks et al. (2004) in a South African case study. In the forefront of these analyses is the realization that it is not animals making the decisions of where to congregate to obtain resources at the landscape scale, but the people who manage the animals (e.g., Coppolillo, 2000).

This case study of mobile pastoralism in semi-arid Kazakhstan uses the matching hypothesis of IFD and applies multi-disciplinary research methods to assess the extent to which resource matching is a compromise between biophysical imperatives and the social, economic and institutional conditions within which the humans operate their livestock. Our case study allows us to assess not only the tension between biophysical optima and socio-economic feasibility but to reveal the further mediation due to the differential attributes of individual pastoralists.

2. Scope and aims of the study

The assessment considers what constitutes “resources” for different types of pastoralists, in order to evaluate the extent to which they are matching their livestock to available resources. The assessment is based on comparing the apparent advantages and disadvantages of particular ecozones with the recorded distribution of livestock by their owners in each season of an entire annual cycle. This empirical analysis, using remotely sensed and survey data, is then interpreted with rationales from pastoralists, gained by anthropological methods, on why certain ecozones are useful or not, at particular times of year. The resulting distribution patterns suggest there are a variety of biophysical and socio-institutional factors that constrain or attract and thus influence forage resource matching (Butt, 2010b; Behnke et al., 2011).

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