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N. Yamamura · N. Fujita
A. Maekawa *Editors*

The Mongolian Ecosystem Network

Environmental Issues Under Climate and
Social Changes

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Norio Yamamura · Noboru Fujita
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Editors

The Mongolian Ecosystem Network

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and Social Changes

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Cover illustration: Front cover: A pastoralist in the Mongolian grassland. Back cover: *Left:* A herd of sheep and goats; *Center:* A GPS being attached to a sheep; *Right:* Measurement of shrub roots.

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Preface

Most ecosystems on the planet, including grasslands and forests, have been seriously degraded by climate changes and human activities, particularly the overuse of natural resources, and are now in critical condition, with a loss of biodiversity and reduction in ecosystem functions. This situation is widely accepted as one of the most serious global environmental problems. Human activities that use resources are usually embedded in complex social-ecological systems and involve numerous interacting subsystems.

The Research Institute for Humanity and Nature (RIHN), Kyoto, Japan, promotes “integrated cooperative research toward the solution of global environmental problems” and has helped to create the field of global environmental studies, concentrating on interactions between people and nature. One RHIN project, “Collapse and Restoration of Ecosystem Networks with Human Activity,” examines environmental problems associated with ecosystem reductions, using the key concept of ecosystem networks. In February 2010, the project hosted an international symposium on grassland reduction in Mongolia, which is one of the main topics of the project. The main environmental issue addressed in Mongolian grasslands was the reduction and loss of usable pastures for nomadic pastoralism.

The aim of this book is to describe what is currently occurring in the Mongolian grasslands, to analyze how various factors creating environmental problems interact with each other, and to suggest solutions for sustainable management of the grasslands. These analyses and discussions are based on the results of the symposium and other studies within the host project. The title, *The Mongolian Ecosystem Network*, indicates that environmental issues are analyzed from both natural and social perspectives.

This book is divided into three parts. Part I is an introduction, explaining the key concept of an ecosystem network within the project (Chap. 1) and providing background information on the general features of Mongolian nomadic pastoralism (Chap. 2). The distribution of vegetation in Mongolian grasslands is also reviewed, as a fundamental factor in the environment and for pastoralism (Chap. 3).

Part II describes the effects of natural environmental factors and nomadic activities on grassland conditions. Climate change caused by global warming, especially

changes in precipitation, has affected the grassland vegetation (Chaps. 3, 4). Water dynamics that maintain the grassland system are analyzed in a steppe region with shrubs (Chap. 5) and in a forest-steppe region with trees (Chap. 6). Furthermore, the effects of grazing livestock on Mongolian ecosystems are described in relationship to forests (Chap. 7), soils (Chaps. 8, 9), and grassland vegetation (Chaps. 10, 11, 12, 13).

Part III describes the effects of economic and social factors on land use and the livelihood of herders. After the introduction of a market economy to Mongolia in the early 1990s, nomadic people tended to increase their livestock numbers, especially goats, and to move closer to large cities for economic advantages. This shift has led to the degradation of pastures by overgrazing. Rules for pastureland possession, designed to minimize overgrazing, are examined (Chap. 14), and a model representing movement between rural and urban sites is presented (Chap. 15). The social factors driving the increase in goat herds that produce economically profitable products are analyzed (Chaps. 16, 17). Recently, pastureland has also been used intensively for dairy farming, agriculture, and mining. These human activities are described, and their effects on grassland degradation are discussed (Chaps. 18, 19, 20). Finally, the impacts of global warming and globalization on the Mongolian society and ecosystem are examined (Chap. 21).

The chapters in Parts II and III address current environmental problems in Mongolian grasslands and suggest solutions for the sustainable use of grasslands, from both ecological and social perspectives, based on studies within the project. This book analyzes the environmental problems faced in Mongolian grasslands, but the contents contribute to the identification of environmental problems and consideration of sustainable pasture use in grassland areas throughout the world.

We acknowledge the Institutes of Geoecology, Biology, and Botany, Mongolian Academy of Science, and the Institute of Meteorology and Hydrology, Mongolian Ministry of Nature and Environment, for cooperative research in the project. We also thank RHIN, Japan, for financial support for the project (D-04) and the symposium.

Kyoto, Japan
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Part I
Ecosystem Network
and Mongolian Nomadism

Chapter 1

Ecosystem Networks as Social–Ecological Systems

Norio Yamamura

Keywords Ecosystem network • Land cover • Land use • Mongolian grassland • Nomadic pastoralism • Social–ecological systems

1.1 Introduction

Most ecosystems on the planet, including grasslands and forests, have been seriously degraded by human activities, especially through the overuse of natural resources, and have reached critical situations, leading to a loss of biodiversity and reduction in ecosystem functions. This crisis is widely accepted as one of the most serious global environmental problems (Millennium Ecosystem Assessment 2005). Human activities that use natural resources are often embedded in complex social–ecological systems in which various subsystems interact with each other.

Recently, several groups have proposed research frameworks to address the complex social–ecological systems that have resulted in ecosystem degradation (GLP 2005; Folke et al. 2004; Ostrom 2009). Here, we propose another research framework for understanding ecosystem degradation, stressing the fact that social–ecological systems comprise a network of subsystems. In a project titled “Collapse and Restoration of Ecosystem Networks with Human Activity,” conducted at the Research Institute for Humanity and Nature (RIHN), we designated the entire system as an ecosystem network, which we defined as a social–ecological system in which a network of ecological subsystems, characterized by land cover or land use, interacts with a human network, affecting the quality of and transitions among the subsystems.

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The usefulness of this concept lies in its ability to forecast extensive human impacts through changes in land cover, for which data are generally available from area statistics, field surveys, and satellite information. The primary environmental issue in Mongolian grasslands is the reduction and loss of usable pastures for nomadic pastoralism that results from livestock overgrazing and agricultural cultivation (Hirano et al. 2006; Okayasu et al. 2007; Mearns 2004). Recently, extensive mine development to extract rich underground resources has also contributed to reduction in pasture areas (see Chap. 20, this volume). By explicitly depicting the structure of the ecosystem network, we can understand the network structure of environmental issues in Mongolian grasslands, including both ecological and social perspectives. We can also use this concept to examine how the network structure produces environmental problems and to determine which links should be modified to resolve or mitigate the problems.

1.2 Ecosystem Network for Mongolian Grasslands

For our project titled “Collapse and Restoration of Ecosystem Networks with Human Activity” (http://www.chikyu.ac.jp/rihn_e/project/D-04.html), conducted at the Research Institute for Humanity and Nature (http://www.chikyu.ac.jp/index_e.html), the field research takes place in the tropical rainforests of Sarawak, Malaysia, and in the grasslands of Mongolia. During the past few decades, social and environmental conditions in both areas have been profoundly affected by resource extraction, which has recently intensified in response to the demands of the global economy. Local people have used natural products from the forests in Sarawak and have lived by grazing livestock on the grasses in Mongolia. Although the ecological characteristics of their natural environments, such as the regeneration time of vegetation and the position of humans in the food web, are quite different, the livelihoods of many inhabitants in these regions are strongly dependent on services from natural ecosystems.

We hypothesized that the ecosystem network for Mongolian grasslands can be described as a network of social and ecological subsystems, as shown in Fig. 1.1. Subsystems and interactions are indicated by nodes and links, respectively, following the terminology of network theory. In the bottom row, we draw ecological subsystems as characterized by land cover or land use, including suitable pasture, degraded pasture, agricultural fields, and mining areas. Pastures interact with forests in the Forest-Steppe zones and often include shrubs in the Steppe and Desert-Steppe zones. These ecological subsystems are transformed into one another through human activities such as logging, planting, and overgrazing by livestock. In the middle row of Fig. 1.1, we place social subsystems, including nomads with their livestock, governments, and markets and enterprises, which affect the quality of and transitions among the ecological subsystems. The social subsystems also interact with each other. In the top row, we include external factors such as climate change, nongovernmental organizations (NGOs), international agencies, and foreign enterprises that affect the internal subsystems and links in the ecosystem network.

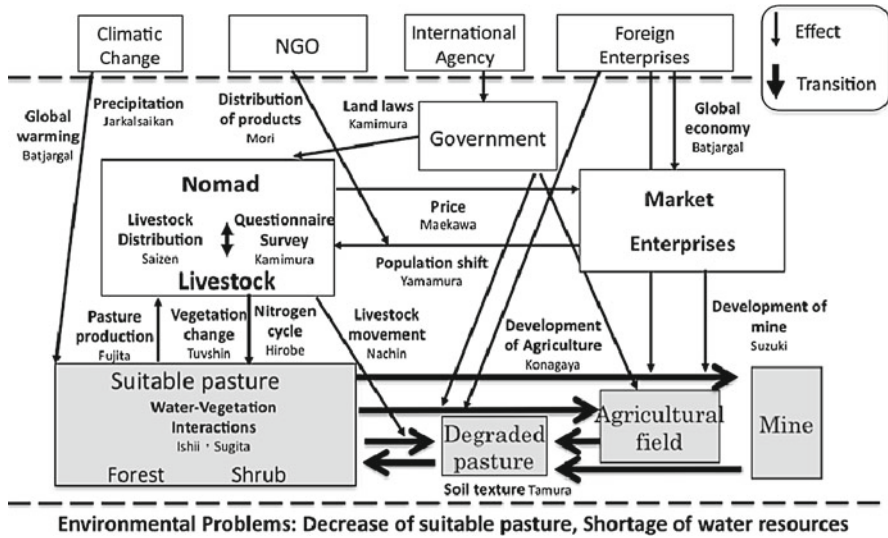


Fig. 1.1 Ecosystem network in Mongolia, where environmental problems are resulting in decreased availability of suitable pastures and shortages of water resources. The network of ecological subsystems, characterized by land cover or land use, interacts with the human social network, thereby affecting the quality of and transitions among subsystems. *NGO*, nongovernmental organization

Parts II and III of this book describe individual studies that clarify the strengths of the links among subsystems, the effects of subsystems on each other, and the interactions within subsystems in the ecosystem network. The links and nodes in the network (Fig. 1.1) reflect the contributions of numerous studies described in the chapters of this book. These ecological, economic, and social studies use various data sources, including field surveys, statistical data from the Mongolian government, and satellite data, to delineate land-cover distribution and its changes. Based on the network structure, we can understand the relationships among the individual studies in this book and can examine the emergence and prevalence of environmental problems related to grassland degradation.

The left side of the ecosystem network shown in Fig. 1.1 is related mostly to relationships between natural environments and grassland ecosystems. The chapters that correspond to links in this part of the network address mainly meteorological and ecological issues and are included in Part II, “Natural Environment and the Ecosystem Network.” The right side of the network is related primarily to economic and social factors that affect land use and the livelihood of herders, and the related chapters are in Part III, “Socioeconomic Activity and the Ecosystem Network.” Individual chapters discuss not only the corresponding link but also nearby links and subsystems as well as various effects throughout the network structure.

We also present a definite ecosystem network for the forest system in Sarawak. A comparison between ecosystem network structures further illuminates the ways in which interactions among social and ecological subsystems result in environmental problems that lead to ecosystem reductions.

1.3 Simplification of the Ecosystem Network and Implications for Conservation

We can simplify the structure of the entire ecosystem network shown in Fig. 1.1 by confining our attention to a specific environmental problem. Here, we focus on two important problems in Mongolian grasslands that result in the loss and deterioration of pastures used for nomadic pastoralism, specifically, overgrazing by livestock and mine development by foreign enterprises (see Fig. 1.2). The expansion and abandonment of agricultural fields have network structures and impacts similar to those of mine development.

In Mongolia, the vegetation (grasses) has no direct economic value for humans. Instead, the value of the vegetation is stored in the livestock that feed on the grasses, as humans use the livestock and related products to maintain their family and to produce income from sales. Global economics affect the behavior of the inhabitants of Mongolia: when international prices for livestock products increase, herders work to increase the number of livestock in the herd, which leads to overgrazing on vegetation and the subsequent degradation of grasslands (Fig. 1.2a). Climate change, especially with respect to precipitation, also has an impact on grasslands.

A reduction in the supply of livestock feed resulting from grassland degradation adversely affects the inhabitants. When grassland begins to degrade, the inhabitants may refrain from overuse by decreasing the number of livestock. Thus, through a type of negative feedback loop, inhabitant behavior and grassland condition can reach a steady state, and the system will tend to be inherently stable. The environmental problem of grassland degradation caused by overgrazing occurs when various factors disturb this negative feedback. Severely degraded grasslands may ultimately become deserts, contributing to the global environmental problem of yellow sands. Therefore, effective technological solutions or political policies are needed to address inhabitant behavior to restore the negative feedback loop.

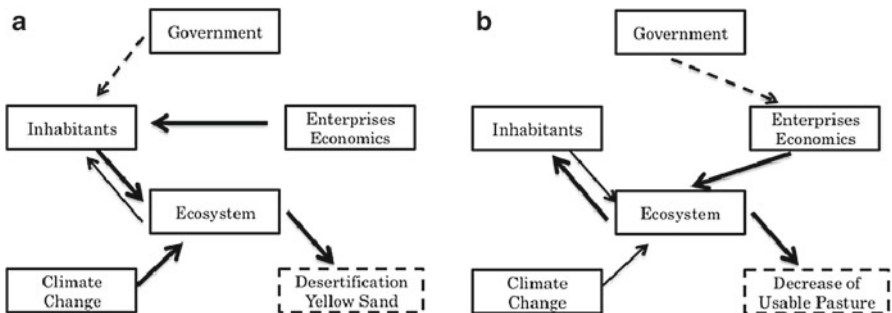


Fig. 1.2 Simplified ecosystem network in Mongolia. (a) A network with a negative feedback loop, represented by overgrazing. (b) A network with a positive feedback loop, represented by mine development

In contrast, mine developments are made by foreign enterprises and directly destroy wide areas of grassland with the permission of the government (Fig. 1.2b). The developed area can no longer be used by nomadic people and their livestock, and areas surrounding the mine must often be avoided because of water shortages and pollution. This process is almost independent of climate change. Enterprises can expand mining areas into unoccupied land that was traditionally used for pastoralism. Therefore, mine development and the withdrawal of pastoralism may constitute a positive feedback loop. Once mine development begins in an area, it easily expands to encompass wider areas. It is critical that effective solutions or political policies for the conservation of grasslands include limited mine development by enterprises and the government.

These two feedback patterns of overgrazing and mines in the ecosystem network structure (Fig. 1.2) appear to be typical in environmental problems of ecosystem degradation throughout the world. Some ecosystem networks may include both network patterns with different proportions. Therefore, a particular environmental problem could be placed at some point in the spectrum of network structures that has the overgrazing type and the mining time at both ends. Potential solutions and proposed political policies should be considered in the context of the ecosystem network structure. In conclusion, the ecosystem network concept may provide useful general guidelines for recognizing the structure of problems and devising sustainable ecosystem conservation in areas where the inhabitants depend strongly on natural ecosystems and are strongly influenced by economic globalization.

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Chapter 2

Characteristics and Transformation of the Pastoral System in Mongolia

Yuki Konagaya and Ai Maekawa

Keywords Market economy • Mongolia • Nomadic pastoralism • Pastoral system • Socialism

2.1 Introduction

This chapter provides conceptual and historical contextualization of the keys to understand the Mongolian pastoral system.¹ Specifically, it details the structure of the pastoral system in the Republic of Mongolia (which is characterized by its high mobility), explains the socialist modernization process, and offers further analysis of the country's contemporary transformation into a market economy. Nomadism is sometimes treated as a legacy of romanticism; however, it is a contemporary phenomenon. Therefore, this chapter is designed to trace the process of modernization.

Researchers who have pointed out the importance of socioeconomic aspects, for example, Simukov (1935), Bazargur et al. (1989), and Erdenebaatar (1996), tried to elucidate the mechanism of seasonal movement but did not focus on the natural deterioration caused by the nomads' management strategy under a market economy. This chapter gives overall perspectives to understand the impacts of nomadic activities on the natural environment. It also aims to clarify the discussions of the chapters that follow.

¹This article is based on the paper in E-journal *GEO* published by The Association of Japanese Geographers, vol. 2 (1)34–42, 2007, in Japanese.

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2.2 Historical Descriptions of Nomadic Pastoralists on the Mongolian Plateau

On the Mongolian Plateau, groups known by various names, such as the Xiongnu (Huns), Wuhuan, Xianbei, Rouran, Gaoche, and Tujue (Turks), have developed their strength by utilizing livestock since ancient times. Those societies adjacent to them often recorded their characteristically high degree of mobility. For example, a description by Sima Qian in the *Shiji (Records of the Grand Historian)*, an account of the Xiongnu, reveals how “their animals eat grass and drink water, and they migrate regularly.” Similar descriptions appear repeatedly in many later works. For example, the *Hou Han Shu (History of the Later Han)* describes the Wuhuan thus: “They pasture their animals widely across the grasslands, do not have permanent dwellings, and form encampments using yurts (*qionglu*.” A description contained in the *Beishi (History of Northern Dynasties)* observes of the Tujue (Turks) that “they live in yurts made of felt carpets, and move in order to seek for water and grass.” These examples demonstrate how the mobility of the northern pastoralists was noticed and recorded from early times in China.

2.3 Adaptation to the Environment

The characteristics of, and adaptations to, the natural and social environments explain the Mongolian pastoral system.

2.3.1 Adaptation to the Natural Environment

In the mid-latitudes of the Eurasian continent, grasslands extend broadly in a belt shape from east to west. In the case of the Mongolian Plateau, evaporation and transpiration rates are reduced, although the aridity is comparatively mild because average temperatures are low. Additionally, rainfall is concentrated in the summer months. Amid the abundance of the summer season, female animals conceive, give birth, and lactate. The summer food of the nomads is derived from setting aside some of the milk, which is shared with the animals’ young offspring. In addition, the animals fatten up in the summer and are thus able to withstand the winter. During the winter, the animals generally lose weight and deteriorate, and there are some that will not survive the winter. Nomads slaughter livestock that are unlikely to survive the winter to secure a supply of food. This system is a form of livelihood that utilizes the behavior of their animals according to the seasons, and as such can be regarded as an example of environmental adaptation (Konagaya 2005: 54–74).

The most serious uncertainties associated with arid regions are the disparities in rainfall in both time and space. Nomads may also endure extreme weather conditions across the entire nation (Shinoda and Morinaga 2005). If they raised

their herds of animals in a fixed location under such uncertain precipitation, it would place a fatal burden on the plant life and vegetation cycle. Therefore, it becomes necessary to regulate the burden of livestock grazing on plant life according to the differences in rainfall over time and space. A pastoral system that supports this regulation through migration is referred to as nomadic pastoralism.

In the case of Mongolia, the level of mobility is noteworthy in the following respects. First, encampments are changed seasonally; second, there are multiple candidates for seasonal encampments concurrently; third, in times of natural disaster, such as extremely harsh winters, migration is allowed that goes beyond the territory which is normally utilized; and fourth, along with migration to the encampments, the composition of the camp group may change.

Furthermore, recent research has revealed that the high degree of mobility is not only a passive reaction to the natural environment by nomads but also helps to actively maintain the natural environment (Fujita 2003). Chapters 12 and 13 in this volume provide further information on the effects of this interaction between grazing and plants.

2.3.2 Social Environment Relative to Natural Conditions

One significant feature of the society on the Mongolian Plateau was the absence of permanent settlements based on an oasis. There are spring waters at the foot of the Altai Mountains in the middle of the Gobi Desert, but historically oases did not develop into permanent settlements. In other words, people did not concentrate on areas with springs, even though they were living in an extremely arid climate. Consequently, a unique social environment was formed that lacked permanent exchange partners and locations. Because they have a pastoral system characterized by a high mobility adaption to the natural environment, the people chose not to develop fixed settlements. Historically, Mongolian nomadic peoples did obtain luxury goods and some commodities from merchant caravans passing through the oasis cities to the west. Hence, some systematic exchanges took place in periodic markets set up in border areas with the agricultural regions to the south, as is known, for example, in the trade of tea and horses in the Ming Dynasty. However, neither of these habits constituted permanent markets.

The absence of constant trading partners resulted in the proportion of castrated males being higher in herds. The next section discusses this point.

2.4 Characteristics of Pastoral Management

The management of animal husbandry has two distinctive characteristics: one is that the herds consist of many castrated livestock, and the second is the usage of a mixed herd. Although these are characteristics from the perspective of animal husbandry management, they also reflect the features of both the social and natural environments.

Table 2.1 Livestock numbers and proportion of adult females

	Total (thousands)	Adult females (thousands)	Proportion of females (%)
Camels	254.2	76.3	30.0
Horses	2029.1	569.7	28.1
Cattle	1963.6	764.3	28.9
Sheep	12884.5	5751.8	44.6
Goats	13267.2	5721.8	43.1
Net totals	30398.6	12883.9	42.4

Source: National Statistical Office (2006) Mongolian Statistical Yearbook 2005

2.4.1 Pastoral System Featured by Castrated Male Livestock

The sheep herds raised in the Mediterranean region are composed mostly of females, as a majority of the males are slaughtered at a young age. Moreover, according to Dahl and Hjort's (1976: 88 ff.) exhaustive compilation of records on various livestock-rearing peoples from around the world, herds of sheep and goats consist mostly of females, and this finding is consistent with other kinds of livestock.

In contrast, adult females in comprise less than half of herds in Mongolia (Table 2.1). Male livestock are infertile because they are castrated before they reach maturity. They survive in the absence of any concerted attempt to cull their numbers. The fact that many male herd members are castrated and kept alive is the most distinctive ecological feature of the Mongolian pastoral system. This aspect of herd management is also intended to avoid the splitting up of the herds that would otherwise occur when females mate with the males after they reach maturity.

Generally, if trading is active, or if the transportation to markets is unproblematic, nomads can sell male livestock at a young age that have not undergone castration. Thus, the high ratio of castrated males in the herd indicates the low level of commercialization and the high degree of self-sufficiency in this economy. However, it does not necessarily mean that herders have to struggle to barely maintain a subsistence economy. Quite the contrary; they keep a large number of animals that they cannot utilize by themselves. We can categorize this pastoral management as the "castrated male keeping type."

According to Tani, during the 1970s, the proportion of males in the sheep herds of the transhumance pastoral system in Italy was 1–3% (Tani 1984). Matsubara reported the goatherds of the Turkish nomads (i.e., the Yoruk) accounted for 2–6% in the late 1970s (Matsubara 1983). These numbers are considerably lower than those of their Mongolian counterparts. Such herds do not contain castrated males, but only fertile males, that is, rams. Newly born sheep are eaten or sold in those pastoral societies. It is possible to posit that limited pasturelands do not allow them to keep infertile livestock, so these nomads live close to the consumers who do not own livestock. This idea suggests it is possible to discern between different pastoral systems.

Sneath discussed how, before the advent of socialism, there were a range of pastoral systems in Central Asia until the time of socialism, from the yield-focused

type to the subsistence type (Humphrey and Sneath 1999: 218). It is possible to add the compositional characteristics of herds to his argument; that is to say, the “yield” can be converted to the “castrated males” and the variation of “yield -focused” type becomes synonymous with breeding herds with a large number of castrated males. It follows that subsistence economy means raising mostly females.

This castrated male keeping type verifies the state’s historical power over the Mongolian plateau, as castrated males could be converted into military strength when needed. In former times, the fastest conveyance in the world was by horse, the most powerful draft engines were camels and oxen, and any castrated males were used as beasts of burden. Although sheep are not employed as beasts of burden, they were a mobile food resource. Therefore, we can consider sheep as contributors to military strength.

2.4.2 Diversified Growing Pattern

Pastoralism from Central Asia through Mongolia generally involves five species of livestock: sheep, goats, horses, cattle (including yaks and mixed cattle and yaks), and camels (Umesao 1976: 122). In contrast, pastoralism in other regions of the world breeds only one or two species.

Two types of farming can be posited: one in which a single crop variety is grown extensively (bumper crop) and another where many varieties are grown to some extent (diverse crop). In the same way, we can posit two types of pastoralism. The pastoralism of the Mongolian Plateau clearly belongs to the latter diverse pattern. In addition, the usage of livestock and their products is broad. The use of males and females is a characteristic feature. The development of multifarious uses has created a highly self-sufficient system.

Specifically, large livestock species (including horses, cattle, and camels) are necessary to guarantee a high degree of mobility. During the summer, people ride horses and use cattle to pull carts. During the winter months, camels are used for these purposes. In whichever variety of animals, milk is taken and made into precious dairy products. Smaller animals (such as sheep and goats) are important as a food supply. Moreover, felt is made from sheep’s wool; however, herders do not spin the wool into thread to weave clothing. Sheepskins are used as coverlets or are tanned and made into leather clothing.

2.5 Transformations of the Socialist Period

From the time when the Chinese Revolution of 1911 liberated Mongolia from the rule of the Qing Dynasty, up until the Peoples’ Revolution in 1921, a government headed by the Living Buddha Boghda Khaan, a leading Tibetan Buddhist lama, was inaugurated in Mongolia. Later, in 1924 when the Living Buddha had passed

away, Mongolia became the world's second socialist country, which was christened the Peoples' Republic of Mongolia, after the Soviet Union. The democratic movement that began in 1989 led to the abandonment of the Peoples' Revolutionary Party dictatorship in 1990. As a result, a new constitution was established and the country's name was changed to Mongolia in 1992. Mongolia embarked on a course of modernization through socialism under the leadership of the Soviet Union for approximately 70 years.

Among the various aspects of modernization, the three following significant changes can be cited in the industrial field: first, the nomadic pastoralism was altered; second, an agricultural sector was created; and third, cities were built and a heavy industrial sector was created (Konagaya 2004). Women were encouraged to give birth to many children to provide workers for the new industrial development (Konagaya 1999). As a result, the population rapidly increased, and most of this increase was absorbed into the cities (Konagaya 2003: 522).

As for the modernizing changes in the pastoral system, I would like to highlight the following three points: first, socialist collectivization was carried out; second, livestock were bred and sold as raw materials for industries; and third, there was a heightened dependency on facilities in fixed locations. The following sections detail these three points.

2.5.1 Socialist Collectivization

In the days before socialism, society consisted of small numbers of wealthy nomads and large numbers of poor nomads (Vreeland 1957: 32–35; Goto 1968:249–264). To a certain extent, the Tibetan Buddhist clergy played a significant role in the redistribution of wealth. According to a survey in 1918, the number of livestock owned by Buddhist institutions was 19% of the national total (Maiskii 1921: 289). Each monastery held property known as *jas*, and those herds were called *jas* livestock. They were entrusted to poor nomads who lived in the vicinity for pasturing. Various conditions were placed on this outsourcing of animal herding (Toshimitsu 1986), but in principle, usage rights were allowed without transfer of livestock ownership, and a portion of the animals was paid as rent in kind. Consequently, the herders entrusted with these animals could support their livelihood, even though they owned no animals.

With the onset of the socialist period, the animals of poor herders were gradually gathered and ownership was transferred to a livestock collective union. Ownership of the *jas* livestock was transferred en masse to the livestock collectives, which became responsible for the redistribution of wealth.

By 1957, the socialist collectivization of livestock had spread to 30.1% of households and included 42.5% of the total number of animals (Foreign Ministry Asia Bureau China Section 1962: 153, 127), with 100% collectivization achieved by 1959.

2.5.2 *Industrialization of Livestock Rearing*

Through the modernization program under socialism, the pastoral system changed from being a lifestyle to support individual people to an industry to support the nation. It evolved to supply the raw materials of the livestock industry to the capital city to firmly establish the herding sector as an important national industry.

From the late 1930s onward, under the slogan “wool is gold,” the cadres themselves engaged in wool-shearing projects and eventually wool shearing spread throughout the country (Konagaya 2004: 112). Besides its use in the manufacturing of felt in factories built in the center of each region, wool provided the material needed to make textiles and carpets at factories in the capital. None of these were products that had traditionally been produced on the Mongolian Plateau. The utilization of wool was thereby added to the pastoral system.

For milk products, the degree of freshness is important, and dairies were built on the outskirts of the cities. Surrounding the capital, 11 dairies were built under the organization of state farms. Women working at these dairies as milking specialists migrated to this area from all over the country.

In relationship to meat, a long-distance migration known as *tuuvar* is carried out in the fall, providing large amounts of meat to processing plants in the capital. Additionally, specialized farms have been built for the purpose of fattening up and holding livestock that have been driven to the capital’s outskirts before slaughtering them to fill in the seasonal gaps in the meat supply. As a result, the proportion of castrated males in herds has dropped off drastically subsequent to the *tuuvar* migration. The castrated male animals that were once the source of military power, as already mentioned, have turned into raw material for the meat industry. Consequently, the Mongolian diet has also significantly changed (Konagaya 2005).

2.5.3 *Rise of Solidified Facilities*

In general, sedentarization has increased during the socialist period. The Sum (township) is the government areal unit that limits the extent of migration, and, generally, the territory of migration has become smaller than that of the banners under the Qing Dynasty. In addition, facilities for protection against the cold have been established at spring and winter encampments, which have contributed to the solidification of migration bases. During times of natural disasters, people once sought refuge from catastrophe through long-distance migrations, but these happenings have become less prevalent, because herders used the wheat and barley bran produced as animal feed as a result of the progress of agriculture, and this practice has reduced the risk to herding.

Furthermore, people have also come to live in clusters near established bases to take advantage of social services such as schools and hospitals. The lifestyle has moved toward the sedentary mode overall. However, mobility in herding has at times been encouraged as a means to have higher productivity at the same time

(Toshimitsu 1983). For example, the migration known as *otor* used to be a subsidiary for the horse herds pasturing far from the encamping site, or for conducting a march of escape from natural and social hazards. However, *otor* has encouraged an intensification of regular utilization of the grasslands in the fall, on a scale even larger than before. Accordingly, the socialist period created a new migration pattern in herding. This change typically meant having seasonal encampments at various times through the four seasons, which progressively moved by the fall. Over time, this became the standard model.

Also, excavations of wells were promoted by the state through the country. Consequently, it has become possible to use pastureland that had groundwater resources, and the potentially usable area has expanded.

In the ways just described, the pastoral system has been transformed in response to modernization (industrialization) policies by using the original characteristics of the Mongolian form of pastoralism. As a result, the number of livestock has increased threefold (Konagaya 2003: 523).

2.6 Changes Since Democratization

In 1989, the democratization movement became active, and Mongolia was pushed into a transition to a market economy. Public subsidies were no longer given to any industry because of acceptance of the economic policy known as shock treatment. All industries suffered great impacts. The most far-reaching changes to the herding system were the appearance of regional and household economic disparities.

2.6.1 Appearance of Regional Disparities

The cooperatives collected livestock products and engaged with the national markets during the socialist period. Although herders were required to fulfill a demanding production quota, they received a monthly cash salary. However, following the advent of marketization, the collective channel to transport livestock products stopped functioning. Herders in remote areas were placed at a significant disadvantage when it came to selling their livestock products because of their distance from the market. Chapter 17 by Maekawa discusses this issue in detail.

Regional disparities have therefore arisen: these are discernible in the regional difference in the ratio of adult female livestock according to the national statistics for 2005 (maps 1 through 5 in Fig. 2.1). If herders have better access to the markets, such as those located in the capital city and trading cities along the border, castrated male livestock are easily sold. Therefore, it is assumed that the ratio of female livestock reflects regional marketability. However, camels are an exception, given that there is a high ratio of females in the Gobi region where the marketability is indeed limited and the region is ecologically arid, because camels are a source of milk

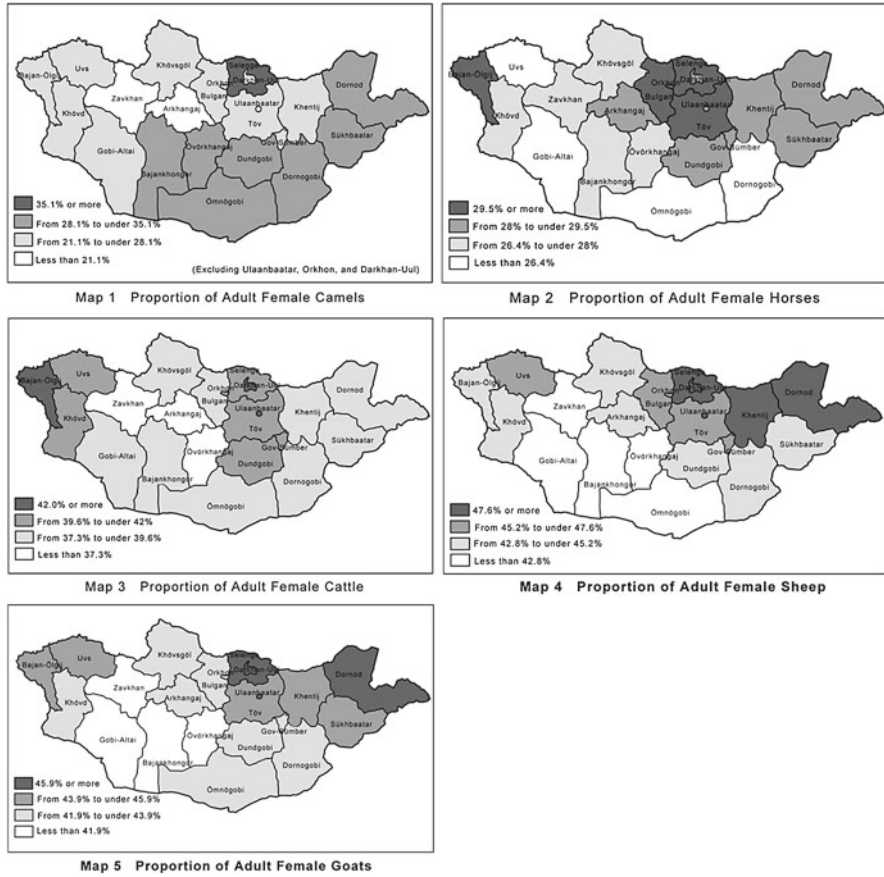


Fig. 2.1 Regional disparities are discernible in regional differences in the ratio of adult female livestock of five species (*maps 1–5*)
 Source: National Statistical Office (2006) *Mongolian Statistical Yearbook 2005*

supply. In other regions, cattle are a main milk source, and cattle are less suited to a dry climate than are camels.

To mitigate the economic difficulties associated with marketization, the nomadic inhabitants of the regions far from the markets have largely migrated to the capital region since the 1990s. Table 2.2 shows that only three industrial cities in central Mongolia gained a positive net migration rate. Chapter 15 by Yamamura et al. provides further understanding of the population shift between urban and rural areas.

The migrants originate from provinces with conspicuously declining populations: Uvs, Zavkhan, Gobi-Altai, Bayankhongor, Arkhangai, and Khovd. They are concentrated in the central west, and the proportion of adult female animals is comparatively low, which suggests that castrated males are dominant as a result of the lack of marketability.

Table 2.2 Migration rate in 2002

	Net numbers of migrations ^a	Net migration ratio ^b (%)
Ulaanbaatar	26,344	3.11
Darkhan-Uul	908	1.03
Orkhon	156	0.20
Dornogovi	-165	-0.32
Bayan-Olgii	-371	-0.38
Gobisumber	-51	-0.41
Khovsgol	-550	-0.45
Selenge	-664	-0.65
Bulgan	-556	-0.88
Dornod	-731	-0.98
Tov	-1,026	-1.06
Sukhbaatar	-675	-1.20
Khentii	-933	-1.30
Omnogovi	-718	-1.52
Ovorkhangai	-1,880	-1.65
Dundgovi	-919	-1.80
Khovd	-1,771	-2.00
Arkhangai	-2,372	-2.43
Bayankhongor	-2,499	-2.96
Govii-Altai	-2,476	-3.95
Zavkhan	-3,456	-4.09
Uvs	-3,760	-4.50
National average	-1,835	-28.17

^aPopulation increase from 2001 to 2002 minus the natural number of increases

^bNet number of migrations divided by population

Source: National Statistical Office (2003) *Mongolian Statistical Yearbook 2002*

There are other specific phenomena related to regional differences. Goat breeding is widespread in the Gobi region because of the profits generated by cashmere (see Chaps. 16 and 17). The high ratio of castrated male goats in herds has arisen because male goats can also produce cashmere. Particularly in Dornogovi, where the border trade with China is flourishing, the decline in population is small. These examples show that regional disparities occur because of differing approaches to herd management and the physical distances from the capital.

2.6.2 Appearance of Disparities Among Households

Because of the abolition of the balancing system implemented under the socialist regime, which sought economic equality, economic disparities between families have become apparent. They have also manifested at the interregional level.

According to the national statistics for 2005 (National Statistical Office 2006), nomads who own more than 1,000 head of livestock account for 0.70% of the total.

These wealthy herders are able to invest in fixed animal sheds or wells. Their poorer counterparts, who have no more than 50 head of livestock, comprise 37.00% of the total, while those with 10 head or less constitute as much as 10.77%. These figures tell us that only a minority of herders may be considered wealthy while nearly half of the total number of herders can be classed as poor.

As Chap. 17 shows, there is a tendency for households owning more head of livestock to sell more diversified livestock products. Consequently, they have a steadier cash income. In contrast, the fewer animals a household owns, the more dependent it will be on cashmere from goats, making management less secure. Their management strategies based on the difference of possessing livestock is more and more distinct. Consistent with these regional and household disparities, Mongolian herders are opting for different managerial strategies based on their relative mobility.

2.7 Remaining Issues

This chapter has mainly discussed how each nomad adapts to natural and social environments through a management strategy of migration. Although nomads approach the diverse transitions flexibly, the most problematic condition is the large-scale deterioration of the natural environment. Human activities have caused the following five major problems.

First, the majority of the state farms built during the socialist period have fallen into ruin. The land that was used for those farms generally cannot be again utilized as pasture and farms: they are simply abandoned. Environmental restoration is necessary in such areas. Tamura et al. provide further information on this issue in Chap. 8.

Second is the widespread nonpastoral usage of pastureland. For example, the development of large-scale mining resources and small-scale tourism is proceeding rapidly. Suzuki discusses the conflicts over land use between the mining industry and herding in Chap. 20.

Third, the forests that help to sustain the grasslands are dwindling consequent to fires and insect damage. Tsogtbaatar discusses the problem of deforestation in Chap. 7.

Fourth, the majority of the wells excavated during the socialist period have been allowed to deteriorate because of disuse. Utilization of the grasslands in sustainable combination with underground water resources is necessary. Chapters 5 and 6 detail the issue of water resources in the pasturelands.

Fifth, the Mongolian government has discussed the privatization of pasturelands in recent years. It has not yet reached a conclusion, but this will obviously restrict the spontaneous mobility herders have used to adjust to social and natural environmental changes. The privatization of pastureland might cause further land degradation. Kamimura takes up this issue in Chap. 14.