Chapter 1
Overview: Pastoralism in the World

Shikui Dong

Abstract This chapter provides an overview of global pastoralism, including the definition, forms, structures, origin, development, distribution, value, and future of pastoralism. Pastoralism can be defined as mobile livestock herding in the dimension of either production or livelihood. Nomadic and transhumant rearing of domesticated animals are generally two essential forms of pastoralism, with pastoral farming/enclosed ranching as the third form of pastoralism in the broad meaning. A clan is generally the basis of pastoral organization, which is responsible for the control of the optimum territory and management of the livestock species herded in every corner of the world. Most of the burden of pastoral activities is borne by women, and empowering women remains a challenge in most of the pastoral regions across the world. Although the emergence of pastoralism was a complex and multifaceted phenomenon, primitive hunting has been commonly accepted as the primary source. The origin of pastoralism can be dated to 6000 B.P. in the Andes of South America, and even as early as 9000 B.P. in Northeast Africa. A multiple-center origination is more probable than a single-center origination for explaining the spread of pastoralism worldwide. Currently, extensive pastoralism occurs on about 25 % of Earth's land area, mostly in the developing world, from the drylands of Africa and the Arabian Peninsula to the highlands of Asia and Latin America. Globally, pastoralism is critically important in supporting huge human populations, providing tremendous ecological services, maintaining long-standing civilizations, and making significant contributions to subsistence economy in some of the world's poorest regions. However, the practices of pastoralism have been overwhelmed by agricultural expansion, industrial development, and sedentary livestock farming in recent decades. Pastoral societies across the world will have more unpleasant fates with the stress of global change in the future.

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1.1 Introduction

Extensive pastoralism exists on all continents except Antarctica, mostly in the drylands or highlands, where intensive crop cultivation is physically not possible (FAO 2001). Currently, pastoralism occurs in more than 100 countries on about 25 % of Earth's land area and supports about 200 million households and herds of nearly a billion animals, including camels, cattle, and smaller livestock that account for about 10 % of the world's meat production (FAO 2001). Pastoralism provides very important ecological services, such as primary production, biodiversity conservation, and erosion control. However, the social, economic, and environmental importance of worldwide pastoralism has been overlooked in the modern era. It is necessary to review the history, distribution, and importance of global pastoralism, especially in the developing world. Here, we provide an overview of global pastoralism and its human–natural systems.

1.2 Definition and Forms of Pastoralism

1.2.1 Definition of Pastoralism

The definition of pastoralism varies greatly in terms of purposes and focuses (e.g., intensional, extensional, descriptive, stipulative, etc.). Basically, two common definitions derived from either the production perspective or the livelihood perspective are broadly used for "pastoralism." In the dimension of production, pastoralism is animal husbandry, the branch of agriculture concerned with the care, tending, and use of grazing livestock in dry or cold rangeland areas. In the dimension of livelihood, pastoralism is a subsistence living pattern of tending herds of large animals (Blench 2001) or a successful livelihood strategy on less productive lands through livestock herding (IFAD 2008). As summarized by the International Fund for Agricultural Development in Fig. 1.1, pastoralism, with the features of mobility, adaptation, flexibility, diversification, conservation, and mutual support, is "the finely-honed symbiotic relationship between local ecology, domesticated livestock and people." As the traditional rangeland management strategy, pastoralism represents a complex form of natural resource management, involving the direct interaction between natural resources and their users done within a larger geopolitical context (Pratt et al. 1997). Therefore, pastoralism can be understood as one of the coupled human–natural systems in the developing world (including remote and marginalized areas of developed countries).

In the literature, "pastoral system" is often used as an alternative term for "pastoralism." A pastoral system is defined as a system occurring in rangeland areas, where livestock grazing is the predominant form of land use (FAO 2002). A pastoral system is a system that is adaptive to particular natural, political, and economic environments. In a pastoral system people who herd or raise livestock are called "pastoralists," and they currently live in more than 100 countries (Fig. 1.2).

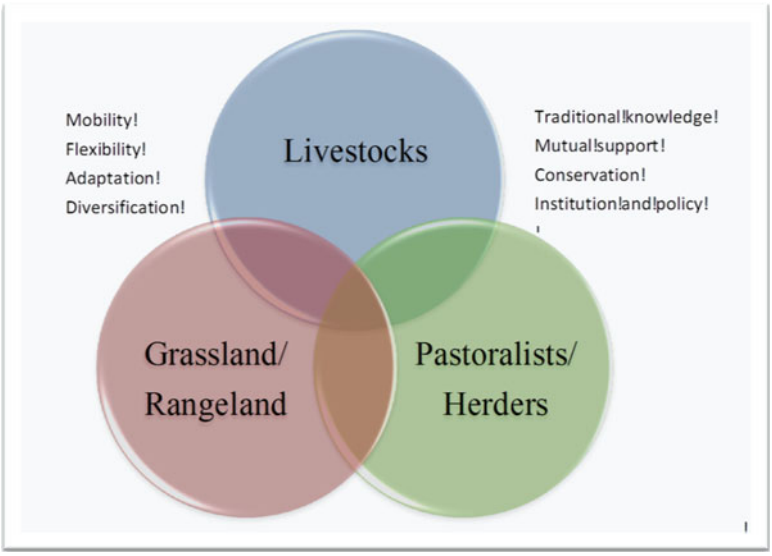

Fig. 1.1 Pastoralism: a sustainable natural resource management system. (Adapted from IFAD 2008 http://www.ifad.org/lrkm/factsheet/pastoralists.pdf)

Pastoralist groups can take many forms to adapt the particular natural, political, and economic environments across the world. The types of livestock kept by these pastoralists differ according to variations of the climate, environment, water and other natural resources, and geographical areas. As summarized by Blench (2001), cattle and sheep are broadly raised as pastoral herds, by ranchers in North America and Australia and by herders in Africa, Europe, and Asia. llamas and alpacas are mainly raised as the key pastoral herds in the Andes of South America. Horses are mostly herded in Central Asia. Donkeys and dromedaries are predominantly grazed in North Africa and West Asia. Bactrian camels are mostly raised in East and Central Asia. Goats are predominantly raised in West Africa and West and Central Asia. Yaks are mainly grazed in the highlands of Central Asia. Reindeers are grazed in circumpolar Eurasia (Table 1.1, Fig. 1.3).

A pastoral system is characterized by relatively large herd or flock sizes, a high proportion of females, and more steers than oxen in the case of cattle (FAO 2002). The management of livestock in a pastoral system is aimed at ensuring subsistence, averting risk, and adapting to the institutional environment, which consists mostly of communal grazing (FAO 2002). In addition, there is agropastoralism in the transition zone between pastoral areas and agricultural areas. People who live on agropastoralism are called “agropastoralists.” Agropastoralism is defined as a set of practices that combine pastoral livelihoods with production of millet, sorghum, maize, vegetables, and pulses (annual legumes). This system is extremely important and is the most prevalent land use in arid and semiarid environments

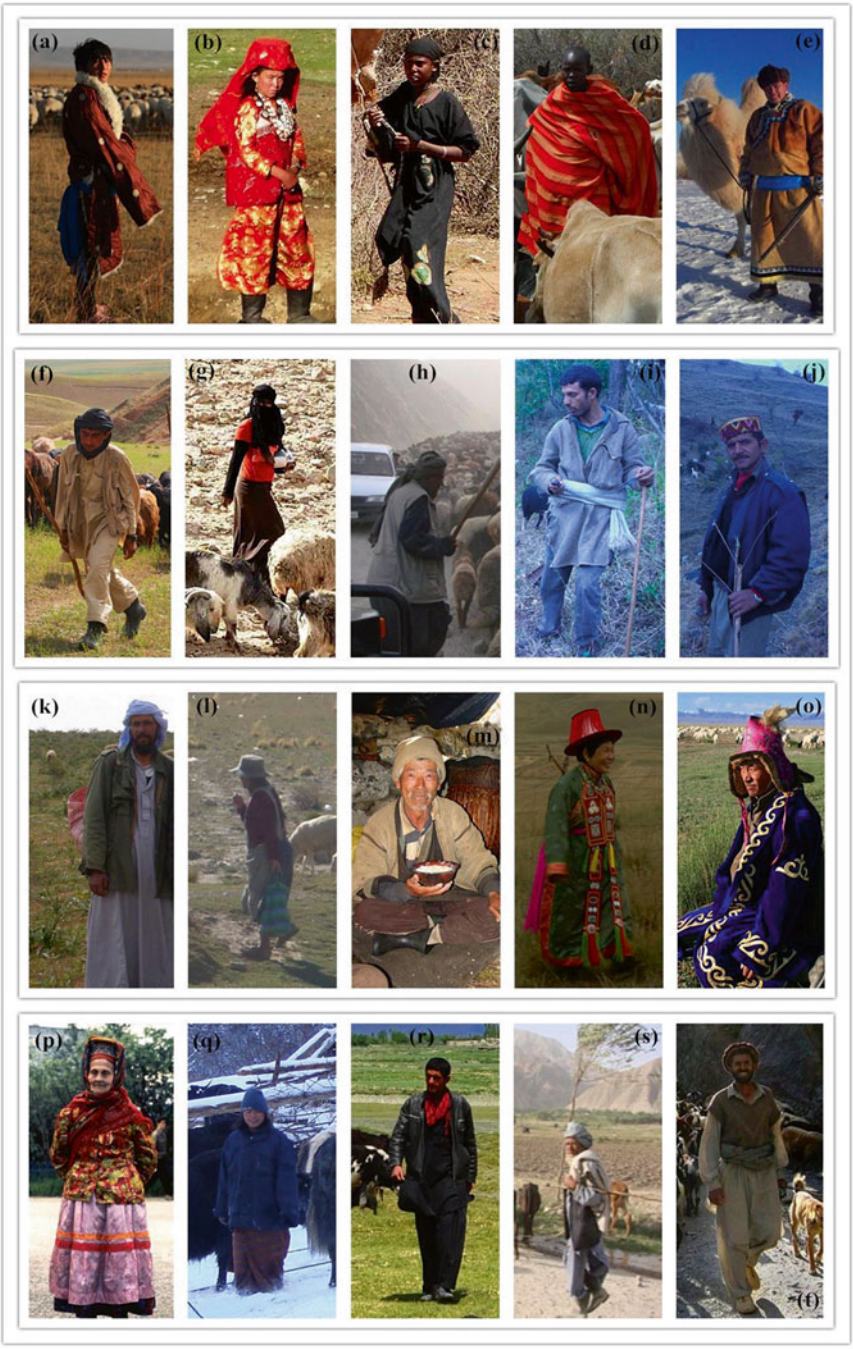

Fig. 1.2 Some pastoral groups in the world: (**a**) Tibetan in Qinghai, China; (**b**) Kirghiz in Badakhshan, Afghanistan; (**c**) Boran in Borana, Ethiopia; (**d**) Massai in Kenya; (**e**) Mongol in Inner Mongolia, China; (**f**) Tajik in Yangi Qala, Afghanistan; (**g**) Bedouin in Negev, Israel; (**h**) Baloch in northern Pakistan;

Table 1.1 Pastoral species and their management strategies in the world

Species	Scientific name	Main regions	Nomadic	Transhumant	Agropastoral	Enclosed
Alpaca	*Lama pacos*	Andes	–	+	+	–
Bactrian camel	*Camelus bactianus*	East and Central Asia	+	+	+	–
Buffalo	*Bubalus bubalis*	Iran, India	+	+	+	?
Cattle (taurine)	*Bos taurus*	Europe, West Asia, West Africa	–	+	+	+
Cattle (zebu)	*Bos indicus*	Africa, Central Asia	+	+	+	+
Donkey	*Equus asinus*	Africa, Asia	+	+	+	–
Dromedary	*Camelus dromedarius*	Africa, West Asia	+	+	+	–
Goat	*Capra hircus*	Africa, Europe, Asia	+	+	+	+
Horse	*Equus caballus*	Central Asia	+	+	+	–
Llama	*Lama lama*	Andes	–	+	+	–
Reindeer	*Rangifer tarandus*	Circumpolar Eurasia	+	+	–	?
Sheep	*Ovis aries*	Africa, Europe, Asia	+	+	+	+
Yak	*Poephagus grunniens*	Highland Central Asia	–	+	–	–

Adapted from Blench (2001)

(USAID 2011). By definition, the difference between pastoralism and agropastoralism is that pastoralists derive most of their family incomes (more than 50 %) from livestock and livestock products, whereas agropastoralists derive most of their family income from cultivation and only a small amount from livestock production (IFAD 2008).

Fig. 1.2 (continued) (**i**) Kanets in Himachal Pradesh, India; (**j**) Gaddi in Himachal Pradesh, India; (**k**) Bedouin in Egypt; (**l**) Aymara herder in the Bolivian Andes; (**m**) Tamang in Rasuwa, Nepal; (**n**) Yugur in Gansu, China; (**o**) Kazak in Xinjiang, China; (**p**) Sami in Kola Peninsula, Russia; (**q**) Ngalop herder in Paro, Bhutan; (**r**) Wakhi in Wakhan, Afghanistan; (**s**) Pashtun in Pakistan; (**t**) Gujjar in Pakistan. (Photos by (**a**) Xukun Su, 2014; by Aziz Ali, 2012; (**c**) Allan Degen, 2010; (**d**) Jianchu Xu, 2012; (**e**) Wei Sha, 2014; (**f**) Shaoliang Yi, 2012; (**g**) Allan Degen; (**h**) Abdul Wahid Jasra, 2010; (**i**) Shikui Dong, 2010; (**j**) Shikui Dong, 2010; (**k**) Jean François Tourrand, 2012; (**l**) Jean François Tourrand; (**m**) Shikui Dong, 2007; (**n**) Kiran Elana, 2010; (**o**) Xi Wang, 2012; (**p**) Karim-Aly Kassam, 1996; (**q**) Shaoliang Yi, 2010; (**r**) Shaoliang Yi, 2010; (**s**) Abdul Wahid Jasra, 2010; (**t**) Abdul Wahid Jasra, 2010)

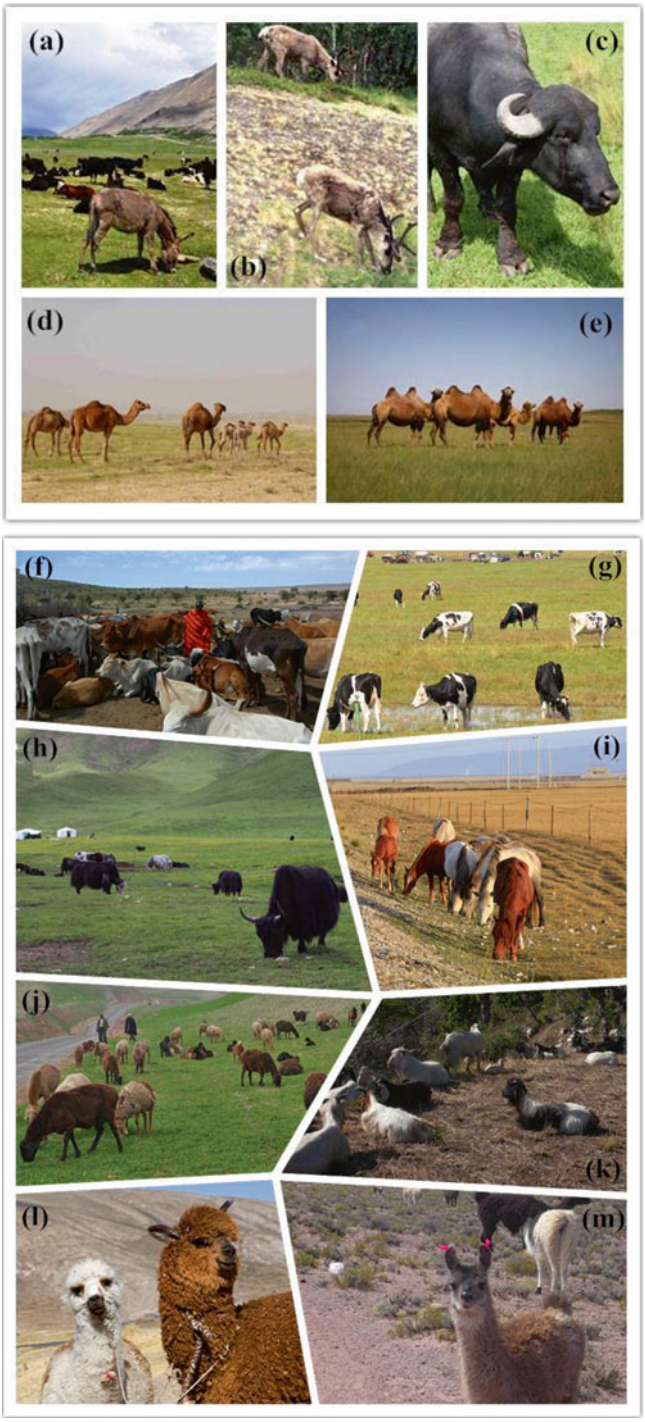

Fig. 1.3 Pastoral livestock in the world: (**a**) donkey; (**b**) reindeer; (**c**) buffalo; (**d**) dromedary; (**e**) Bactrian camel; (**f**) zebu cattle; (**g**) taurine cattle; (**h**) yak; (**i**) horse; (**j**) sheep; (**k**) goat; (**l**) alpaca; (**m**) llama. (Photos from (**a**) Afghanistan by Shaoliang Yi, 2010; (**b**) Russia by Karim Kassam, 1996;

1.2.2 Forms of Pastoralism

The forms of pastoralism are often classified by the method of mobility, a key feature qualifying pastoralism (Blench 2001). There are generally two essential forms of pastoralism: nomadic and transhumant (O'Neil 2011). Pastoral farming/enclosed ranching is considered the third form of pastoralism in the broad meaning (Blench 2001). Sometimes agropastoralism is also defined as one of the forms. The term "nomadic pastoralism" is used for pastoral mobility in highly irregular patterns. The term "transhumant pastoralism" is used for pastoral mobility of regular back-and-forth movements between relatively fixed locations. The term "pastoral farming" is used for pastoral mobility with little or no long-distance movement (i.e., enclosed ranching). Different forms of pastoralism have been practiced on different types of livestock by different indigenous pastoralists across different regions of the world (Table 1.1).

1.2.2.1 Nomadic Pastoralism

Nomadic pastoralism is the common practice in regions with little arable land, typically in the drylands and highlands of the world. It exists in areas of low rainfall, such as the Arabian Peninsula and Northeast Africa inhabited by Bedouins. It is also found in areas of harsh climate, such as northern Europe and arctic areas of Russia inhabited by Sami. In this pastoral system, the pastoralists follow a seasonal migratory pattern of a nomadic cycle varying from year to year with the grazing needs in the northern hemisphere, as exampled as follows for the Aertai region of Xinjiang:

- Spring (April to June)—transition
- Summer (July to late September)—high mountains
- Autumn (October to end of November)—transition
- Winter (from December to March)—dry plains

The migration routes of this nomadic cycle range from tens to hundreds of kilometers, even 1000 km (e.g., in Central Asia). Sometimes pastoralists have to find the ways for mobile livestock among the heavy traffic on the highway during the long migration (Fig. 1.4). Nomadic pastoralists live in the tents or other movable dwellings all year round (Fig. 1.5). Camps or semipermanent shelters are usually established in the same place along the yearly migration route.

There are about 30 million to 40 million pastoral nomads, the people who practice nomadic pastoralism. The Mongols in Mongolia, Russia, and China, the Tatars and Turkic people of eastern Europe and the Kazaks in Central Asia practiced nomadic pastoralism along Asian–European steppes in the past. Some of these populations

Fig. 1.3 (continued) (**c**) Pakistan by Abdul Wahid Jasra, 2010; (**d**) Egypt by Jean François Tourrand, 2010; (**f**) China by Wei Sha, 2012; (**f**) Kenya by Jianchu Xu, 2013; (**g**) China by Mingjiu Wang, 2010; **h** China by Shikui Dong, 2012; **i** China by Xukun Su, 2014; (**j**) Afghanistan by Shaoliang Yi, 2012; (**k**) India by Shikui Dong, 2011; (**l**) Bolivia by Jean François Tourrand, 2010; (**m**) Bolivia by Jean François Tourrand, 2010)

Fig. 1.4 Tibetan pastoralists transferring their flocks of sheep from one pasture to another along the highway at Daotanghe, Qinghai Province, China. (Photo by Shikui Dong, 2014)

still practice nomadic pastoralism. Presently, about 40 % of the populations in Mongolia are nomadic pastoralists.

In the high HImalayas, where the average elevation is more than 4000 m above seal level, some people of Tibetan origin practice nomadic pastoralism as the dominant livelihood as sedentary agriculture is impossible because of low temperatures and limited irrigation. In arid and semiarid regions of Central Asia, pastoral people such as Kazaks, Kyrgyzs, and Tajiks migrate hundreds of miles in a year even in winter to herd their livestock (Fig. 1.6). In arctic regions, including northern Finland, Sweden, Norway, and the Kola Peninsula of Russia, the indigenous Sami practice nomadic pastoralism of reindeer raising in cold and harsh environments. In north Africa, the pastoralists include the Zaghawa, Kreda, and Mimi, and Bedouins also practice nomadic pastoralism in dry and infertile lands. Even in Europe, sheepherders such as the Mesta in Spain are keeping the traditional way of nomadic pastoralism in the grassland areas against small peasants through *cañadas* (Caballero et al. 2009).

1.2.2.2 Transhumant Pastoralism

Transhumant pastoralism has traditionally occurred throughout the pastoral world, particularly in the pastoral regions of Europe, Asia, Africa, and South America. It is a common practice characterized by the fact that the pastoralists move their

Fig. 1.5 Different types of camps used by nomadic pastoralists: (**a**) Mongolian herder's yurt in Inner Mongolia, China; (**b**) Massai herder's hut in Arusha, Tanzania; (**c**) Kuchi herder's tent in Pashtoon, Afghanistan; (**d**) Kyrgyz herder's yurt in Alichure, Tajikistan; (**e**) Tamang herder's camp in Rasuwa, Nepal; (**f**) Gaddi herder's camp in Himachal, India; (**g**) Boran herder's hut in Borana, Ethiopia; (**h**) Tibetan herder's tent in Qinghai, China. (Photos by (**a**) Mingjiu Wang, 2009; (**b**, **e**) Shikui Dong, 2007; (**c**, **d**) Shaoliang Yi, 2011; (**f**) Shikui Dong, 2011; (**g**) Chuan Liao, 2012; (**h**) Shikui Dong, 2010)

Fig. 1.6 Kazak pastoralists travel to find grazing pastures for their livestock in winter in Aertai, Xinjiang Autonomous Region, China. (Photo by Yining Lai, 2011)

livestock between fixed summer and winter pastures on a yearly basis. The pastoralists have a permanent home or dwelling typically in valleys or low-elevation areas. There are two types of transhumance: vertical and horizontal. Vertical transhumance occurs typically in mountain regions, where the movements shift between high-altitude pastures in summer and low-altitude pastures in winter (Fig. 1.7). Horizontal transhumance exists mostly in plain or plateau regions such as Mongolia, where the movement occurs between the summer pastures far from the home to the winter pastures close to the home (Fig. 1.8). In contrast to vertical transhumance, horizontal transhumance can be more easily disrupted by climate change or socioeconomic changes.

In Europe, vertical transhumant grazing between valley and high pastures is still practiced widely in Bavaria, Austria, and the Swiss Alps and other European highlands, although tourism and industry are presently playing a very important role in the local economy of these mountainous regions. In some of these mountainous areas, cattle are grazed by local farmers who still insist on the tradition of transhumant pastoralism, whereas in some other places in these mountainous areas, the cooperatives that own the pastures employ herdsmen to graze the livestock in the manner of seasonal migration. In some high valleys of the Pyrenees and the Cantabrian Mountains of the Iberian Peninsula, vertical transhumant pastoralism has been practiced as the sole support of the economy. In the Austrian highlands, unique social groups such as the *Pasiegos* in Cantabria, *Agotes* in Navarre, and Vaqueiros de alzada practice the lifestyle of transhumant pastoralism as a remnant of an older ethnic culture. In Scandinavia, transhumant pastoralism is still practiced as such: in summer, the herders move the livestock to a common mountain or forest

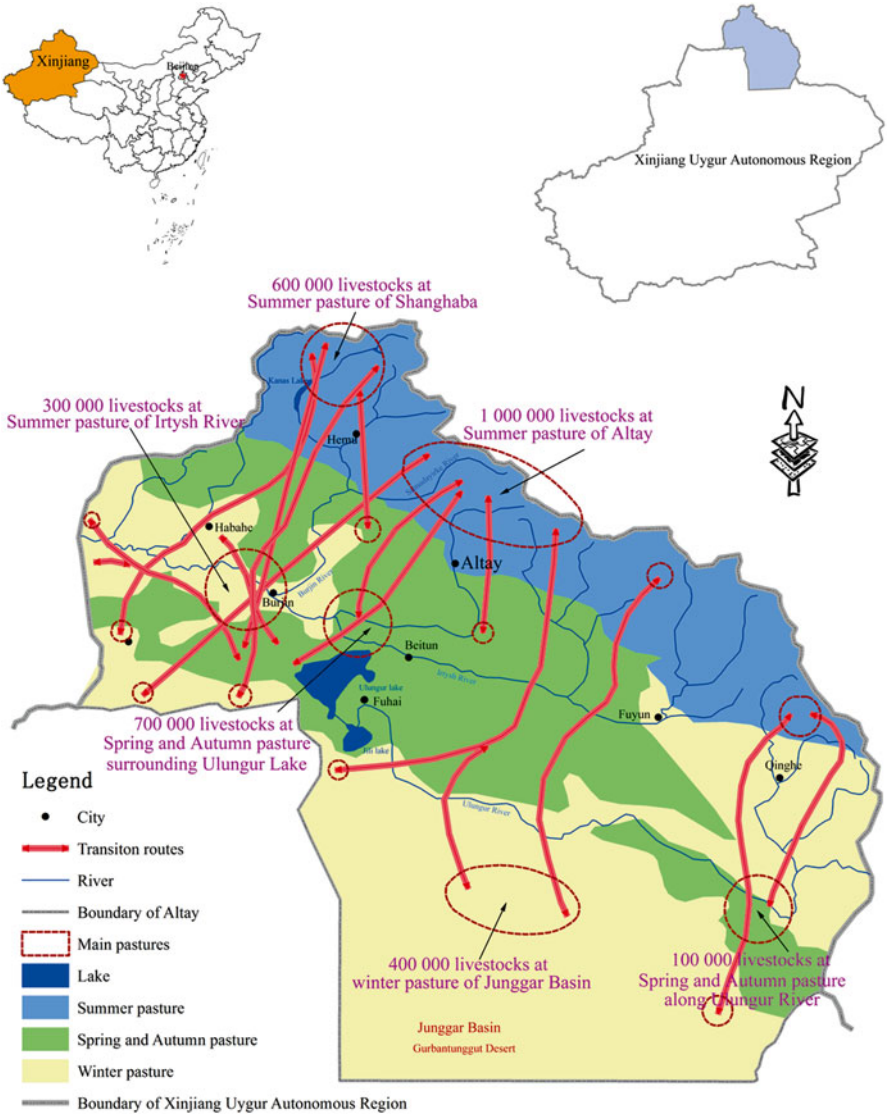

Fig. 1.7 Vertical transhumant grazing systems in the Altay region, Xinjiang Unger Autonomous Region

pasture, which is called *seter* (summer residence); in winter, they return the livestock to a home farm in valleys where the meadows are preserved for hay production. However, the arrival of motorized vehicles has been changing the character of traditional transhumance in this region. In the British highlands, livestock keepers used to spend summer on hillsides or in mountain areas and used to spend winter in valleys or low-lying meadows. Nowadays, most livestock keepers send their grazing

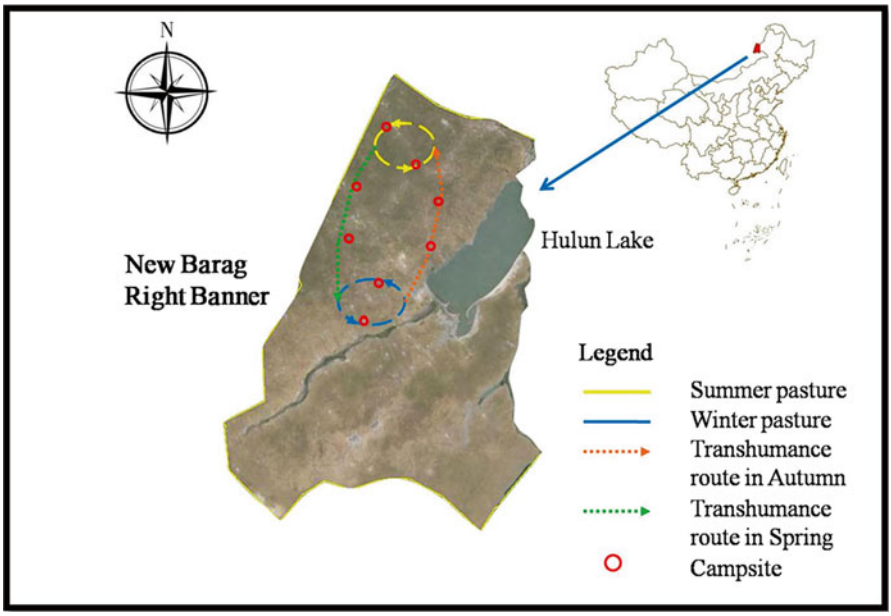

Fig. 1.8 Horizontal transhumant grazing systems for cattle and sheep on the Mongolian steppe in New Barag Right Banner, Inner Mongolia Autonomous Region, China

flocks by trucks to upland pastures during summer and lowland pastures during winter in a transhumant pattern.

In Asia, transhumant pastoralism has been maintained as the mainstay of subsistence economies in temperate and alpine zones more than over 2000 m above sea level on the southern slopes of the Himalayas and the alpine semiarid and arid zones over 3000 m above sea level on the northern slopes of the Himalayas, through the Qinghai–Tibetan Plateau in western China to the Eurasian steppe in Central Asia, including northern China and Mongolia. Along the Himalayan ranges, pastoral people of Tibetan origin such as the Zanskari in northwestern India, the Tamang in northern Nepal, the Brokpa in northern Bhutan, and Tibetans on the Qinghai–Tibetan Plateau of China still practice vertical transhumance, although in some cases nomadic pastoralism is also performed by these mountainous people. Across the Eurasian steppe in Central Asia, pastoral people such as Mongols in Mongolia and China, Kazaks in Kazakhstan and China, and Kyrgyzs in Kyrgyzstan predominantly practiced horizontal transhumant and nomadic pastoralism in some cases for centuries. In the mountain ranges of Central Asia and Southwest Asia, pastoralists move their herds seasonally back and forth between their homes in the valley and their temporary dwellings in the foothills every year. A typical example is the mobile life of Iran's Bakhtiari tribe, who practice vertical transhumant grazing from the Zagros mountain rangelands in Azerbaijan to the lowland pastures near the Arabian Sea (Rouhollah 1966).

In South America, transhumant pastoralism is practiced in the Andes of Argentina, Chile, Peru, and Bolivia (Andaluz-Westreicher et al. 2007), as well as in the Brazilian Pantanal (de Abreu et al. 2010). South America's transhumant pastoralism mainly

Fig. 1.9 Pastoral farming in Queensland in Australia: a grazier on a horse moving the herds of cattle (*left*); cattle grazing in different paddocks (*right*). (Photos by Shikui Dong, 2013)

involves movement of cattle in the Pantanal of Brazil and in parts of Argentina, whereas camelids are extensively raised on the altiplano. Goat raising is the major transhumant pastoralism in northern Neuquén and southern Mendoza, whereas sheep raising remains a major transhumant pastoralism on the Patagonian plains. In South America, the Criollos and other indigenous people are mostly pastoralists who are involved in transhumant grazing practices.

1.2.2.3 Pastoral Farming

Pastoral farming is a modern variation of nonnomadic pastoralism. It is often termed "farming/ranching aiming at producing livestock," rather than growing crops. Examples include dairy cattle farming, beef cattle farming, and wool sheep farming. Pastoral farming is practiced mostly in the ranches/pastures of developed countries such as Australia, Great Britain, Ireland, New Zealand, the USA, and Canada or developed regions of developing countries such as Argentina and Brazil. Pastoral farmers are also known as "graziers" and "ranchers" in most cases (Fig. 1.9). Some pastoral farmers grow crops purely as fodder for their livestock or purchase the fodder from crop farmers. This modern pastoralism is very different from the "traditional" pastoralism of the nomadic or transhumant system in terms of the level of investment in land and animals (Blench 2001).

1.3 Origin and History of Pastoralism

Pastoralism has been described as one of the great advances in human civilization, but the origin of pastoralism has been largely debated among scholars for centuries. According to Khazanov (1984), there are mainly three viewpoints. In the eighteenth and nineteenth centuries, a great number of scholars, including Montesquieu, Herder, Condorcet, Mortillet, Lubbock, Morgan, and Engels, were supporters of the "tripartite theory," which insists that pastoralism was derived from hunting and emerged earlier than agriculture. In their view, the hunters became nomads as they

Fig. 1.10 Stone sculpture of hunting in the Mongolian grasslands in prehistory. (Photo by Shikui Dong, 2010)

started to domesticate and herd some injured, weak, or baby animals on the grasslands. In contrast, Vico objected to this theory by saying that agriculture emerged earlier than pastoralism; however, his opinion did not receive recognition at that time. Until the second half of the twentieth century, some scholars (Bacon 1954; Lattimore 1967; Vainshtein 1980) stated that agriculturalists could have begun the breeding of animals and that hunters borrowed the domesticated animals from the neighboring agriculturalists. A possible explanation is that wandering hunters were unable to follow herds as they could not maintain the necessary speed of movement (Khazanov 1984). Moreover, the changeable composition of the herds made their domestication impossible (Khazanov 1984). Differently from these two viewpoints, some scholars believed that early humans had to diversify their livelihoods to cope with the pressures of climate change (Toynbee 1935; Zeuner 1956) and population growth (Lees and Bates 1974; Spooner 1975; Gilbert 1975); for example, some hunters became nomadic pastoralists to domesticate and herd animals. It would appear that the emergence of pastoral nomadism was complex and a multifaceted phenomenon that cannot possibly be explained by any one isolated factor (Khazanov 1984). However, it has been commonly accepted that pastoral nomadism mainly evolved from primitive hunting (Fig. 1.10).

The time at which pastoralism originated has not been fully agreed among scholars. Some scholars claim that the raising of domestic cattle in Northeast Africa occurred as early as 9000 B.P., although more solid dates are available for domestic llamas and alpacas in the Andes of South America from 6000 B.P. onward (MacDonald and MacDonald 2000). The earliest literature documented that the people who firstly appeared as pastoralists were the Amorites. In the first half of the

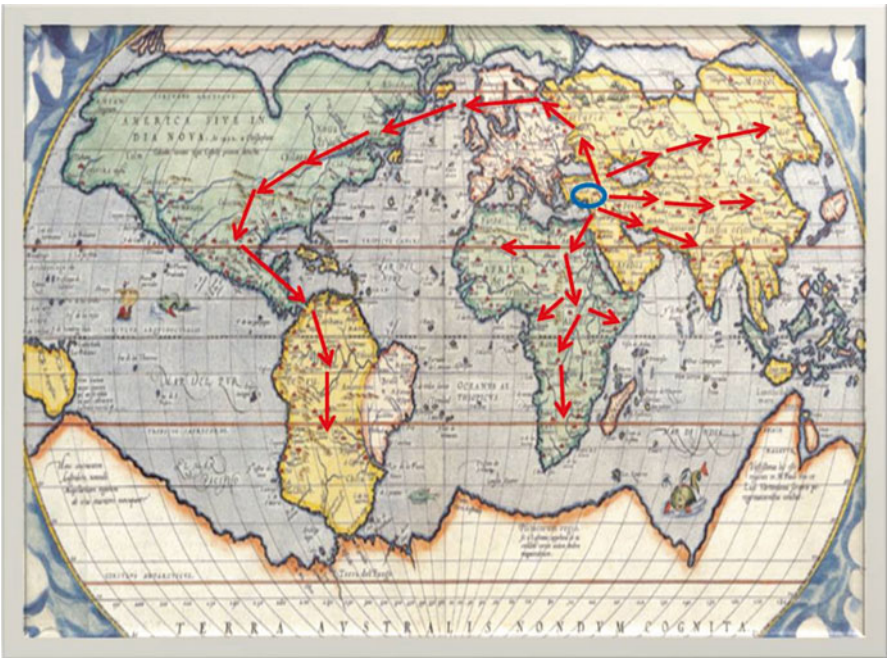

Fig. 1.11 One-center origination of pastoralism

second millennium B.C., those Amorites started to herd cattle, sheep, goats, and donkeys in the Near East (Cribb 1991). The pastoral culture that was recognizably described in sub-Saharan Africa can be dated back to Pliny, who firstly recorded blood and milk drinking in the Horn of Africa, whereas pastoralism in this region is believed to have originated much earlier than this record. Although the literature can give some clues about the first appearance of pastoralism, the exact time of occurrence of pastoralism can be concluded only from archaeology, particularly from careful osteometric work which can demonstrate the relationships between domesticated animals and their undomesticated wild relatives. According to the archaeological record, pastoral culture in both East Africa and West Africa appeared in 4500–4000 B.P. (Marshall 2000). However, the assumption for interpreting the osteometric evidence that the early herders were controlling breeding conflicts with the fact that the herders were involved in the management of wild animals at the earliest stages of pastoralism; for example, reindeer pastoralism is stil controlling beeding conflicts today through involvement in wild animal management.

The centers where pastoralism originated and the routes by which it spread have now been examined more specifically (Khazanov 1984), but there is still a lot of debate on these issues. Some scholars believe that nomadic pastoralism originated from one center, the mountainous Zagros region of Southwest Asia (northern Iraq and northwestern Iran), where the earliest herders domesticated goats and sheep about 9000 years ago (Miller 1998). Concomitant with cereal cultivation, which began somewhat earlier in the same region (Southwest Asia), animal husbandry quickly dispersed from this center of origin northward and eastward (Fig. 1.11).

Fig. 1.12 Multiple-center origination of pastoralism

Some scholars think that nomadic pastoralism originated from multiple centers in different parts of the world (Fig. 1.12). With the domestication of the horse about 6000 years ago, on the fertile steppes of southwestern Russia, nomadic pastoralism as a way of life really started to expand throughout Central Asia (including Mongolia). Some of these ancient nomads would undoubtedly also have penetrated into the western Himalayas, where alpine meadows would have provided good grazing for their livestock. Some of them would have reached the Tibetan grasslands from Central Asia to the west and north (Miller 1998). The Qiang, a nomadic tribe believed to be the ancestors of modern Tibetans, started herding animals on the rangelands of the Qinghai–Tibetan Plateau about 4000 years ago. These early nomads were known to the Chinese in the Hsia Dynasty (2205–1766 B.C.) as they sent rugs made from the "hair of animals" to "Hsia Emperor." The nomads originated from the Kurgan culture of southern Russia are believed to have expand into the Indian subcontinent about 3500 years ago, bringing with them not only the practice of nomadic pastoralism but also the Indo-European languages they spoke (Miller 1998). From the Nile Valley and North Africa, the pastoral culture spread to other places on the African continent, possibly through the agency of the ancestors of the present-day Berbers (Blench 2001). Although there is no common view on the exact routes by which and dates at which pastoralism reached southern Africa (Bousman 1998), it seems that pastoralists' herding of sheep firstly and cattle shortly thereafter occurred in pre-Iron Age transmission in nearly 2000 B.P. (Blench 2001). In the Andes of South America, the first domestication and herding of llamas and alpacas occurred in about 6000 B.P.

(MacDonald and MacDonald 2000). In terms of a great difference in sociocultural features (such as language, tradition, and herding practices) among different pastoralist groups across the world, we assume that a multiple-center origination is more probable for explaining the spread of pastoralism worldwide.

1.4 Distribution of Contemporary Pastoralism

According to the global pastroralism map developed by the World Initiative for Sustainable Pastoralism, pastoralism is presently predominant in sub-Saharan African, southern Africa, Central Asia (including the Himalayas), northern Europe (including the Russian Arctic), central South America, western North America, and Australia (Fig. 1.13).

In most of Europe, pastoralism usually occurs in high mountains, in arid zones, or on poor soil lands, where intensive cultivation is physically not possible (World Initiative for Sustainable Pastoralism 2007). These areas also very often have high biodiversity or very specialized plant and animal communities of high nature value. In the European Alps and highlands, pastoralism is one of the major components of the agricultural sector (Biber 2006). For example, Alpine pastures account for a quarter of farmland for 500,000 cattle raised by 70,000 farmers on 12,000 sites in Austria as transhumant pastoralism. Alpine pastures in Upper Bavaria host about half of 50,000 cattle from 1400 sites in Bavaria and alpine pastures in Allgäu host the other half under transhumant pastoralism. Alpine pastures on the Swiss highlands, amounting to 35 % of the nation's farmlands, are grazed in summer by about

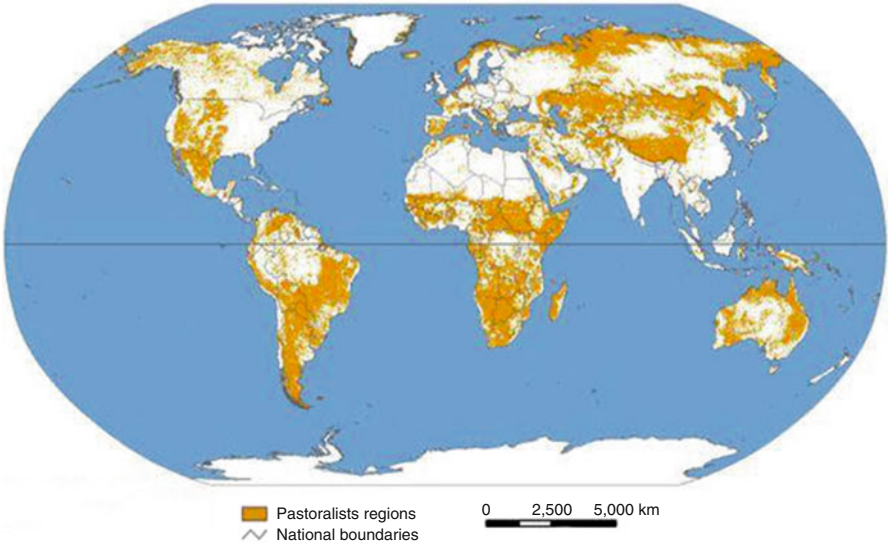

Fig. 1.13 Global distribution of pastoralism. (From http://www.iucn.org/wisp)

380,000 cattle (including 130,000 cows) and 200,000 sheep in transhumant pastoralism. The highlands of the Great British Isles (including Wales, Scotland, England, Ireland) maintain a great number of sheep and cattle by use of trucks as the transportation medium in upland–lowland migrating pastoralism. In Scandinavia, transhumant pastoralism is still largely practiced on sheep and cattle rearing in mountainous areas, such as Värmland, Dalarna, Härjedalen, Jämtland, Hälsingland, Medelpad, and Ångermanland in Sweden, in addition to reindeer rearing.

In Asia, grasslands/rangelands are composed of the largest contiguous landmass, stretching from the borders of eastern Europe to the Pacific Ocean. Asia's grasslands account for 25 % of the total grasslands/rangelands in the world (Kerven 2006). In Central Asia and the Far East, the rangelands/grasslands are climatically characterized by cold and snowy winters and warm summers. There, the low temperature (about −30 °C in Central Asia and inner Asia, and around −70 °C in Siberia) is the dominant environmental factor which limits the growth of grassland vegetation. In the grassland/rangeland areas of this region, pastoralism is practiced to raise common livestock such as sheep, goats, horses, and cattle, and some specific livestock, including yaks, Bactrian camels, and reindeer (Kerven 2006). The grazing pastures vary from permafrost tundra in the north to hot sandy deserts in the south, from the temperate tussock in low valleys of southern China to highland alpine meadows at altitudes of more than 4000 m on the Qinghai–Tibetan Plateau. The economic, social, and political position of pastoralism in this region varies considerably between the countries across the region. In China, more than 40 % of national landmass is covered by grasslands/rangelands, which occurs mostly in northern and western China. Inner Mongolia, Tibet, Xinjiang, Qinghai, Sichuan, Gansu, Yunnan, Liaoning, Jilin, and Heilongjiang are top ten provinces for pastoral production. The Chinese population involved in pastoralism is about, accounting for 15 % of the total national population of 1.3 billion. For pastoralism-specialized ethnic groups such as Tibetans, Mongols, and Kazaks, most of these populations are traditional pastoralists. In Mongolia, most of the population (85 % of the agricultural population) are pastoralists, and pastoral production provides the mainstay of the national economy, with a powerful political lobby. In Kazakhstan and Turkmenistan, a high proportion of the rural population (68 % and 43 % respectively) is engaged in raising livestock, but the relative value of livestock production is far less than the revenues from minerals in the national economy. In Tajikistan, most pastoralists (4 % of the total agricultural population) live in the high mountain areas in the east, where marketing is poor because of international trade barriers. Uzbekistan and Kyrgyzstan have considerable numbers of pastoralists (6 % and 7 % of the total agricultural population respectively) who make a living through selling meat and dairy products to urban and arable areas. China has the highest population of pastoralists (19.5 million) in Asia, although this number (only 2.4 % of the total agricultural population) is far lower than the population of Chinese cultivators. The grasslands/rangelands in Siberia in Russia are vast, even larger than those in China. However, these grasslands/rangelands are very in low productivity and support only a couple of million livestock and less than a million pastoralists (Kerven 2006).

In the Near East and South Asia, pastoralism is one of the major agricultural production systems in arid and semiarid areas (Gura 2006). In Iran and Jordan, up to 90 % of the country is dry land. The ratio of drylands to total land area is 45 % in Afghanistan, 60 % in Pakistan, 63 % in Iraq, and 55 % in Syria. Most of these drylands have, with exception of pastoralism, limited economic use (Gura 2006). In the Himalaya of South Asian countries such as Bhutan, Nepal, India, and Pakistan, pastoralism is still providing the mainstay for the regional near-subsistence economy, as agricultural production is impossible because of low temperatures at high elevation and steep terrains in the mountainous areas (Dong et al. 2009). For instance, regions such as Zanskar in northwestern India, Skardu in northern Pakistan, and Kham Magar in western Nepal still maintain nomadic pastoralism as the subsistence economies in the societies.

In Africa, pastoralism is distributed all over the continent. North Africa has vast areas of grasslands/rangelands, mainly steppe and arid Saharan land (Dutilly-Diane 2006). In terms of grassland/rangeland size, Morocco and Algeria are the top countries. They have about 20 million hectares of steppe, accounting for more than 40 % of the nation's territory. Tunisia ranks third in the size of grasslands/rangelands, which cover 25 % of the total territory. Two large desert counties, Egypt and Libya, the grasslands/rangelands covering about 1–2 % of the national territory (Dutilly-Diane 2006). The primary vocation on the grasslands/rangelands is livestock production. Therefore, the steppe in North Africa is called "the world of sheep." Pastoralism of small ruminant rearing is the traditional mode of valorization of the steppe. Although the reality may be overestimated to some extent, the document shows that 48 %, 62 %, and 75 % of the total small ruminant populations belong to pastoral production systems in Algeria, Tunisia (the data include animals in the center of the country as well) and Morocco respectively (Dutilly-Diane 2006).

In East Africa, pastoralists can be found in all countries, especially in the arid and semiarid dryland areas, where pastoralism is a major production system and livelihood strategy (Odhiambo 2006). In Kenya, there are about four millions pastoralists, accounting for more than 10 % of the nation's population. All of the arid and semiarid lands, constituting 80 % of the national landmass, are occupied by pastoral and agropastoral communities (Pastoralist Thematic Group 2001). In Uganda, there is a cattle corridor specialized for pastoral production. This corridor ranges from Mbarara in the southwest to Kaabong in the northeast of the country, covering 42 % of the country's landmass and 51 % of the national territory. Traditionally, most households (more than 60 %) along the cattle corridor are pastoralists (Odhiambo 2006). Outside the cattle corridor, such as in Kasese and Bundibugyo in the Western Rift Valley, there are also a large number of pastoralists. Totally, pastoralists constitute 22 % of the population of the whole nation (Odhiambo 2006). In Tanzania, the pastoral economy is the mainstay for supporting the livelihood of 10 % of the nation's population (Odhiambo 2006). The land use in most of the nation's arid and semiarid areas, such as Manyara, Arusha, Dodoma, Singida, Shinyanga, and Mwanza, is dominated by pastoralism. The pastoral groups own about 99 % of Tanzania's livestock population, and form the backbone of the livestock sector (Odhiambo 2006). In Sudan (including South Sudan), 20 % of the national popula-

tion is involved in pastoralism, especially in arid and semiarid regions such as desert, and savanna, where pastoral production accounts for 80 % of the country's livestock wealth (Sin 1998) and contributes 25 % of foreign exchange earnings from livestock export (Odhiambo 2006).

In West Africa, pastoralism occurs mainly in Burkina Faso, Mali, Mauritania, Niger, Senegal. and Chad. located in vast Sahelian zone dominated by climatic hazards (Wane 2006). Although these countries are very similar in terms of pastoralism, mobile livestock production on the natural rangelands, there are some differences in the pastoral systems (i.e., nomadism, transhumance, or agropastoralism) which are determined by the mobility of the pastoralists' dwellings and the presence or absence of agricultural activities (Wane 2006). Within the vast Sahelian zone, pastoralism is principally the activity of the multivariety ethnic group of Fulani, and other ethnic groups such as the Touareg, Toubou, Wolof, and Serere have recently adopted pastoralism (Wane 2006). These pastoral people herd either monospecific or mixed groups of different livestock species, including bovines, ovines, goats, camelids, donkeys, and equines (Wane 2006). In the Sahelian zone, the livestock production characterized by pastoral mobility and full use of natural resources (the rangelands) contributes a great share to the national economy. According to the report prepared for World Initiative for Sustainable 1674 Pastoralism by (Wane 2006), the shares of agriculture in national GDP of Sahelian countries in 2003 were 31.0 % in Burkina Faso, 38.0 % in Mali, 20.0 % in Mauritania, 39.9 % in Niger, 17.6 % in Senegal, and 45.6 % in Chad, and the shares of livestock production in the national agricultural GDP were 24.7 % in Burkina Faso, 41.6 % in Mali, 70.0 % in Mauritania, 29.8 % in Niger, 37.3 % in Senegal, and 11.0 % in Chad (Wane 2006).

In southern Africa and the Horn of Africa, pastoralism is practiced widely from the Cape of Good Hope to Cairo. In this region, countries such as Somalia, Ethiopia, Botswana, Zimbabwe, South Africa, Namibia, Malawi, and Zambia have a tradition of pastoralism, although each of them is remarkably distinct in terms of livestock production and marketing systems because of variations in climate, natural resource endowment, colonial history, and current levels of national economic development (Behnke 2006). In Somalia, nearly 98 % of agricultural land is pastureland, most of which is rangeland, where three quarters of the total nation's population (9.7 million) make a living on livestock production. In Ethiopia, pastoral residents account for only 8 % of the total population, whereas the pastoral population occupies a large area (60 % of the country's land) and produces a higher share of national livestock outputs; that is, 73 % of the goats, 25 % of the sheep, 20 % of the cattle, and 100 % of the camels in the nation's livestock population (Aklilu 2002). In Botswana, rangelands account for 99 % of the nation's agricultural lands and support about 0.6 million people (47 % of the national population) who live on pastoral production. In Zimbabwe, pasturelands account for 84 % of agricultural lands, and 6 % of the nation's population lives on rangeland-based livestock production. Similarly, in South Africa, 84 % of agricultural lands are pasturelands ,and 16 % of the nation's population (more than 6.3 million) live in rangeland areas for livestock production. Despite South Africa being a relatively advanced industrial

economy among all African countries, many pastoralists are unwilling to be involved in marketing production and insist on keeping the tradition of livestock production. Namibia ranks first among African counties in terms of ruminant meat production per capita. In this country, pasturelands account for 98 % of total agricultural lands, and 54 % of the total population lives on livestock production in semiarid rangeland areas. In contrast, Malawi ranks last among African countries in terms of meat and milk production. Although 42 % of Malawi's agricultural lands are pasturelands, only 2 % of the nation's population lives in rangeland areas for livestock production. In Zambia, pasturelands account for 85 % of the nation's agricultural lands, and 14 % of the national population lives on livestock production in semiarid rangeland areas (Behnke 2006).

In South America, indigenous pastoralism of herding camelids (llamas, alpacas, vicuña, and guanaco) has a long tradition as a form of livelihood and a production system in mountainous areas, particularly in the Andes (Westreicher et al. 2006). Nowadays, South American pastoralism exists mostly in the habitat known as "puna" or "altiplano" in the semiarid regions of the Andes between 3700 and 5000 m above sea level. Along the Andes, Argentina, Bolivia, Chile, and Peru are presently four major South American countries involved in pastoralist activities (Westreicher et al. 2007). In the central Andes, Bolivia and Peru are at the heart of South American pastoralism for historical, cultural, and geographical reasons, and pastoralist activities are importantly in their national economies (Westreicher et al. 2006). In Bolivia, rangeland-based alpaca production is the key pastoralism in the Andean highlands called "altiplano," particularly in the Cordillera Oriental, which is close to the Peruvian border. In Peru, the Andean highlands called "sierra" provide home for 41 % of the nation's population and serve as the production base for all of the nation's sheep, llamas, and alpacas and 70 % of the nation's cattle. In Argentina and Chile, pastoralists occupy marginal areas in the southern Andes and their economic relevance lies in their capacity to activate economic niches; that is, goat raising in northern Chile and southern Argentina, and camelid raising in northern Argentina.

In North America, pastoralism continues to be an important livestock production system practiced in mountainous areas and parts of the Great Plains (Huntsinger et al. 2010). Moreover, there is also reindeer pastoralism in arctic regions of North America. In the western USA, pastoralism relies in most cases on the use of public land resources, which are highland pastures under the jurisdiction of the US Forest Service and lowland steppes and deserts under the jurisdiction of the Bureau of Land Management (Sulak and Huntsinger 2007). The American ranchers traditionally move their herds up to highland pastures with the appearance of green grass in spring and summer, and graze their herds on the lowland steppe or desert in winter. In California and Texas, more ranches tend to have private land for pastoral production mainly because of the tradition of the Spanish land grant system. In these areas, livestock keepers, including ranch family members, hired shepherds, and hired cowboys, move to the mountains and stay in the line camps to herd their sheep and cattle on highland pastures during the summer, or visit the upland ranches regularly by

using trailers to transport horses to the highland pastures (Huntsinger et al. 2010). In the southern Appalachians, livestock, especially sheep, are often grazed on grassy bald mountaintops where wild oats predominate. These balds might be the remnants of ancient bison grazing lands maintained by early Amerindians to some extent.

In Oceania, extensive pastoralism has been practiced on vast rangelands since European settlement (Earl and Jones 1996), allowing sheep and cattle to move as they choose the grazing lands over large areas. In Australia, this practice continues to survive in modern ranching systems throughout the country except in the central and coastal areas, where less pastureland can be found (Earl and Jones 1996). In New Zealand, this practice exists on one third of the country's land at high altitude (Lambert and Snow 2011).

1.5 Identity and Structure of Pastoralism

1.5.1 Characteristics of Pastoralism

Pastoralism generally has a mobile aspect, with herds being moved in search of fresh pasture and water (except for pastoral farming, in which pastoral farmers grow crops and improve pastures for their livestock). Pastoralism is often the optimal subsistence livelihood, which is generally independent of any particular local environment (O'Neil 2011). By nature, "pastoralists are flexible and opportunistic and can rapidly switch management systems as well as operating multiple systems in one overall productive enterprise" (Blench 2001). For example, pastoralists sell their herds or move them to new pastures when there is a drought. In contrast, agricultural cultivators rarely have these options. A pastoral subsistence pattern (especially nomadic pastoralism) is very often an adaptation to an irregular climate to reduce the risk in semiarid open country (O'Neil 2011). Mobile livestock grazing on the extensive grasslands/rangelands in arid and semiarid regions is a key feature of pastoralism (Blench 2001). The species of pastoral animals vary with different regions across the world, but they are all domesticated herbivores that are kept normally in herds and fed on rangeland forages or other abundant plant foods such as fodder trees (Blench 2001). The pastoral animals are herded as single species or mixed ones by pastoralists, depending on their traditional grazing practices. Sometimes, pastoralists keep nonpastoral species such as dogs and chickens, in addition to pastoral animals. Dogs are very important in protecting the livestock from wolves across a wide range of Eurasia from the Near East to Central Asia. In some parts of western Europe, pastoralists' still practice the tradition of using dogs to herd sheep (Fig. 1.14). This can help save a great amount of human labor inputs. In West Africa, Fulani nomads carry their chickens to feed on the rangeland worms when they graze their cattle and sheep, which adds significant value to livestock production for the pastoral households (Blench 2001).

Fig. 1.14 A dog herding the flocks of sheep on the Larzac Plateau, southern France. (Photo by Shikui Dong, 2011)

Different people who are involved in pastoralism across the world have the same identity of mobile livestock raisers, no matter in which region they live and to which ethnicity they belong. In addition to "pastoralists," these people are also named "nomads," "herders," "graziers" (mostly in Australia), and "ranchers" (USA, Canada, Brazil, Argentina, and South Africa) in the different literature. Historically, the culture of pastoralists has been interwoven with the culture of peripatetics, the other groups who move around the pastoralist communities to supply services to them. The most famous itinerants throughout much of Eurasia from Wales to India are the Gypsies, who are named "peripatetics" by Rao (1982, 1987). Although they do not herd any livestock on the rangelands/grasslands, peripatetics have played an important role in livestock trade in the long history of Eurasian pastoralism, particularly in Afghanistan and India, where both peripatetics and pastoralists are usually stereotyped as ethnically distinct in the same way and treated in the same category by national governments (Olesen 1994). Although both pastoral nomads and peripatetics adopt a similar mobile way of living, peripatetics are very different from pastoralists by identity. For example, in Afghanistan, pastoralists live in black goat-hair tents, but peripatetic live in white tents.

1.5.2 Social Structure of Pastoralism

The requirements of mobile grazing under extensive conditions have shaped the nature and structure of pastoral societies. Although there is an exception to any generalization, the basis of pastoral organization in every corner of the world is the clan, whose groupings can be very small and very shallow in time depth (Khazanov 1984). Control of the optimum territory by the clan is a function of the quality of pastures, the variability of the environment, and the livestock species herded. Livestock herds tend to be individually managed, whereas pastures are mostly collectively managed in the traditional pastoral areas of Africa, Asia, and South America. The livestock are normally herded by the individual households in the clan, but pastoralists can hire outsiders to graze their livestock if the herd sizes are too big to be managed by the household labor. For example, Ful∫e herders in modern Niger made slaves manage their great numbers of cattle herds. As such, "many pastoral societies in Africa and the Near East developed elaborate caste systems based on slaves and non-slaves in 19th century" as stated by Blench (2001). When the slaves received their freedom in the colonial era, they stayed with their original camps for some time, but the clans have been gradually broken up away to form independent households, particularly in the remote areas where traditionally authority cannot be brought to bear (Blench 2001).

Collective control of pasture resources is an ideal way of assuring pastoralists' mobility, as they must have access to a very large territory to reduce the risks of drought and inclement weather in arid regions. For Somali, as an example, to maintain mobility is so important that the territory is not strictly refined, and even the use of wells or pastures clearly defined to belong to an individual or other groups is possible if there is sufficient water or grass for all of the groups (Swift 1977). However, there are always some contradictions between the individual pastoralists who want to expand the family herds and the collective group that wants to equally share the pastures. The expansion of herds leads to unequal accumulation within pastoral communities, threatening group unity and pasture health. The individuals do need access to communal grazing lands and the aid of fellow pastoralists to help protect themselves from outsiders (Swift 1977).

These conflicts can be mitigated by a variety of institutions and beliefs. For example, the needs of the community are reinforced by a system of ideology, "livestock fetishism" (Bonte 1981), which reduces the inequity and promotes group unity. Moreover, these institutions and beliefs can sanctify the traditions of sacrifices, bridewealth giving, hospitability rules, and animal lending, which can not only reduce inequality of pastoral groups, but can also lessen the risk by permitting a wider dispersal of animals and by resolving labor bottlenecks. As an important aspect of pastoral life, hospitality plays a very important role in facilitating mobility and helping isolated herders obtain needed information. Segmentary lineages and similar forms of social organization are also well adapted to the needs of pastoral societies (Salzman 1978). Self-reorganized organizations (such as livestock associations), elected bodies (such as community committees), and norms, rules, and

regulations derived from the traditions and practices have run the pastoral production systems in the pastoral realm worldwide for a long time.

1.5.3 Sex in Pastoral Society

The role of women in pastoral society has been widely debated, in part because pastoral societies are much more dominated by men than are most other subsistence systems (Blench 2001). There is an exception in the pastoral society of the Saharan Tuareg, which is mother (patrilineal) and women dominated. The use of labor within pastoral societies is very much sex specific. For pastoral production, women usually contribute more labor and play more important roles than men. However, pastoral women play less important roles than pastoral men or are totally ignored by the pastoral society in decision-making processes. In the male-dominated pastoral societies, elderly men usually make important decisions regarding herd mobility, turnover planning, conflict mitigation, and social relations among pastoral groups. In the family, men traditionally own the animals and control the money and the women have no rights to own animals and make budget plans.

In many pastoral societies, women primarily care for children and elderly people and perform domestic chores such as childcare, cooking, and weaving cloth (Fig. 1.15). In addition, women are customarily responsible for livestock rearing and herding (Fig. 1.15). Women are the key laborers in many pastoral societies for both processing and marketing milk and dairy products (Fig. 1.15), although women are not allowed to milk the animals or are allowed to milk only certain kinds of livestock in some societies (Blench 2001). When the animal herds are moved to new pastures, women may have to participate in dismantling and rebuilding their houses. In most cases, women herd the livestock and care for young and sick livestock kept near the homestead, whereas men herd the animals and sell meat animals in systems when a herd is split. Normally, the income from selling live animals and animal products goes to the men. Although women are responsible for most of the workload in pastoral societies in general, men usually acquire prestige and power in controlling the pastoral incomes and family consumption. Much evidence shows that empowering women remains a challenge in most of the pastoral regions across the world.

1.6 Importance (Values) of Pastoralism

Globally, the importance of pastoralism can be found in many dimensions, especially the socioeconomic, ecological, and cultural dimensions; for example, it supports huge human populations in rangeland areas, provides tremendous food and ecological services, makes significant contributions to the subsistence economy in some of the world's poorest regions, and maintains long-standing civilizations

Fig. 1.15 Female pastoralists' activities: (**a**) fuel (yak dung) collection in Qinghai, China; (**b**) livestock herding in Bolivia; (**c**) household chores such as water collection and carrying in Ethiopia; (**d**) milk processing in Tibet, China; (**e**) making of living materials (such as tents) in Tibet, China;

(Nori and Davies 2007). Davis and Hatfield (2007) stated that pastoralism can economically create existence values (intrinsic benefits for the global society), option values (retaining future opportunities), direct values (local benefits in social, economic, and environmental dimensions), and indirect values (associated with tourism and agriculture); see Fig. 1.16. In terms of economic values from the measured direct value point of view, Hatfield and Davies (2006) highlighted that pastoralism makes great contributions to agricultural and national GDP in countries such as Mongolia and Sudan, where pastoralism is as a predominant agricultural sector. According to official statistical data, pastoralism accounts for as much as 30 % of national GDP in Mongolia and 80 % of agricultural GDP in Sudan (Hatfield and Davies 2006).

Although few countries have official data on the contribution of pastoralist systems to national accounts, the available information indicates that the contributions of pastoralism to agricultural GDP are quite high in several African countries, such as Sudan, Senegal, Niger, and Kenya (Fig. 1.17). In East African counties, almost all Massai communities depend totally on pastoralism as the subsistence production system. It is believed that no system other than pastoralism can utilize the physical, climatic, and vegetative variations inherent in dry Africa as effectively, and the productivity of pastoral systems in Africa can be higher than that of other systems under the same conditions. African pastoralism has been shown to be between two and ten times more productive per hectare than ranching systems (Scoones 1995). These facts have changed the common belief that pastoralism adds little to national economic activities and is less productive than sedentary livestock raising to the new viewpoint that pastoralism is a viable economic system which can improve the livelihoods of millions of pastoralists and contribute to poverty reduction and environmental management in dry zones by promoting market access and enhancing mobility (Pastoralist Thematic Group 2001).

In addition to economic values, pastoralism has significant environmental value by providing all kinds of ecological services listed by Millennium Assessment 2003, including provisioning (such as food and fiber), supporting (such as soil formation and retention), regulation (such as climate regulation), and cultural (such as spiritual and religious) services. In terms of ecological services, a great amount of evidence shows that effective animal grazing can contribute to maintaining healthy rangeland vegetation, which generates rich biodiversity, promotes biomass production, captures carbon, reduces erosion, maintains soils, and facilitates water-holding capacity (Voisin 1959; Savory 1999; Frank et al. 1998). Large pastoral systems such as tropical savannas and temperate steppe represent a great (actual and potential) carbon sink, and pastoralism can effectively promote the potential of rangeland for capturing carbon. It was estimated that grasslands/rangelands store approximately 34 % of the global stock of CO_2, whereas only US$7 per hectare for the gas regula-

Fig. 1.15 (continued) (**f**) child caring in India; (**g**) milking animals in Afghanistan; (**h**) calf rearing in Qinghai, China; (**i**) handicraft making (such as embroidery) in Xinjiang, China. (Photos by (**a**) Xukun Su, 2014; (**b**) Tourrand, 2010; (**c**) Allan Degen, 2010; (**d**, **e**) Ruijun Long, 2008; (**f**) Shikui Dong, 2010; (**g**) Shaoliang Yi, 2010; (**h**) Xukun Su, 2014; (**i**) Xi Wang, 2011)

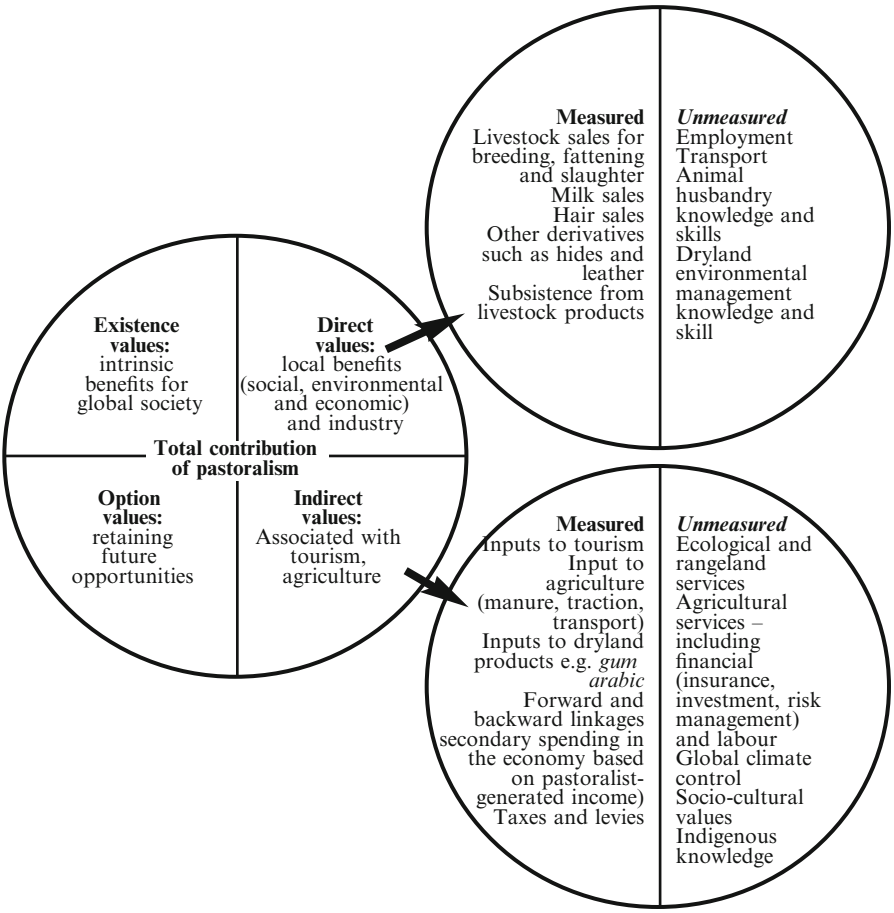

Fig. 1.16 Total economic values derived from pastoralism. (From Davis and Hatfield 2007)

tion function of this biome was given in a global valuation study (Costanza et al. 1997). Effective pastoral grazing management can be used as tool not only to improve grassland/rangeland biodiversity but also to prevent land degradation and desertification through maintaining rangeland ecosystem integrity (Niamir-Fuller 1999). The mean value of the maintenance of biodiversity in grasslands across different sites was estimated to be about US$7.5 per hectare per year (Yu et al. 2005), although the accurate estimation varies with many factors, such as the inclusion of all animal and plant species living in the grasslands/rangelands and the outsiders' willingness to pay for conserving grassland/rangeland biodiversity. Water-holding services are essential for pastoralism in the different grassland/rangeland areas, and effective pasture management, including grazing management, can improve

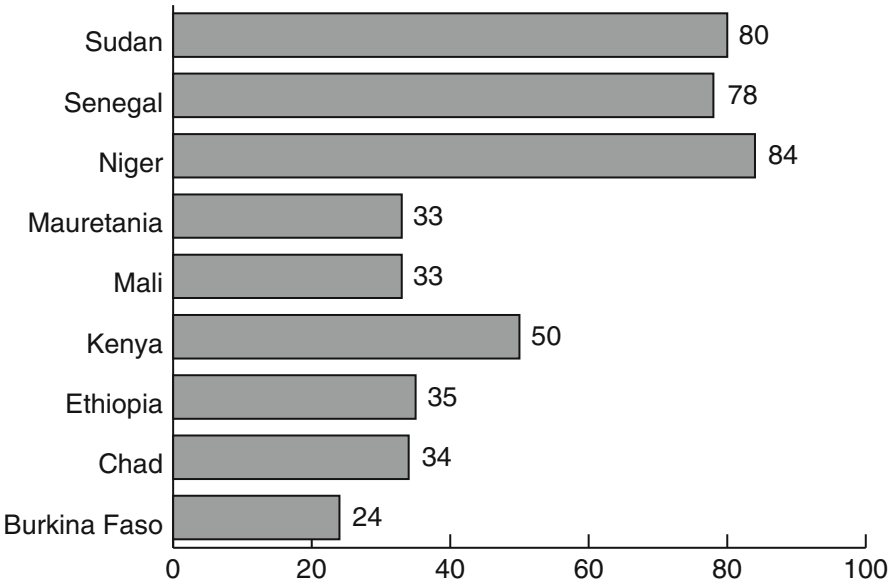

Fig. 1.17 Contribution of pastoralism to agricultural GDP in several African countries (Source: Davis and Hatfield 2007)

infiltration of water and reduce runoff, and thereby raise water tables. Although it is hard to quantify the water-holding services of pastoralism on a global scale because of data scarcity, the case study conducted by Yu et al. (2005) shows that water holding of the grasslands/rangelands (mostly grazing pastures) in the Qinghai–Tibetan Plateau of China was valued at US$1524 per hectare per year, which may provide an idea for gauging the value of the water-holding service provided by worldwide pastoralism. A great number of studies have shown that pastoralism plays important roles in maintaining ecosystem health and resilience and promoting water and mineral cycling in many grassland/rangeland ecosystems, but still no data are available for quantifying the value that pastoralism provides for maintaining water and mineral cycling. The case study conducted by Yu et al. (2005) in the grasslands/rangelands of China showed that the value of soil maintenance provided by pastoralism was US$3 per hectare per year.

Other key features of ecological services of pastoralism are sociocultural ones, traditional knowledge of the pastoralists (e.g., transhumant grazing by generations of traded knowledge on the carrying capacity of soils), pastoralist's coherent association with the landscape (usually mainly formed by pastoral activities), and the diversification of language and religions within pastoral societies in the world. A Mongolian saying states that "half of human history has been written in the grasslands." This does mean that pastoral civilization and agricultural civilization

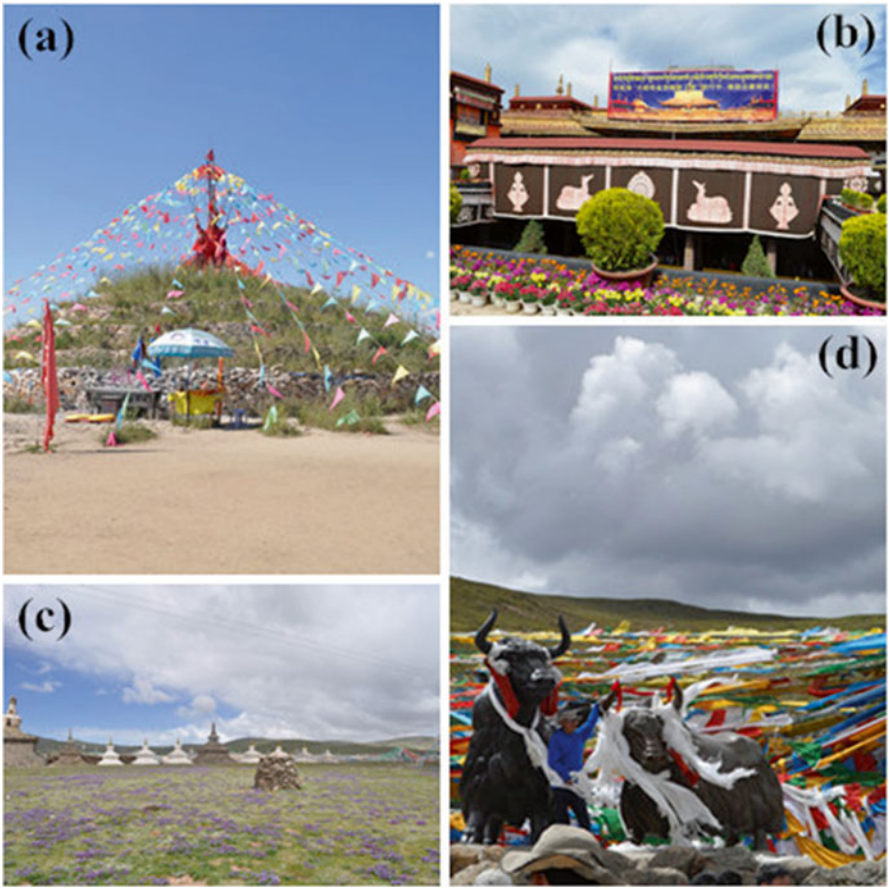

Fig. 1.18 Religion associated with pastoralism: (**a**) Mongolian Obo, praying sites on grasslands; (**b**) Tibetan Buddhist temple, half-down sheep in the main gate; (**c**) Tibetan Maany stones, the praying rite on Tibetan rangelands; (**d**) holy mountain with scared yak status in Tibet. (Photos by (**a**) Wei Sha, 2012; (**b**) Shikui Dong, 2013; (**c**, **d**) Shikui Dong, 2012)

were equally important in human history. The diverse cultures created by different pastoral societies represent the rich resources of the arts (Fig. 1.18), sports (Fig. 1.19), religion, etc., across the different corners of developing world (Fig. 1.20). Although these values have often been underestimated or even overlooked by researchers and policymakers, there is great potential for adding extra values to pastoralism by converting these sociocultural resources into tourism and education.

Fig. 1.19 Sports associated with pastoralism: (**a**) horse racing among Tibetan pastoralists in Qinghai, China; (**b**) horse catching among Mongolian pastoralists in Inner Mongolia, China; (**c**) wrestling among Mongolian pastoralists in Inner Mongolia, China; (**d**) archery racing among Mongolian pastoralists in Inner Mongolia, China. (Photos by (**a**) Shikui Dong, 2012; (**b**–**d**) Wei Sha, 2013;)

1.7 Future of Pastoralism

In its long history, pastoralism has coevolved and coexisted with agriculture, and pastoralists have even successfully conquered agricultural societies. This is particularly true for the Mongol horse pastoralists, who conquered the agriculture-dominated

Fig. 1.20 Arts associated with pastoralism: (**a**) Kazak pastoralist's painting of donkey grazing in Xinjiang, China; (**b**) Kazak pastoralist's embroidering in Xinjiang, China; (**c**) Yugur pastoralist's dance in Gansu, China; (**d**) Kazak pastoralist's horse-feet-like violin in Xinjiang, China. (Photos by (**a**) Shikui Dong, 2013; (**b**, **d**) Xi Wang, 2013; (**c**) Chengzhang Zhao, 2014)

societies of China and Central Asia in the thirteenth century, and they also seized control of agriculture-dominated societies of Persia, Iraq, much of Russia, and the northern parts of South Asia in the fourteenth century (O'Neil 2011). Much evidence shows that the pastoralism as the mobile livestock production system has been adopted in recent centuries and will certainly remain in the future in the developing world (including developing regions in developed counties such as rangeland zones in Australia). Pastoralism will be kept as the backbone of the economy and as the mainstay of ecosystem protection in marginal and fragile areas, because it is generally regarded as an efficient, low-energy-requiring subsistence base for these areas.

However, the present shape evolved from very distinctive influences in the twentieth century (Table 1.2), and there will unlikely be a return to some prior imagined golden era. Similar situations can be found in the pastoral societies in various regions of the world; the drivers that have heavily changed African pastoralism are affecting pastoralism in Central Asia and other pastoral regions. Pastoralism has been declining because of agricultural expansion, industrial development, and sed-

Table 1.2 Key factors influencing pastoralism in the twentieth century (Blench 2001)

Factor	Impact
Modern veterinary medicine	Increases in productivity and greatly enlarged herds
Modern weapons	Major decline in predator threats, increasingly violent ethnic conflict, and high levels of insecurity
Enclaving	Collapse of traditional "safety nets" in terms of long-distance migration in periods of climatic extremes
International pressure for hygiene in slaughtering and dairying	Declining market for pastoralist products
Declining prestige of dairy products	Terms of trade running constantly against pastoral livelihoods
World market in livestock products	Governments import cheap meat, milk, etc., to satisfy urban demand at the expense of the pastoral sector
Ideological interference by the state	Inappropriate social and management strategies adopted and maintained by a combination of subsidized inputs and implied violence
Alternative calls on pastoral labor	Pressure for children to go to school and younger people to earn cash outside the pastoral economy
Modern transportation infrastructure	Replaces systems where transport is a major element of economic production (llamas, horses)
Introduction of high-input, high-output exotic breeds	Makes pastoralists dependent on effective infrastructure where input supply is irregular, creating periodic crises
Emergency relief, restocking, and rehabilitation programs	Keeps nonviable households in pastoral areas, thereby accelerating the cycle of deficits
Conservation lobby	Pressure to turn previously pastoral land over to reserved wildlife/biodiversity regions with corresponding hard currency income from tourism
Encroachment on rangeland	Rangeland is being eliminated through the use of politically attractive but often uneconomic irrigation systems

entary livestock farming in recent centuries. Most national governments in pastoral regions tried to settle pastoralists and reduce herd populations prevent overgrazing. Many pastoral communities are increasingly becoming sedentarized groups, often devoting themselves to small-scale cultivation, even though the quality and success rate of this type of cultivation are quite low. With the increasing sedentarization of pastoralists, the reduction in labor input in mobile livestock rearing may lead to a shift from multiple pastoralism toward solely pastoral farming or agropastoralism production, implying a terrible loss of diversity of pastoralism. As a result, the practices of pastoralism have been overwhelmed. If these situations continue, it is likely that pastoral societies across the world will have more unpleasant fates in the future.

Although pastoralism is changing to adapt to natural pressures and socioeconomic forces, most pastoral societies are marginalized by governmental policies and development strategies. In High Asia, the tragedy of responsibility associated with modernizing traditional pastoral practices and preserving modernist worldviews is currently challenging the sustainable development of pastoralism (Kreutzmann 2013). In Central Asian republics such as Kazakhstan, Turkmenistan, Uzbekistan, and Kyrgyzstan, decollectivization and the consequent loss of subsidies provided by the former Soviet regime may have the potential to bring about a return of more traditional systems of nomadic pastoralism. However, the collapsed public veterinary services, poor access to pastoral areas, and unstable market prices for livestock products reflect big problems for most places in the pastoral regions. In China, the increased pasture enclosure and the pastoralist settlement aiming at decreeing resource utilization strategies and implementing "modern" lifestyles through the interference of central authorities are nowadays altering the traditional land use practices of pastoralism in vast grassland areas. With the perception that modernity can be achieved only in urban settings, the central and regional governments in China are promoting the urbanization of township development in pastoral areas (Kreutzmann 2013). The associated consequences of overgrazing on some pastures are grassland degradation and desertification and those of undergrazing on some pastures are shrub encroachment and biodiversity loss in northern and western regions of the country. In Africa and the Near East, pastoralism is being much more marginalized by the gradual expansion of agricultural production with increasing rainfall. Increased grazing pressures on pastures are leading to the degradation of fragile grasslands/rangelands and may force some of pastoralists to quit their traditions of livelihood, mobile livestock rearing. In the Americas and the circum-Mediterranean region, infrastructure development and enclosed livestock production associated with regional development strategies are forcing out the remaining pastoralists. In some areas, the marginal lands that were previously used as pastures and homelands by pastoralists are increasingly being converted into reserves of biodiversity. These consequences have been accelerating impoverishment in many countries in the developing world, a situation intermittently remedied by mineral revenues but not through the development of pastoral systems.

Whatever the future of pastoralism is, the lessons learned in different pastoral areas across the world could be absorbed in the policy-making structures of sustain-

able pastoralism. Whether the importance of pastoralism is appreciated by global communities or not, the environmental services of pastoralism need to be widely recognized and the respective governments in the pastoral regions should act effectively to protect or restore such services. Irrespective of whether the emerging economies can benefit from the past mistakes made in the pastoralism sector, it is important to maintain the environmental benefits of pastoralism while it still exists. As stated by Davis and Hatfield (2007): "The key is to disseminate improved understanding of pastoral society as broadly as possible, making both policy and the effective management of pastoral systems as widespread as possible in the future." Moreover, McAllister et al. (2006) stressed that understanding past adaptation of pastoralism is important for planning and directing the future of pastoralism. Therefore, the lessons learned and experiences obtained in the past should be considered in the policy making for sustaining pastoralism in the future.

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