BIODIVERSITY PROTECTION AND THE SEARCH FOR SUSTAINABILITY IN TIBETAN PLATEAU GRASSLANDS (QINGHAI, CHINA)

by

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A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

ARIZONA STATE UNIVERSITY

December 2000

ABSTRACT

Grasslands have provided fundamental goods and services to humankind for millennia. In many of the world's mountain regions, pastoralists (livestock herders) have benefited from and maintained alpine grassland biodiversity through sustainable land use practices. In recent times, however, many new factors have begun to impact even the remotest ecosystems. Developments far removed from the grassroots – both literally and metaphorically – now largely determine the future of these critical habitats, both their biodiversity and the local people that they support.

The Tibetan plateau is the highest and largest alpine grassland region in the world. Situated in western China, its vast rangelands form the headwaters of Asia's most important rivers, including the Yellow, Yangtze, Mekong, Salween, and Brahmaputra rivers, and they are home for the internationally endangered Tibetan antelope, wild yak, snow leopard, black-necked crane, and other Central Asian wildlife. Tibetan pastoralists also have inhabited the region for many centuries and their survival in this exceptionally harsh environment is testimony to the sustainability of traditional resource management practices. In recent decades, however, as the Tibetan plateau region has become increasingly integrated with the rest of China, many new socio-economic and political realities have begun to emerge. Protecting the native biodiversity of the Tibetan plateau and seeking sustainable development opportunities for this economically poor region of China are the two parallel and tightly interwoven themes of this dissertation.

In climatically variable environments, such as found on the Tibetan plateau, flexible resource management strategies are essential. The maintenance of mobility and seasonal grazing also promote sustainability, while large fencing schemes and the conversion of high altitude lands to agriculture are unsustainable and decrease grassland biodiversity. Fortunately, several policies and initiatives in China now have begun to rectify some former misguided development practices.

Perhaps most significantly, grassroots participation in conservation and development now is increasing in China. In Qinghai, for example, local leaders in the source area of the Yangtze River recently have established the Upper Yangtze Organization. Based on their experience (reported in this

dissertation), local community participation and ownership are found to contribute very significantly to the success of integrated conservation and development projects.

ACKNOWLEDGEMENTS

Many different people have helped me with this work. However, a special word of thanks must go to the following people. Without the genuine support of the faculty and staff of the Qinghai Education College (*Qinghai Jiaoyu Xueyuan*) in Xining, virtually none of this work would have been possible. I am in particular indebted to my language teacher, Mr. Shi Wenhua, as well as to Mr. Zhao Yanwu and Ms. Wang Minghui of the Foreign Affairs Office. The Jianhua Foundation also provided various forms of assistance, especially through its Qinghai Office.

For true friendship and for inviting me into his world, the pastoral community of Suojia in the source area of the Yangtze, I especially want to thank Zhaduo. Through him I have met many other people as well, from local pastoralists to academic researchers to government leaders. Here I extend my heartfelt thanks to all of them, as well as to Zhaduo, for helping me to better understand this special part of the world and for doing their utmost to make me feel at home.

For their wonderful companionship and real encouragement along the way, I also want to thank Laurens Wester, Chris Turner, and Raija Pyykkönen. I also thank my advisor, Dr. Andrew T. Smith, for his ongoing assistance and genuine friendship that dates back to our fieldwork together in Qinghai in 1991. All the other members of my research committee (Drs. Will Graf, Donald McTaggart, Dave Pearson, and Frederick Steiner) have been extremely supportive as well, and I thank them too.

Finally, I give heartfelt thanks to my parents, Peter and Beth Foggin, for their unwavering support throughout all these years, and to my wife, Marion Torrance, who I met in the course of my research in Qinghai, who has provided valuable assistance in this work, and with whom I now have the joy of continuing in life together.

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PREFACE

Fields and fences now line the highway along the southern shore of Qinghai Lake. Crops of rape sway gently in the breeze, turning a resplendent yellow when in blossom. Far above, high in the Qinghai Nanshan mountains, the rich and colorful alpine pastures are the summer home of local Tibetan herders. Summer is the season of plenty, a time for sheep and yak and wildlife – not to mention the pastoralists themselves – to recover their strength. This also is the time for herders to make strategic decisions in careful preparation for the colder, darker season that always lies ahead, another winter in the cycle of seasons, a cycle of abundance and scarcity. In the autumn and winter, livestock deplete the rangeland resources as they forage and prepare for the hardest time of all, the spring season. This is not a spring of new growth, but of a longing for summer, of resources virtually exhausted, of persistent cold and barren lands. In this season, two shadows cover the land, one figurative, and the other real. In the former, summer is longed for as livestock begin to die of starvation, often leading to a despair reinforced by local perceptions of inevitability and fate. In the latter, tons of soil are blown away, literally, by the winds of spring, fertile soil that is lost forever from the recently tilled fields – yesterday's most fertile pasturelands that recently have been converted into agricultural fields. And this shadow is real, a shadow that risks growing in the light of current winds of development and change. Yet, as always, a time of plenty is just around the corner, the cycle of seasons about to begin once again. Or will it? Indeed, what exactly are the present winds of change, the driving forces behind the interconnected social, economic, and ecological changes presently taking place in the Qinghai Lake area and elsewhere on the Tibetan plateau? What do Qinghai's alpine grasslands look like today? And what can be done to protect the fragile ecological balance and biodiversity of the Tibetan plateau, a truly unique world-class natural heritage? To discuss and to answer in part these crucial questions is at the heart of this dissertation.

CHAPTER ONE

Introduction: Biodiversity and Sustainable Development in Qinghai Province, People's Republic of China

Overview and Summary (back to top)

The end-goal of this dissertation is simple: to protect the unique biodiversity of the Tibetan plateau. "Biodiversity is the variety of life and its processes. It includes the variety of living organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever changing and adapting" (Noss and Cooperrider 1994). Conservation biology, on the other hand, is the investigation of human impacts on biodiversity, in its broadest sense, and the development of practical approaches to preserve biodiversity and ecosystem integrity (Miller 1996).

"Practical approaches" imply that proposed solutions must be reasonable, relevant, and useful in the real life contexts of the ecosystem or region where conservation is to be promoted. The contexts of the Tibetan plateau, and of Qinghai's alpine grasslands in particular (which comprise over one-third of the Tibetan plateau rangelands), are complex and in a process of rapid transition. In particular, the evolving socio-political, ecological, and economic situations in the Tibetan plateau region (and in China as a whole) are directly relevant to – and to some degree even determinant of – the success or failure of biodiversity conservation efforts. Thus much more than the purely biological must be considered and studied when planning for success (Ives and Messerli 1989, McNeely 1996a, Carpenter 1998, Margoluis and Salafsky 1998, Schaller 1998).

There are many parts to this dissertation. The primary reason for this is that although a number of studies already have examined the biology of several key species of concern in the Tibetan plateau region (i.e., internationally endangered species; see, e.g., Kaji 1985, Schaller and Ren 1988, Schaller et al. 1988, Harris 1991, Schaller et al. 1991, Harris and Cai 1993, Jiang et al. 1994, Miller and Jackson 1994, Yang 1994, Harris and Miller 1995, Jackson and Hunter 1996, Oli 1996, Schaller and Liu 1996, Schaller 1997, 1998, Harris et al. 1998, Harris et al. 1999), no study has been published

– at least none originating in the environmental or conservation circles – that draws together the many interrelated strands, or pieces of the puzzle, that impact biodiversity conservation in western China. In particular, no study has yet comprehensively brought together the issues of grassland ecology, natural resource management, socio-economic development, and biodiversity conservation in this part of the world, along with a practical and innovative case study of grassroots participatory conservation and development in a remote nomad (pastoral) community of the Tibetan plateau.

All these topics will be integrated in the following chapters with the goal of biodiversity preservation in Qinghai's alpine grasslands, a very unique and special habitat of the world (see Foggin 1998a, 1999a, China Council for International Cooperation on Environment and Development 1999a, Upper Yangtze Organization 1999). As such, this dissertation purposes to provide a basic analytical framework for future integrated conservation and development work in the alpine grassland regions of western China.

This first chapter provides a brief overview of the environment and current development trends in Qinghai and the Tibetan plateau, including a glimpse of the people affected most by any conservation or development effort, the Tibetan pastoralists. Chapters 2 and 3 then provide more in-depth background information and preliminary analyses pertinent to conservation in China. The thematic topics reviewed include grasslands, pastoralism, sustainability, and biodiversity; and the four different geographic areas (scales) analyzed in this work are the nation as a whole, the Tibetan plateau region, Qinghai province, and most specifically Qinghai's alpine grasslands. The overview of the main development priorities in China's pastoral (animal husbandry) areas is especially noteworthy. The specific natural and cultural landscapes of the Qinghai Lake area then are studied in Chapter 4. Next, some of the ecological impacts of fencing and associated changes in livestock grazing patterns on grassland vegetation are examined in Chapter 5. The impacts of several other socio-economic factors on grassland quality and on mammalian biodiversity also are analyzed at a regional (provincial) level in Chapter 6. Chapter 7 provides detailed information on the wildlife that I observed in Qinghai between 1994-1999, as well as a brief discussion on the historic abundances and distribution of native wildlife species and main causes of their decline. Finally, in Chapter 8, I provide a detailed case study of a current grassroots conservation effort in the source area of the Yangtze River. This last chapter also lists some of the key lessons learned from integrated conservation and development projects around the world, and summarizes the recent development and potential role of civil society in China for environmental protection and sustainable development. Based on the real life practical experience gained thus far (cf. the case study in Chapter 8), the critical roles of local ownership and community participation in conservation efforts and the need to integrate the meeting of basic human needs with longer-term environmental needs are particularly noted. In this latter context, the potential role of ecotourism as a means to generate community funds for conservation and development is discussed, and a locally developed regional land management plan is described.

Qinghai's Grasslands at a Glance (back to top)

Qinghai province is situated in northwest China and comprises much of the northeastern part of the Tibetan plateau. The region is one of the main grassland areas of China, and also one of the most important nomadic pastoral areas of the Tibetan plateau (Hu et al. 1992, Smith 1996). According to one classification, 26 of Qinghai's 44 counties are pastoral, and 4 are semi-pastoral (Liu 1993). The province has a total population of around 4.5 million people and over 20 million head of livestock (mostly sheep and yak). Pastoralists graze their livestock on the 385,873 km^2 of grassland in the province (or around 54 percent of the total provincial land area; Jing 1986).

The larger biogeographical context of Qinghai's vast grasslands is the Tibetan plateau, the highest and most extensive alpine region in the world. The Tibetan plateau is a generally arid landmass confined by several mountain ranges to the east, the Himalaya and Karakoram ranges to the south and west, and the very arid continental Central Asian deserts to the north. With average elevations of 4,000-5,000 m and with many mountain ranges rising to elevations over 7,000 m, the climate generally is too severe for agriculture (except in some borderlands and lower valleys), and is favorable only to nomadic pastoralism (Hu et al. 1992). The Tibetan plateau includes virtually all of the Tibetan Autonomous Region, most of Qinghai province, and southeastern Gansu, western Sichuan, and northwestern Yunnan provinces.

The Tibetan plateau is home not only to a unique wildlife assemblage (biodiversity), but also to a uniquely adapted nomadic pastoral society. The long interaction between Tibetan culture and the biological resources of the plateau is a special feature of this environment. In the words of Miller and Jackson (1994), “the fact that viable pastoral cultures and wildlife remain to this day bears witness to the remarkable diversity and resilience of this highly unique ecosystem, as well as the sustainability of its resources if wisely used.” However, if biodiversity is to be maintained outside of protected areas (i.e., in the broader landscape) and if the Tibetan plateau’s montane and grassland systems are to be kept from further degradation, then unsustainable forms of resource utilization must be eliminated (see, e.g., Smil 1993). Although this may be difficult in the face of current social, economic, and political changes occurring in China, many recent trends, especially at the national level, give grounds for hope (Administrative Centre for China’s Agenda 21, 1994, Edmonds 1994, Maxey and Lutz 1994, Carey 1996, Drake 1997).

Finally, a special note should be made here about the people considered most extensively in this dissertation, the local Tibetan pastoralists. Robert Ekvall lived for many years among Amdo Tibetan nomads – the “high pasturage ones” (Ekvall 1968) – in the 1920s and 1930s, and he describes their environment and their ethos well.

> “As a result of the interaction of topography and the extreme oscillation of temperature, the Tibetan nomadic pastoralist lives and carries on his subsistence technique while being battered by windstorms, sandstorms, rainstorms, hailstorms, and snowstorms of awesome dimensions and intensity. It is a constant attack to which he must react with action if he is to survive, and make his way of living supply him with the affluence [livestock] which is his proudest boast. …
>
> The routines of herding are not patterns of behavior by rote, but ad hoc responses to exigencies: a continuous exercise of vigilance, calculation, decision-making, and mastery in the control, by a variety of means, of animals which in themselves are unpredictable in situations which change from moment to moment. …
>
> [Despite these hardships, Tibetan nomadic pastoralists] simply assume that their way of life is vastly superior to the way of life of the sedentary tillers of the soil” (Ekvall 1974).

It is such pastoralists that today are heading up a grassroots conservation movement in a critical part of the Tibetan plateau, the alpine grasslands in the source area of the Yangtze River. Devoted to the protection of their local natural resources, the community leaders now recognize the enduring links between biodiversity and sustainability, and hence the necessity to integrate conservation activities with meeting the short- and long-term socio-economic development needs and aspirations of the local population. With the experiences of such a grassroots model of integrated conservation and development to learn from, as well as the numerous demonstration projects that are planned for Qinghai's alpine grasslands within the context of China's newest nature reserve (see 'China plans…' 2000, 'New reserve…' 2000), soon it will be possible to experiment even more in the development of ecologically sound and culturally appropriate ways to protect the native biodiversity of the Tibetan plateau. In the meantime, this dissertation provides an initial framework for biodiversity conservation work in one area of China, it pursues several specific lines of discussion on current development trends and environmental protection in China, and it reports on a unique case study of participatory, community-based conservation.

CHAPTER TWO

Grassland Conservation in a Global Perspective: Four Key Themes

Introduction (back to top)

Conservation biology aims "to investigate human impacts on biodiversity and to develop practical approaches to preserving biodiversity and ecological integrity" (Miller 1996). It also is known as "the science of scarcity and diversity" (Soulé 1986), and has most commonly been placed within the disciplinary boundaries of the natural sciences. Similar to the maturation of ecology, however, conservation biology has grown beyond its original (artificial) boundaries and no longer can be confined solely to the natural sciences. Indeed, just as cultural ecology, ecological anthropology, landscape ecology, and political ecology (Spooner 1973, Moran 1982, Senft et al. 1987, Bennett 1988, Hecht and Cockburn 1990, Schreiber 1990, Fleharty 1995, Manning 1995, Humphrey and Sneath 1996, Skånes 1997) exemplify some of the changes observed in the field of ecology over the past several decades, so to has the face of conservation biology evolved over time, particularly in the arena of international conservation (Jacobs and Munro 1987, Jeffries 1997) and development work (World Bank 1992, Conway et al. 1998). Conservation biology also has been described as "the newest player in the area of applied ecology" (Temple et al. 1988), as cross-disciplinary or a "metadiscipline" (Jacobson 1990), as "mission oriented" (Soulé and Wilcox 1980, Soulé 1985), and as a "crisis discipline" (Noss and Cooperrider 1994). Schaller (1998) equally has noted that "conservation problems are mainly social and economic, not scientific." The maturation of applied conservation work has thus helped to integrate science and the "real world," and has contributed to many new and exciting areas of inquiry (e.g., community participation in and ownership of conservation and development projects; see Ghai and Vivian 1992, Friedmann and Rangan 1993, Narayan 1996, Ravnborg and Guerrero 1997, Carpenter 1998). As explained by McNeely (1996a):

> "The modern conservationist [clearly] needs to be a sort of renaissance person, with a solid grounding in both biological and social sciences, as well as resource management and practical diplomacy, and a sense of awe for nature and culture. ... Sustainability in a

> highly dynamic social, economic, political, and biological setting [is] a daunting challenge [and] solutions often will be site-specific."

Although it will be difficult to generalize from such site-specific experiences, even the simple recurrence of *unique* solutions at least suggests that the adoption of a post-modern approach could be valuable for conservation biology.

Postmodernism essentially emphasizes differences rather than similarities, the unique rather than the general. Cloke et al. (1991) explain that

> "one of the key premises of postmodernism as a way of thinking – one of its few own starting points of any generality – is that we need to contemplate the human world less in terms of 'grand theories' and more in terms *humble*, *eclectic and empirically grounded* materials. ... [And a] second starting point [is] the focus upon *difference*, an alertness to the many differences that distinguish one phenomenon, event, process or whatever from another, and an insistence on not obliterating these vital differences in the face of grand theoretical statements (whatever their origin)."

Since the primary intended focus of the present work is to develop *practical approaches* to grassland conservation (see the definition of conservation biology), rather than to seek impractical "ideal" solutions, I have adopted an integrated and geographically bound (site-specific) approach to the study of grassland systems and their long-term protection in Qinghai, China. Nonetheless, in order to ensure that a common language is spoken, I still need to define and discuss four key themes – grasslands, pastoralism, sustainability, and biodiversity – as well as to explore some of the main linkages between these themes. Ultimately, the main purpose of this chapter is to make explicit some of the frames of reference that I use to represent the natural world, frames which directly affect how science is practiced, yet that all too often "remain conspicuously unacknowledged and unexamined" (Williams 1999).

The next chapter (Chapter 3) will further complement this background chapter by examining the complex geographic, socio-political, and economic contexts that specifically affect the alpine grasslands of Qinghai. Together, these two background chapters – one thematic, the other geographical – provide the essential framework for the subsequent analytical chapters that form the core of this dissertation.

Grasslands (back to top)

Grasslands of the World (back to top)

Global estimates of the current extent of grasslands range from 16 to 30 percent of the land surface of the Earth (Whittaker and Likens 1975, Ajtay et al. 1979, both in Heywood 1995). Historically, however, grasslands covered between 25 percent (Shantz 1954, in Heywood 1995) to over 40 percent (Costanza et al. 1998, Miller 1996) of the Earth's land surface. Three main types of grasslands are found worldwide: tropical, temperate, and polar (tundra) grasslands. Temperate grasslands – the grasslands examined in this work – include "the *tall-grass prairies* and *short-grass prairies* of the midwestern and western United States and Canada, the South American *pampas*, the South African *veldt*, and the *steppes* of central Europe and Asia" (Miller 1996; also see Riley and Young 1968).

Despite the fact that grasses may be "the most versatile crop on Earth" (Nagy 1997), they often are overlooked. For example, of the 330 nature reserves reported in China in the mid-1980s, over 50 percent included forest ecosystems, while only 3 percent included grassland ecosystem (Li and Zhao 1989). This situation is very surprising when one considers that grasses are the wild progenitors of our cereal crops – wheat, rice, maize, barley, rye, oats, millet, and sorghum (Šikula 1978) – and that they serve many important, even essential, ecological functions and services (Chapman and Peat 1992, Miller 1996, Smith 1998). For example, Miller (1996) notes that grasslands

- • help to prevent soil erosion;
- • provide forage and habitats for large numbers of wild herbivores and other wildlife;
- • help replenish and purify surface and groundwater resources;
- • provide forage for about 10 billion domesticated animals worldwide;
- • are a valuable resource for recreation; and
- • are a renewable resource.

In a more comprehensive list of grassland services, Costanza et al. (1998) additionally note that grasslands provide or affect

- gas and climate regulation;
- soil formation;
- waste treatment;
- pollination; and
- biological control.

When cereal crops and fodder production (for animal husbandry) are considered together with the many other goods and services that grasslands provide, one can readily agree with Šikula (1978) that "of all existing plants, grasses have played the most important role in the life of mankind." Grassland systems clearly deserve more attention – and where necessary, stricter protection – than they generally have received to date.

From an economic standpoint, too, grasslands are an impressive ecosystem. Costanza et al. (1998) recently estimated the value of grasslands at $ 232 US dollars (USD) per hectare per year. Based on this valuation and on an estimated grassland area of 3,898 million ha worldwide, the global value of grasslands amounts to no less than $ 904 billion USD each year.

Grasslands of China (back to top)

Some of the world's most extensive grassland systems are found in northern and western China (Reardon-Anderson and Ellis 1990). In total, grasslands cover between 40 percent (Su 1993, Mao et al. 1997, National Environmental Protection Agency 1998) and 50 percent (Hu et al. 1992) of China's total land area. Based on Costanza et al.'s (1998) estimations, the actual value of this area amounts to between $ 93 billion and $ 116 billion USD per year, or around 14 to 17 percent of the country's gross domestic product (China's gross domestic product was $ 675 billion USD in 1995; World Bank 1997a). The value of the products and services provided by China's total biological resources has been estimated at between $ 257 billion and $ 421 billion USD by the Biodiversity Working Group (of the China Council for International Cooperation on Environment and Development), and in excess of $ 450 billion USD per year by another independent group of Chinese biologists and economists that were commissioned by the United Nations Environment Programme to write a national biodiversity report (Biodiversity Working Group 1996).

There are five main grassland areas in China: the Northeast Prairie, the Inner Mongolia-Ningxia-Gansu Rangeland, the Xinjiang Rangeland, the Tibetan Plateau Rangeland, and Southern China's Mountain Slopes (Mao et al. 1997). Most of these lands are found in the high montane or plateau areas of China, a terrain that comprises nearly two-thirds of the country. Sparse rainfall is the main determinant of the distribution, composition, and productivity of these grasslands, and the main types include prairie, steppe, semi-steppe, desert, and alpine desert (Hu et al. 1992).

The Tibetan plateau alone covers around 2,500,000 km^2, or one-quarter of China (Zhao 1994). The dominant vegetation in this high altitude environment is "dry and cold steppe vegetation" (Chang 1981, Walter and Breckle 1985). Hu et al. (1992) provide a general classification which divides the high alpine region of the Tibetan plateau into three primary biogeographic subregions: forest mixed with scrub and grassland, grassland and scrub vegetation only, and steppe grassland and desert.

Basic grassland biology (back to top)

The physical geography of the Tibetan plateau is unique in the world. Only the Altiplano of South America approaches it. Because of high altitude, solar radiation, and global climatic patterns, the plateau has characteristics from at least three generally distinct ecosystem types – grasslands, alpine ecosystems, and arid lands (see Riley and Young 1968, Heywood 1995).

Temperate grasslands

Narrowly defined, grasslands are plant communities in which grasses are the dominant species. Grasses grow in a wide range of environmental conditions, but are dominant only where trees and shrubs are absent. Extensive grasslands are found mainly in areas where continental conditions prevail and most precipitation occurs in summer. The growth cycle and productivity of grasses in temperate regions is linked closely to summer rainfall and soil water-holding capacity (Sala et al. 1988, Scott and Kong 1990, Miller 1996).

Alpine ecosystems

A larger variety of herbaceous plants grow in alpine ecosystems, including grasses, sedges, rushes, and many flowering herbs. The growing season is extremely short and strong winds almost invariably stunt plant growth. Few trees grow in alpine environments, and usually there is a well-developed ground layer of mosses and lichens. The main limiting factor is a lack of warm temperatures in summer (not low winter temperatures; Scott and Kong 1990)

Arid and semi-arid lands

In arid and semi-arid environments, vegetation must adapt to water stress. These adaptations take several forms. Some plants develop deep root systems to reach moisture far below the soil surface. Some plants have small leaves or produce a waxy cuticle to guard against water loss. And still other plants have adapted life cycles that are well suited to highly unpredictable conditions and long periods of drought.

The Tibetan plateau

The vegetation of the Tibetan plateau clearly exhibits characteristics from all three of the above ecosystem types. Thus I use the term “grassland” broadly when referring to the Tibetan plateau vegetation. I will also use the term interchangeably with alpine grassland, steppe, and rangeland.

According to Anderson (1982) and Milchunas et al. (1988), grasslands in general are impacted and shaped over time by three main environmental pressures: drought, fire, and grazing by large ungulate herbivores. All of these pressures create a high turnover rate of above-ground biomass, a low-lying physical structure, and the allocation of a large portion of plant biomass (energy) and plant activity below ground. The most important pressures on the Tibetan plateau, at least insofar as recent environmental changes are concerned, are drought and grazing pressure – grazing by wild herbivores as well as domestic livestock.

Grassland biodiversity (back to top)

Grassland biodiversity includes both plant species and the wild animals that inhabit this vegetation type. Thus “grassland conservation” covers both the protection and long-term sustainable use of grassland plants as well as the maintenance of the native mammalian, avian, and other faunas.

It has been shown elsewhere that moderate levels of grazing are associated with higher biodiversity (Forsyth 1983, Shi et al. 1991, Belsky 1992, Bian et al. 1994, Agricultural Research Service 1999), and that plant biodiversity is associated positively with plant resistance to and recovery from drought (Tilman and Downing 1994), with grassland productivity (Tilman et al. 1996), and with resistance to invasion (Hobbs and Huenneke 1992, Tilman 1997). At high grazing intensities, however, there usually is a decrease in the abundance of palatable species, a decrease in overall plant productivity, and a decrease in total ground cover (Skarpe 1991, Fuls 1992). Clearly, any level of grazing also will affect the community structure, species composition, and the quality of grassland plants (Mattson 1980, Milchunas et al. 1988, Huntly 1991, Fernández et al. 1992). In fact, some species are even maintained by sustained grazing (McNaughton 1979, 1985). Thus, as McNaughton (1979) explains, an "optimum defoliation level is anticipated (Noy-Meir 1975; Caughley 1976)," an optimum reached only when livestock grazing closely mimics the spatial and temporal patterns of wild ungulates. Otherwise, the land usually changes beyond recognition. Grazing systems therefore must have inherent flexibility and mobility to ensure quick responses to fine-scale spatial and temporal heterogeneity in the grassland. In highly variable environments like the Tibetan plateau, only this kind of land management system can be maintained in the long-term (Scott and Kong 1990, Skarpe 1991, Chen 1997).

Clearly, the above discussion also overlaps extensively with the following three themes of this chapter: pastoralism, sustainability, and biodiversity.

Pastoralism (back to top)

Pastoralists of the World (back to top)

Classification systems and typologies

Along with foraging, fishing, and agriculture, pastoralism is a basic and distinctive form of human subsistence economy. Furthermore, the notion of a pastoral system applies not only to "highly specialized cases [but also to any] household economy [that] contributes significant labor to managing livestock on extensive, usually natural pasture" (Galaty and Johnson 1990). In fact, it is rare for livestock to be the exclusive means of production in pastoral systems. A combination of pastoral and agricultural or trade activities is most common, representing an important mode of production within complex farming systems (Turner and Brush 1987).

Because of the large variety of pastoral cultures and practices worldwide, pastoral people have often been divided into "pure pastoralists" and "semi-pastoralists" (based on their degree of dependence on non-pastoral foods; Jacobs 1965) and into "nomadic" and "semi-nomadic" or "semi-sedentary" people (based on their degree of movement and the extent of their agricultural practices; Khazanov 1984). However, only the economic and cultural dominance of animal husbandry will be considered in this work. A community or group thus will be referred to only as pastoral or non-pastoral. The real significance of the animal in pastoral communities, as opposed to the nomadic factor, also renders the use of vague terms like "nomadic" and "semi-nomadic" nearly meaningless (Bonte 1981, Schneider 1981, Galaty and Johnson 1990; but see Swift et al. 1990). Nomadism and pastoralism clearly are two very distinct phenomena, one being a spatial movement and the other a type of resource extraction. Therefore both can and should be examined separately (see, e.g., Salzman 1971), as indeed they are throughout this work.

Galaty and Johnson (1990) also make useful distinctions between several forms of pastoralism based on two main dimensions of pastoral variation, livestock density (the number of livestock per area of land), and labor intensity (measured as per capita livestock holdings). From these two axes, four types are distinguished: dairying, mixed farming, ranching, and extensive pastoralism. The focus of this work is on extensive pastoralism, a form of animal husbandry that has been practiced for centuries in some of the world's most arid regions. To a lesser extent, ranching systems also are examined.

Basic characteristics of pastoral systems

Domestic animals are perhaps the most obvious trademark of pastoral systems. They serve many functions including the production of milk, meat, fuel, power, and many other renewable and non-renewable products. Livestock are thus both a capital good and a living technology used to transform unpalatable plant materials into consumable products (Irons and Dyson-Hudson 1972, Galaty and Johnson 1990).

Pastoral production also involves the relationship between livestock, land (including minerals and water), and labor. Livestock clearly are central to pastoral systems by mediating between the community and the land, yet people and the land also influence each other directly. On the one hand, people impact the land by the choices they make in caring for their livestock, in managing their herds, and in managing the rangeland. On the other hand, the seasonal nature of grasslands, the punctuated distribution and availability of water, the vertical zonation of grazing lands in mountain areas, and the convergence of aridity and extremes of temperature – some of the main characteristics common to most pasture lands around the world – also shape the pastoral cultures that live in these lands. However, although there are some environmental constraints on pastoral societies, this cannot be interpreted as ecological determinism (see, e.g., Spooner 1973) because pastoralists have many land use and other options from which to choose. Thus pastoralists can, and invariably do, influence their surrounding environment through the choices they make, both in the short-term and over successive generations. Indeed, pastoralists partake in an ongoing process of modifying, even recreating, their surrounding landscapes.

Furthermore, the choices that pastoralists make are influenced by much more than only environmental factors since there also are many complex interactions between the social, economic, and political factors that surround pastoral systems. The outcome of these interactions depends on "continuous compromises between social values and objectives, the local realization of power, and animal ecology" (Galaty and Johnson 1990). Thus the local, regional, and national contexts of pastoral societies all affect, in highly interactive ways, how these societies develop as well as their current socio-economic status and position within the larger regional and national entities.

Views about pastoral strategies and objectives have varied considerably over the past several decades. Aronson (1980) in particular sheds light on the fact that

- • pastoral livelihoods are a multi-resource economy, not a single-resource economy;
- • pastoralists move because they have to, not because they love to;

- pastoral strategies are geared to long-term security, not only to current production; and
- pastoralists optimize a number of goals, not just economic goals.

One of the earliest views (which still persists in some circles) was that pastoralists are not rational. Later it was suggested that pastoralists follow a strategy of *profit maximization* because of their enduring efforts to increase herd size. Since sustaining a community also is considered important, and because short-term hardships are accepted in light of future benefits, an *optimization strategy* has been proposed as operational in some pastoral societies. However, the most commonly held view today is that pastoralists follow a strategy that combines *risk aversion* and *opportunism* (Miller and Jackson 1994). Risk aversion is an attempt to decrease uncertainty by anticipation, while opportunism takes advantage of the large variability of local conditions in time and space. Opportunism also implies the need for economic diversification and inherent flexibility. A recent addition to this list of proposed solutions to the question of pastoral decision-making is that pastoralists seek to *maximize reliability*, not income or products (Roe et al. 1999). The latter view is adopted in this work, in conjunction with risk aversion and opportunism.

Wester (1997) includes the following practical strategies in his overview of how pastoralists cope with seasonality in arid and semi-arid lands:

- moving animals to different seasonal pastures (mobility);
- maximizing herd size;
- diversifying livestock species;
- splitting herds into different management units;
- keeping a high proportion of females;
- maintaining social systems for resource sharing, borrowing, lending, etc.;
- minimizing the reliant human population in times of drought; and
- implementing special strategies in times of drought, such as the use of buffer zones.

The broad objective of all these management strategies is to maximize livestock survival (Wester 1997). Pastoralists also have coping strategies that relate to the improvement of feed quality and/or quantity, to the adjustment of herd size and composition, and to variations in what constitutes acceptable levels of livestock production.

Finally, pastoralism is practiced in three main environments around the world, in plains, deserts, and mountains (Moran 1982, Galaty and Johnson 1990). In the grasslands (plains), precipitation is strongly seasonal and highly irregular in space. Consequently, spatial and temporal flexibility in herd movements and opportunistic management are both needed. In extremely harsh, variable, and risky desert conditions, only extensive and mobile grazing patterns can effectively be used to exploit the limited resources. In highlands, however, it is the seasonal differences in temperature and the altitude that most affect how pastoralism is practiced. Responses to these conditions generally include an increase in trade activities and tighter linkages with agricultural communities, an intensification of pastoral production (i.e., a shift towards ranching), and a greater responsiveness to market forces because of the increased interaction with farmers. Moran (1982) lists the main ecological constraints, or limiting factors, on human economic and biological productivity for these three biomes: prolonged dry season, cyclical drought, herd size and composition (in grasslands); low and uncertain rainfall, high rates of evaporation, low biological productivity (in arid lands); low oxygen pressure, daily cold stress, low biological productivity, and high neonate mortality (in high altitudes). Thus pastoral communities clearly both impact and are impacted by their surrounding environments.

Pastoralism in Central Asia and the Himalayas

Plains, deserts, and mountains all come together in a very unique way in the Tibetan plateau. The area will be described at greater length and in a variety of contexts throughout this work, yet some commonalities between the pastoral areas and peoples of greater Central Asia and the Himalayas are worth noting here. One important characteristic of pastoral cultures is their tendency to be marginalized by larger, usually nationally dominant groups (Stone 1992, Miller and Craig 1997, Szynkiewicz 1998). This can be seen, for example, in typical Han stereotypes of China’s national minorities (Lattimore 1951, Ma 1994, Zhao 1994). Most pastoralists in Central Asia also have lived for many decades in centralized control states (Bacon 1966, Khazanov 1984, Loomis 1988, Leeuwen et al. 1994, Honhold 1995). However, several new systems of governance have emerged in the last ten years which allow for insightful comparisons to be made between different forms of land use, property rights, community participation, the role of mobility in pastoral systems, and other issues pertaining to sustainable development and the protection of biodiversity in these lands (Li et al. 1993, Potkanski 1993, Finke 1995, Müller 1995, Humphrey and Sneath 1996, Miller and Craig 1997, Szynkiewicz 1998). There also are many cultural and religious similarities between the pastoral groups in the region. Many groups from the Himalayas, the Tibetan plateau, and greater Mongolia are animistic, mostly Tibetan Buddhist, while Central Asian pastoralists tend to be monotheistic Muslims, though they, too, often practice folk religion. Because of the many cultural and religious similarities between Mongolians and Tibetans, based in part on their tightly interwoven histories (Prejevalsky 1876, Lattimore 1951, Stein 1972) and similar systems of governance in the past (Mongolia was under USSR state control until 1990), a number of comparisons will be made throughout this work between them, their respective national development policies, and the conditions of their pasture lands (Goldstein and Beall 1994, Honhold 1995, Germeraad and Enebisch 1996, Fernández-Giménez 1993, 1997). The geographic distribution of the highly specialized yak also is worth noting, for it virtually defines some aspects of the pastoral cultures that keep it among their livestock (Bonnemaire and Jest 1976, Larrick and Burck 1986, Zhang et al. 1994, Miller et al. 1997, Yang et al. 1997). In the Tibetan plateau area, yak provide more than 90 percent of milk and 50 percent of meat requirements of local pastoralists (Long et al. 1994).

Tibetan pastoralism (back to top)

The specific characteristics of Tibetan pastoralism, from daily household and herding activities to seasonal migration patterns and economic diversification, are reported for different parts of the Tibetan plateau. Ekvall (1968) and Norbu (1997) write about pastoralists in Qinghai, Wu Ning (1997) discusses pastoral strategies practiced in western Sichuan, and Goldstein et al. (1990) and

Cincotta et al. (1991) focus their efforts on traditional pastoralism in Tibet. While each of these studies provide insight into Tibetan pastoralism in general, it is quite important not to over-generalize and thus to obliterate all regional differences. From an earlier period, Combe (1989) provides an overview of numerous Tibetan groups from the entire Tibetan plateau region, drawing special attention to the many similarities and differences between them. Of particular note are his descriptions of the northern nomad (pastoral) tribes, including those of Dsagarnag and Adra Dsamar of present-day Zaduo and Zhiduo counties in Yushu prefecture in Qinghai. Miller (1995) provides a more general overview of modern pastoralism in the entire region.

Based on the above, and on my personal observations, it can be said that Tibetan pastoralism generally consists of a three- or four-part seasonal migration pattern in which sheep are kept in relatively close proximity to a main home encampment in winter and spring, taken to higher alpine pastures in summer, and taken to pastures left ungrazed during the growing season in autumn. There often are intermediate camps as well, for example on long-distance migration routes between winter-spring and summer pastures (Long et al. 1994). Yak are grazed alongside sheep in summer and autumn but generally are kept in the high pastures through the winter, primarily feeding on sedges and low-lying cushion plants. Yak are brought down later to the cold season encampments, sometime in spring. Although the specific timing of seasonal migrations clearly varies between places and sometimes from year to year, this is the general pattern followed over much of the Tibetan plateau, a seasonal pattern which allows livestock to regain their strength (to recuperate from the previous winter) in summer and to add fat reserves (to prepare for the next winter) in autumn. It is during the long cold season that many livestock are at risk of dying because of weakness and the disastrous effect of heavy snowstorms (Schaller and Ren 1988, Macartney 1996, Foggin 1998b, 1999b). Special birthing sites may be kept near the main winter encampments to help strengthen pregnant and young animals.

According to Goldstein and Beall (1990; also see Meiners 1991, Schaller 1998), nomads rotate their livestock to different parts of the pasture over shorter time scales as well. This movement allows the vegetation to regenerate for several days before being subject to further grazing. And over longer periods, a land management system traditionally was used in some parts of the Tibetan world by which pastures were redistributed among pastoral families every three years based on herd sizes and known carrying capacities of the land.

By these and other practices, Tibetan pastoralists not only manage risk – they do not avert risk altogether – they also seek to maximize the overall reliability of their production system, or, in the words of Roe et al. (1999), they seek “to establish a ‘reliable’ flow of life-sustaining goods and services from [their] rangeland.” As with all pastoral societies, they could be said to adhere to the calling: be flexible, be mobile, know the land, be opportunistic (Galaty and Johnson 1990, Miller and Jackson 1994).

Traditional grazing practices that guarded against overgrazing on the Tibetan plateau, such as those outlined above, have allowed wildlife, livestock, and pastoralists to coexist for many centuries. However, much has changed in the last half century. Since the early 1950s, the government has introduced many new ideas and methods of “development” into the entire region. Collectivization in the late 1950s and 1960s transferred livestock ownership and decision-making processes from individual households and monastic institutions to state communes and distant centralized authorities. Many traditional systems of rangeland management that prevented overgrazing were abandoned (Clarke 1987, Goldstein et al. 1990). The Cultural Revolution (1966-1976) only further intensified a general disregard for time-proven practices in favor of “modern science.” A model of pastoral intensification and simple numeric growth thus has predominated in recent decades. However, with risk of long-term negative impacts, this approach largely ignores the climatic and physical realities that led Tibetan pastoralists to adopt their rational strategy in the first place, the harsh and unpredictable nature of their environment. Intensification of livestock production therefore has progressed concurrently with serious ecosystem degradation (Wang 1980, Hu et al. 1992, Qinghai Census Bureau 1994) that only recently has been acknowledged on a wider scale (He 1997, Han 1999, ‘New reserve…’ 2000).

Pastoral development experience [(back to top)]

As noted above, not all pastoral development has been entirely successful – at least not if measured against the criteria of ecological sustainability and cultural relevance. Sadly, we usually have chosen to learn the hard way that traditional economic development practices may have unacceptable environmental costs. The Worldwatch Institute recently estimated that 135 million people worldwide now live in areas undergoing severe desertification, and that over 10 million people are refugees from environmental ruin (Stutz 1993). In this section, we specifically will look at past development experience in some of the world's pastoral areas, particularly in Africa and in Central Asia. We then will return in later sections to some of the broader issues pertinent to development, sustainability, and biodiversity.

Schneider (1981) contends that "current attempts to introduce development programs into pastoral areas face a problem which may be unsolvable in the sense of allowing pastoralists to continue pastoral livestock raising while at the same time contributing to national development." The most common idea of development in pastoral areas has been to encourage pastoralists to increase the number of animals sold for meat production. This solution usually has been offered in concert with suggestions that pastoralism must be further rationalized. For pastoralists, however, animals as wealth may take on a variety of currencies: commodities for trade or exchange, risk aversion, and status among other values (Einzig 1966). As such, the ability to sell cattle to the government simply is one of many possible options for the pastoralist, one that sometimes is a good option, but also one that sometimes is not the best option. Thus "the shift [from pastoralism] to beef production [may be] no more meaningful to the pastoralist than a shift to crop production" (Schneider 1981). Nonetheless, as Bennett (1988) notes,

> "attempts at inducing [pastoralists] to relinquish their migratory way of life, and to shift their distinctive mode of livestock production to one approximating sedentary ranching, have been made repeatedly from the late nineteenth century to the present. Such efforts at production intensification, and the associated requirement of nucleated settlement, are not unique to eastern Africa, but occur in other parts of Africa, the Middle East and Central Asia, wherever substantial numbers of people raise livestock on transient pasturage."

Oxby (1975) lists the main arguments used by past and present governments and international aid and development organizations to justify these kinds of interventions:

- to raise pastoralists' standard of living;
- to integrate pastoralists into national society;
- to make pastoralists easier to administer;
- to make pastoralists economically self-sufficient;
- to make pastoralists contribute to the national economy; and
- to make pastoral nomadism a viable form of livelihood.

Development agencies such as the World Bank and USAID have emphasized in particular poverty alleviation and meeting basic needs. However, this approach often has wrongly assumed pastoralists to be poor, living a subsistence-oriented peasant's life (sensu Scott 1976), when in fact, in the pastoralists' mind, their animals represent wealth. Indeed, in the case of Tibetan pastoralists, yak and wealth are expressed in some instances as the same word, *nor* (Bonte 1981). Because of this and various other false assumptions, many pastoral development projects have failed. In one review of development projects in Africa, it was even found that most pastoral development projects had "failed to operate in the way the government officials had hoped," but, as if to reassure the reader, the author also noted that at least some of the development projects had "failed less completely than the others" (Huntington 1988)! Bennett (1988) similarly found that "none of the USAID or World Bank projects [in East Africa] funded between 1960 and 1975 … were considered to be a success."

It is clear that recent pastoral development experience is not good. Moving even further back in time, around the time that colonial governments in sub-Saharan Africa "replaced pastoral lifestyles with sedentary farming, populations grew and farming and grazing intensified [so much that today] 80 percent of the region's pasture- and rangelands show signs of damage, and overall productivity is declining" (Stutz 1993). The land use history of Soviet Central Asia is equally bleak. As Loomis (1988) explains,

> "the Russian presence at first had little effect on [the] nomadic livestockmen [of the desert rangelands of Central Asia]. But by the late 1800s two major impacts occurred which had

> profound implications, primarily for the Kazakhs. The first was improved transportation to the Russian heartland and its effect on the demand for cattle products. Increased yields were achieved by a more settled agricultural production of cattle feed (Olcott, 1987).
>
> The second major impact involved land policies which fostered homesteading of ‘unused’ land by Russians from the heartland. This land was vital to the native population because a nomadic economy, in effect, has no excess land, particularly in years of poor weather. The loss of this land caused a further decline in traditional stock raising.
>
> ‘Denied sufficient pastures, the vast majority of the Kazakhs had no choice but to adjust to a semi-sedentary lifestyle that combined limited agriculture with a restricted annual migration ... [They were] forced to use the same lands year after year, a practice that had been hitherto unknown. ... overuse further depleted the soil, making the Kazakhs ever more vulnerable to the vagaries of nature.’ (Olcott, 1987)
>
> The consequences were devastating: in the severe winter of 1879, half the cattle and sheep in the Syr Darya and Semirech’e regions died. Even worse was the winter of 1899 when a deep snow fell in the Kizylkum desert. It was followed by an ice crust which killed 90 % of the sheep and goat population (Nikolaev, 1978).”

Bacon (1966) likewise notes that

> “under the influence of settled neighbors, Kazaks began to change their way of life. Some nomads cut hay for winter fodder and built winter shelters for a portion of their animals. Some began to spend their winters in dwellings of wood, sod, or mud, depending on the house styles of their nearest neighbors, or to put up a clay wall around their encampment of yurts. Deprived of their richest pastures, many Kazaks were forced to give up pastoralism partially or completely.”

The above descriptions are supplemented by numerous other reports on pastoral development experiences elsewhere in Central Asia (e.g. Kazakhstan, Kyrgyzstan and Turkmenstan; Kerven et al. 1996) and in greater Mongolia (Mearns 1993, Li et al. 1993, Sheehy 1993, 1996).

Many of the above histories are many decades old, yet they are found to be ominously similar to the so-called new scientific pastoral development policies of China. Too often, planners and decision-makers continue to focus almost exclusively on livestock numbers, not on quality or productivity (Ho 1998), and to follow a single-use or single-purpose philosophy (Loomis 1988).

Even the development of American grasslands has followed many of the same patterns of expansion, fencing, overgrazing, seeding with exotic grasses, breeding, and mass marketing. Yet even after 150 years of so-called development, one can be cynical and lament the fact, as Manning (1995) does, that still “a cow produces [only] about as much meat as a bison, but it is fattier meat, much higher in cholesterol. Many who eat both prefer the taste of bison. A century’s worth of work, warfare, and technology replaced 50 million bison with 45.5 million cattle. One wonders what progress is for."

Finally, because of past misunderstandings regarding the meaning and the use of the term "pastoralism," and false assumptions regarding the social conditions present in pastoral societies, two more topics also must be reviewed, namely nomadism and property rights regimes. In short, nomadism refers to the spatial mobility of some pastoral groups under specific environmental conditions, one of several possible strategies used by pastoralists (Wester 1997). The establishment and maintenance of a social system for resource sharing, such as property rights regimes (Feeny et al. 1990), is another strategy that is used in many pastoral societies worldwide (Wester 1997). However, neither nomadism nor common properties are intrinsically as problematic as often has been assumed (cf. the "pastoralist development problem," sensu Schneider 1981; also see Ellis and Swift 1988, Conca et al. 1995).

The "nomad" question

The use of adaptive, flexible, and mobile land management strategies, such as nomadic patterns of livestock grazing, helps to maintain the long-term productivity (Loomis 1988) and ecological stability (Sheehy 1993, 1996) of the land. Mobile grazing management strategies also allow for the most efficient harvest of grassland vegetation and may even be essential in highly variable environments (Coughenour 1991, Sheehy 1993, Miller 1995, Ho 1998).

Unfortunately, the vast majority of herding societies around the world continue to come under pressure to settle, to sedentarize, to develop or be developed – a situation which requires an important change in lifestyle that, judging from past experience, does not bode well for the long-term viability of the new (non-adaptive) management systems. In China, Li et al. (1993) note that, "especially since [the country] was opened to the outside world in 1978, there has been a major emphasis on settlement of herders into villages or into houses, i.e. an increasing semi-nomadic [versus traditional nomadic] lifestyle." Ironically, though, these and similar attempts worldwide often have failed simply because local people were not involved in the early planning stages. In Inner Mongolia, for example, although many brick houses have been built in winter pastures, most herding families still prefer to live in their yurts (traditional tents) during the coldest season (Li et al. 1993).

Since most questions related to “nomads” and development relate to the use of land and livestock, a clear distinction must be made here between extensive and intensive grazing management strategies. According to Briske and Heitschmidt (1991), an *extensive grazing management strategy* primarily aims to improve the spatial and temporal distribution of grazing herbivores, while an *intensive grazing management strategy* instead turns to the direct incorporation of high energy inputs into the production system. Between these two extremes are *semi-extensive grazing management strategies* that “continue to rely on the strategies of extensive grazing management, but [also] incorporate energy inputs into the system” (Sheehy 1993). In the latter case, the main objective is to raise more livestock and to increase off-take rates, an objective facilitated by improved access to grazing lands and the provision of more stored forage in winter and spring (Sheehy 1993). With around 52 percent of China’s land area used primarily for pastoral production (Shen 1982), national and provincial governments in China encourage a systematic, rapid transition from traditional extensive grazing management systems to semi-extensive or intensive grazing management systems (Stucki 1986, Clarke 1987, Cincotta et al. 1992, Zhao 1994).

The main problem with more intensive forms of livestock grazing, however, is that the addition of energy inputs usually has as prerequisite some degree of sedentarization, that is, the localization of many activities associated with the care of livestock (Li et al. 1993). This localization of livestock production then usually translates into a more continuous use of the grasslands with less seasonal and annual variation (Sheehy 1993). The impact of the loss of seasonal mobility (i.e., the loss of the “nomadic” component of traditional extensive grazing systems) is enormous. Based on their work on natural pasture in Mongolia, Tserendash and Erdenebaatar (1993), for example, found that

> “intensive grazing of 2-3 periods on the same area in a season may lead to a decline in pasture yield of up to 72 % the following year, with a corresponding change in the primary plant groups. Intensive use of a pasture for continuous grazing over a long period has [even] more far-reaching effects; vegetation coverage decreases annually by 10-15 % and the frequency of [some] species ... decreases to between 10-30 %. ... All these negative changes caused by unsystematic use and repeated grazing over many years strongly

> suggest the need to develop systems of pasture use based on the centuries-old traditional experience of Mongolian herders as well as on scientific research."

Therefore, as Aronson (1980) has noted, "policy regarding pastoral peoples ... must outgrow the stereotypical visions that planners and change agents too often have of the nature of pastoral societies… [P]lans have too often seen sedentarization as the quintessential step in 'developing' nomads." Aronson (1980) further comments that there also is the added challenge that in order to change one's view on "nomads" (i.e., nomadic pastoralists) one also must be "interested in a kind of development that serves the citizenry, that is not just for the growth of the national economy in a statistical sense."

For pastoral development to succeed, what is probably needed above all else is simple: to begin to involve pastoralists (and other local stakeholders) in the overall decision-making processes that direct the enterprise called development (Guyette 1996, Ravnborg and Guerrero 1997, Carpenter 1998). Such an approach to development stands in sharp contrast with the "blueprint" or centralized approach that has long been used in China. In Central Asia, Myrdal and Kessle (1971) found that

> "the problem [with a blueprint, centralized] type of planning [is that] it is not based on the people's own decisions... It is technocratic planning, by experts at various levels in various bureaus. And these bureaus combat and intrigue against each other. The technocrats ... do their best, as they understand it. But they understand little in relation to the people themselves…"

The need to involve pastoralists in the overall development process is accentuated further by the fact that a failure to do so almost inevitably increases pastoralists' level of dependence on the state. Thus instead of contributing to national economic productivity, pastoral regions may even increase the state's financial burden if managed inappropriately. The high costs and on-going technical and financial support (input) needed to maintain intensive livestock grazing systems clearly are not consistent with many long-term national development goals and sustainability. In China, government per capita subsidies in Tibet, for example, sometimes have been even greater than the national average annual per capita income (approximately $ 81 and $ 79 USD, respectively, in 1992; Zhang and Huang 1996), and these figures do not include foreign aid inputs. It is clear from a cost-benefit analytical point of view that the sustainability of intensive pastoral development programs cannot be defended when inputs are greater than returns. The local involvement of pastoralists, though, could lead to more effective, ecologically sound, and acceptable ways of nomad or pastoral development (Dyson-Hudson 1985, Swift et al. 1990).

In the end, there also are moral reasons why local people should be involved in making the decisions that affect their lives. And, as Aronson (1980) concludes, “nomads need not settle to change, but will settle if the move (to stop moving!) serves them well.” Thus nomads (pastoralists), too, seek to make rational decisions and should be involved in the decision-making processes that, to date, still remain almost exclusively the domain of other, external forces.

The “common property” question

A second main area of confusion in pastoral development studies relates to the issue of property rights in pastoral societies of the world. Erroneous assumptions have often been made, definitions have become confused, the rationality of common property generally has been ignored, and the relative impacts of different property rights regimes have been compared inadequately (Hardin 1968, Feeny et al. 1990, Bromley 1991, Mearns 1993, 1995, Swope et al. 1997, Ho 1998, 1999).

Feeny et al. (1990) distinguish four categories of property rights: open access, private property, communal property, and state property. They also note that many of the misunderstandings in the literature have arisen from one single false assumption: that common (communal) property implies open access to land or other resources. At the same time, some researchers have focused instead on property ownership, which is a qualitatively different notion from property rights (Mearns 1993). When considered from this perspective, the different forms of resource management can be summarized in even fewer categories, namely open access, common property, and private property. Ho (1998) goes even further and includes common property as a subset of private property, the former simply being private property that belongs to a clearly defined group instead of belonging to an individual. The main point, though, is to remember that “common property” is not the same as “open access” management (or the lack of management).

On the (false) assumption that pastoral societies do not manage their grazing lands, many governments have enforced changes ranging from massive collectivization to full privatization. The history of forced collectivization over the last century, and of the ensuing hardships, is well documented for Central Asia (Leeuwen 1994, Kerven et al. 1996) and Mongolia (Mearns 1993, 1995). Although not all the effects of such collectivization were bad (e.g., the marketing of livestock products has improved; Potkanski 1993), the disruption of linkages between labor, management, and benefits generally has resulted in a decline in the incentive for traditional cooperation among pastoral households and communities (Livingstone 1986, Mearns 1995). Forced collectivization also has been associated with conflict and massive starvation of livestock and people, particularly in Soviet Central Asia (Bacon 1966, Conolly 1967, Olcott 1987, Loomis 1988) and in the Tibetan plateau region of China (Becker 1996). One example from Soviet Central Asia shall suffice:

> "Thousands of nomadic families were forced into collective encampments where their animals often starved to death for lack of adequate grazing. Those who resisted were labeled 'reactionary *bays*' and either liquidated or expelled, their animals confiscated. Many Kazaks fled to the Chinese side of the border, some sought refuge in Afghanistan. Those who could not escape often killed their animals. Altogether, the Kazak population decreased by nearly 900,000 between 1926 and 1939. Although, despite the losses of the civil war years, the number of livestock in 1929 had increased by 35.9 per cent over the 1913 figure, between 1929 and 1934 the number of sheep and goats decreased from 27,200,000 to 2,261,000 [i.e. decreased by 91.7 per cent] and of horses from 4,200,000 to 221,000 [i.e., decreased by 94.7 per cent]" (Bacon 1966).

Thus, often times, collectivization has exacted exceptionally high costs.

Private property regimes also have been studied and introduced in various forms throughout the pastoral world (Bennett 1988, Mearns 1993, Kerven et al. 1996). However, the privatization of communes neither entails a full return to old ways (Müller 1995), nor is it the sole possible solution to some of the problems that plagued the former collectives (Johnston 1992, Putterman 1996). Privatization is never a panacea (Ho 1998). In fact, even though it sometimes has been assumed to be a necessity for successful range management (e.g., Anderson and Hill 1998), privatization also can carry with it a series of negative impacts, including land degradation, a non-equitable distribution of goods or services, and an increased probability of the "free-riding" or cheating problem (Finke 1995, Williams 1996, Sandford 1983, Livingstone 1986). There also is no proof that private property regimes lead to better grasslands or livestock production (Johnston 1992, Putterman 1996). Unfortunately, given the initial success of privatization when it was first introduced to the low-lying agricultural areas of eastern China shortly after the end of the Cultural Revolution, privatization has been pursued and implemented almost blindly in China's grassland regions as well (Reardon-Anderson and Ellis 1990), in general simply ignoring the many ecological and socio-economic differences between regions (Ho 1998). Finally, small scale, household-focused privatization in China ignores the fact that resource management at larger spatial scales may be the best possible institutional response to large environmental variability of arid and semi-arid lands (Thompson and Wilson 1994). Pastoralists, like any other group, also are likely to have a strong commitment to their way of life that goes much deeper than simple economic considerations (Loomis 1988).

What may be needed most, therefore, more than the privatization of so-called common resources, is simply increased security and certainty among local producers that any given land tenure system will last for many years in the future. In fact, it is this issue of certainty that is the real reason why private property generally has been upheld and promoted almost unquestioningly, since a sense of security presumably will result in better use and stewardship of the land (Chalamwong and Feder 1986, Livingstone 1986). In their study of forests and forest management in China, for example, Swope et al. (1997) state that "the uncertainty of tenure discourages any investment in the forests, resulting instead in a tendency to liquidate holds. The domination of coercive policies over incentives, which serve to alienate the people from the resource, can be seen throughout this century." They even go on to explain how "forest preservation has less to do with ownership regime incentives than other factors, such as trust in tenure." A sense of security and trust, therefore, is very important.

What will China's grasslands look like in the future? This will depend largely on the relationship sought and achieved between government planners and local pastoralists. And, as such, the style of development adopted, including especially the overall decision-making process (i.e. whether or not it includes all stakeholders), will direct what future is in store for Tibetan pastoralists as well as for the Tibetan plateau in general and for China.

New approaches in pastoral development (back to top)

In light of the above two sections on nomadism and common property, as well as the previous discussion on the environmental variability of arid and semi-arid grasslands, it should be clear by now that a new approach to pastoral development is needed (Ellis and Swift 1988, Westoby et al. 1989a, 1989b, Mearns 1993, Sheehy 1993). According to Ellis and Swift (1988), there is evidence from their work

> "(1) that stable equilibria are not achievable in many pastoral ecosystems, although long-term persistence is; (2) that interventions aimed at achieving stability in non-equilibrial systems are likely to be irrelevant at best or disruptive and destructive at worst; and (3) that successful interventions will be designed to accommodate system dynamic variation rather than aimed at maintaining equilibrial conditions."

For these and other reasons, they conclude that "pastoral ecosystems may be better supported by development policies that build on and facilitate the traditional pastoral strategies rather than constrain them." However, as already alluded to, much more than correct policies are needed – the pastoralists themselves also must become more involved in the planning of their own future, and planners also must learn a lot more about the people that live in "their" project areas. In closing, as Aronson (1980) has said, pastoralism still lives on, but "planners whose jobs are secure even if their plans fail, and pastoralists whose livelihoods may fail unless they gain better knowledge of the complex world encroaching, both have much to gain from building up, step by careful step, mutual trust and respect."

Sustainability (back to top)

What is development? (back to top)

To define development is no easy task. Although the notion of directional change is common to all definitions of development, the actual content of such change and the determination of what processes are needed for change to occur are more ambiguous and open to debate. In its most basic form, development simply implies "a progression from a simpler or lower to a more advanced, mature, or complex form or stage" (American Heritage Dictionary 1992). As it pertains to populations or geographic regions (i.e., social development), the idea of development suggests "attempts made to foster social progress" (American Heritage Dictionary 1992). Until recently, social progress generally has been understood in material and economic terms only (World Bank 1992, 1997b).

What is sustainable development? (back to top)

The concept of sustainable development has given rise to even more confusion. The World Commission on Environment and Development (also known as the Brundtland Commission) first brought the term into common usage in its 1987 report entitled *Our Common Future*. The Commission simply defined sustainable development as "meeting the needs of the present generation without compromising the needs of future generations" (Davidson and Dence 1988, World Bank 1992). However, the precise meaning of this definition still remains elusive.

For example, even the "World Development Report 1992: Development and the Environment" states both that it "strongly endorses" the Brundtland Commission's definition of sustainable development (World Bank 1992, p.8) and, simultaneously, that "it is imperative that the current moment of opportunity be seized to bring about [a sustained] *acceleration* of human and economic development" (World Bank 1992, p.2). Thus the World Bank makes the erroneous assumption that sustainable development and sustained development are synonymous. Clearly, in light of the Earth's finite resources, it is questionable whether the present rate of development can be sustained indefinitely, let alone to be increased (accelerated) in the future.

The common misunderstanding between sustainable versus sustained development is made clearer by examining the object that is to be sustained. In the case of sustainable development, it is the environment that must be sustained, hence development must be ecologically sound. In the case of so-called sustained development, however, it is development itself that must be sustained. If development is measured as economic growth – as is often the case – then the very premise of the latter term is an impossible hope because development (growth) depends ultimately on the availability of finite natural and human resources.

Similar confusion surrounds the term development, particularly as it relates to the notion of sustainability. Sustained growth already has been dismissed as a contradiction in terms because "nothing physical can grow indefinitely" (World Conservation Union et al. 1991). Unfortunately, this terminology is used widely in China's and other countries' official rhetoric, and it continues to raise false hope in the possibility of perpetual economic growth. The notion of sustainable use, on the other hand, applies only to renewable resources. Only development broadly defined as social progress (e.g., the improvement of a community's quality of life) can support the adjective sustainable, and only in relation to the environment's capacity to support such change or development. Thus, expanding on the Brundtland Commission's definition (see above) and the definition provided by IUCN – The World Conservation Union, the United Nations Environment Programme, and the World Wide Fund for Nature (1991), local sustainable development is defined here as *a process that aims to equitably improve a population's quality of life while remaining within the limits of the region's supporting ecosystems*. The need for intra- and inter-generational equity as well as for short- and long-term ecological protection is implicit in this definition.

In *Caring for the Earth: A Strategy for Sustainable Living*, a sustainable society is described as a society that lives by the following nine principles:

- to respect and care for the community of life;
- to improve the quality of life;
- to conserve the Earth's vitality and diversity;
- to minimize the depletion of non-renewable resources;
- to keep within the Earth's carrying capacity;
- to change personal attitudes and practices;
- to enable communities to care for their own environments;
- to provide a national framework for integrating development and conservation; and
- to create a global alliance.

It is still open to debate, however, whether all of these principles can be achieved simultaneously, and hence whether one can ever successfully "care for the Earth" (Robinson 1993). However, as Holdgate and Munro (1993) explain,

> "unattainable utopia or not, we make no apology for describing a state of the human environment toward which we should strive in the belief that progress even part way would be preferable to the state in which we would surely languish if we remained unaware of our predicament and made no effort to escape it. … *Caring for the Earth* recognizes that there are conflicts between conservation and development [and that they are] distinct activities, but they should not be separate; they should have a common context of concern for the whole community of life. They are [the two] essential parts of one indispensable process, which is the achievement through sustainable development of a decent future for humanity within the biosphere. The alternative is a continuation of the present profligate and destructive impact of people on the biosphere. Unless development is sustainable – based on conservation principles – there will be a massive breakdown in the biosphere, with grave loss of biodiversity and untold human strife and misery."

Summarized more succinctly, "the protection of the environment is an essential part of development. Without adequate environmental protection, development is undermined; without development … environmental protection will fail" (World Bank 1992).

Lawrence (1997) and especially Westing (1996) also provide valuable insights into the variety of positions held on the meaning of sustainability and sustainable development, from the mainstream views of governments to those of non-governmental organizations, academia, and different religious bodies. And, as always, a dash of realism helps to keep us focused on the task: "sustainability in a highly dynamic social, economic, political, and biological setting [is] a daunting challenge" (McNeely 1996a).

UNCED (Rio '92): Poverty and the environment (back to top)

One of the key achievements of the 1990s in the global attempt to achieve sustainability, to start living in balance with the finite nature of our planet, was the convening of many governments and social organizations at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, in 1992. According to Miller (1996), the major results of UNCED included

- • the *Earth Charter*, a statement of broad principles to guide environmental policy that commits signatory countries to pursue sustainable development and to work toward eradicating poverty;

- *Agenda 21*, a detailed action plan to guide countries toward sustainable development and the protection of the global environment during the twenty-first century; and
- the *Convention on Biological Diversity* (CBD) that calls for countries to develop strategies for the conservation and sustainable use of biological diversity and the sharing of the benefits arising from sustainable use.

China is one of the first countries in the world to try to implement some of the key recommendations that were developed at UNCED. Its commitment to integrate environment and development is demonstrated best by its great effort to adapt Agenda 21 to its own national context, adopting the sustainable development strategy made public in 1994 in the report entitled *China's Agenda 21: White Paper on China's Population, Environment, and Development in the 21st Century* (Administrative Centre for China's Agenda 21 1994, 1996). From the highest levels of government down to many local bureaus throughout the country, China's planners and decision-makers now speak many of the "right words" about the multiple linkages between development and the environment, and also about intra- and inter-generational equity (United Nations Department for Policy Coordination and Sustainable Development 1997). However, not all economic development and poverty alleviation plans actually rise to these standards, and a working model that is effective in the real world has yet to be created in China. The take-home message from Rio is clear: Without addressing the root causes of poverty, resource overuse and environmental degradation will continue unabated; and, simultaneously, without halting environment deterioration, the problem of poverty will never be resolved. The problems of poverty and environmental decline are inextricably tied together. Therefore the solution to both these problems must necessarily revolve around the adoption of a more integrated approach to development and conservation.

Development models and criteria for success [(back to top)]

Meeting basic human needs, improving "quality of life"

As already stated, the term sustainability generally is used in association with the notion of development. Development in turn generally is understood to mean meeting basic human needs or otherwise improving their quality of life.

One of humankind's most basic needs is sustenance or nourishment. It is therefore a sad irony that it is in fact modern agriculture, or the science of growing food, that has perhaps had "the greatest impact on the decline in the [global] food supply. In the 1960s [for example] governments began encouraging nomads to settle in one place, to raise one cash crop instead of several, to herd only one kind of livestock, and the soils quickly became exhausted" (Stutz 1993). While one can intuitively know that good health, basic education, adequate economic opportunities, and a good environment, for example, also are all a part of our overall matrix of basic needs (whether these be physical, or psychological, or both), and that each contributes directly and indirectly to our overall quality of life, it is only relatively recently that some measures of development have begun to incorporate non-economic factors (World Bank 1997b).

Development indicators are useful to ensure that progress actually is made toward becoming a sustainable society. For this purpose the United Nations Development Programme has developed a Human Development Index in an attempt to measure quality of life (Miller 1996). This index has three main components:

- • health, measured by longevity (life expectancy at birth);
- • knowledge, measured by education (adult literacy rates and years of schooling); and
- • economic opportunity, measured by income (per capita gross domestic product).

Recently, the environment also has been gaining recognition, even in mainstream economy-oriented development circles, and it is included now in several expanded measures of wealth (e.g., World Bank 1997b). From a different angle, IUCN - The World Conservation Union and several other organizations have proposed that in order to be ecologically sustainable, societies must conserve ecological life-support systems and biodiversity, ensure that uses of renewable resources are sustainable, minimize the depletion of non-renewable resources, and keep within the carrying capacity of their supporting ecosystems (World Conservation Union et al. 1991).

Criteria for success: economic viability, ecological sustainability, social equity, and cultural relevance

Beyond economic and ecological viability (sustainability) – the two criteria discussed so far – the success of development initiatives also depends on at least two other criteria. Social equity refers to the spatial distribution of resulting goods and services in the present as well as in future generations. Cultural appropriateness, on the other hand, refers to whether or not new ideas or techniques are viewed as acceptable for use by the target population or cultural group. One innovative development organization in India, Development Alternatives, has found through their experience that "sustainable development must be equitable, efficient, environmentally sound and endogenous" (Development Alternatives 1997) – the order of which may be said to reflect their own emphasis, beginning with social justice, and followed by more traditional economic development, environmental protection, and the use of locally acceptable or familiar ways.

If social equity is not considered in development planning, the distribution of the benefits of development, both within and between communities in the present generation (intra-generational equity) and between present and future generations (inter-generational equity), usually will be far from uniform (Kretzmann and McKnight 1993, China-Europe Centre for Agricultural Technology 1995, Guyette 1996, Kaufman and Alfonso 1997, Department for International Development Cooperation 1998). Further, cultural and gender issues also are very significant, the latter having received a lot of attention in many development organizations over the past several years (Jamieson 1991, China-Europe Centre for Agricultural Technology 1995, Canadian International Development Agency 2000).

The pragmatics of local participation and ownership

A final important lesson learned from development and conservation work around the world is that local participation and a sense of ownership (psychological as well as legal) often increase the overall likelihood of long-term success (Ghai and Vivian 1992, World Bank 1992, Carew-Reid 1993, Friedmann and Rangan 1993, Kemf 1993, Bayon 1996, Fuller and Hussain 1996, Guyette 1996, McNeely 1996a, 1996b, Wilson 1996, Bernard and Young 1997, Jatulan and Davis 1997, Kaufman and Alfonso 1997, Köhler-Rollefson 1997, Ravnborg and Guerrero 1997, Stevens 1997a, Carpenter 1998, Datta and Virgo 1998, Mehta and Kellert 1998, Zeppel 1998). The themes of participation and ownership will be discussed at greater length in the last chapter of this dissertation, which focuses on and reviews the experience to date of one pastoral community – Suojia township in western Zhiduo county, Qinghai – and its newly established grassroots organization, the Upper Yangtze Integrated Conservation and Development Organization. The work in Suojia is a model initiative because, situated near the source of the Yangtze River, it will draw much local as well as national and international attention, and likely will become a benchmark for comparison with other conservation efforts elsewhere on the Tibetan plateau. The local organization itself also represents a new period in China, one of greater experimentation with civil society, that is, with village- and township-level, non-governmental, grassroots involvement in the overall process of development and change.

Biodiversity (back to top)

What is biodiversity? (back to top)

The definition of biodiversity adopted here is that of Noss and Cooperrider (1994): “Biodiversity is the variety of life and its processes. It includes the variety of living organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning, yet ever changing and adapting.” Unfortunately, it is a “common misconception … that biodiversity is equivalent to species diversity – the more species in an area, the greater its biodiversity” (Noss and Cooperrider 1994). Instead, the tangible manifestations of biodiversity are simply all biological resources, or “any biotic component of ecosystems” (McNeely 1996a). Biodiversity thus includes all the complexity of nature, indeed the whole environment.

Biodiversity is essential for sustainability (back to top)

Biodiversity must be considered carefully in every development initiative in order to ensure that it is ecologically sound, sustainable, and will be successful in the long-term. Saving or protecting the diversity of life is not optional. Until quite recently, however, biodiversity generally has been a forgotten or ignored resource (Biodiversity Conservation Network 1999a).

Why should we care about biodiversity? The Biodiversity Conservation Network (1999b) lists several important reasons to protect biodiversity, including its importance to the global economy, its contribution to food security and human health, and the fact that it is an international (global) asset. Biodiversity clearly is important for its direct utilitarian value. Noss and Cooperrider (1994), however, "are troubled that current arguments for maintaining international biodiversity, such as those expressed in the Global Biodiversity Strategy [(World Resources Institute et al. 1992)], are thoroughly utilitarian [and] hinge almost entirely on presumed benefits to humans." If only utilitarian or instrumental value is given to biodiversity and the protection of sensitive areas is not a part of the overall program, they feel that "sustainable development could [in fact] do more harm than good."

Ehrlich and Ehrlich (1981), Norton (1986), Wilson (1988), and World Wildlife Fund (1991) (all cited in Noss and Cooperrider 1994) provide a more comprehensive overview of the value of biodiversity. Most of the values of biodiversity can be classified in four main categories:

- • direct utilitarian values;
- • indirect utilitarian values;
- • recreational and aesthetic values; and
- • intrinsic, spiritual, and ethical values.

The main problem with a solely direct utilitarian perspective of biodiversity is that if a species does not benefit us, it is considered worthless. However there are less tangible, indirect utilitarian values of biodiversity as well. Ehrlich and Ehrlich (1981) call these indirect benefits "ecosystem services." Ultimately these services are the foundation for all of human civilization. Ecosystem services include:

> "(1) maintaining atmospheric quality by regulating gas ratios and filtering dust and pollutants; (2) controlling and ameliorating climate through the carbon cycle and effects of

> vegetation in stimulating local and regional rainfall; (3) regulating freshwater supplies and controlling flooding (wetlands, for example, can act as giant sponges to soak up moisture during rainy periods and release water slowly during dry periods); (4) generating and maintaining soils through the decomposition of organic matter and the relationship between plant roots and mycorrhizal fungi; (5) disposing of wastes, including domestic sewage and wastes produced by industry and agriculture, and cycling of nutrients; (6) controlling pests and diseases, for example through predation and parasitism on herbivorous insects; and (7) pollinating crops and useful wild plant species by insects, bats, hummingbirds, and other pollinators" (Noss and Cooperrider 1994).

Personal appreciation of nature's beauty, or the recreational and aesthetic enjoyment of nature, also provides reason to protect and conserve biodiversity. However, in the final analysis, it is "intrinsic values (or the spiritual and ethical appreciation of nature for its own sake) [that] offer the least biased and ultimately most secure arguments for conservation. … Without moral consideration of the needs of other creatures, policies for protecting biodiversity remain on shaky ground" (Noss and Cooperrider 1994). The stance taken in this dissertation is that nature and biodiversity possess all four kinds of value described above.

Over the past decade, the protection of biodiversity, the sustainable utilization of natural resources, and the equitable distribution of benefits arising from such utilization all have become major international concerns (see, e.g., McNeely 1990, 1996, World Conservation Union et al. 1991, United Nations Environment Programme 1995, World Bank 1997b). However, most efforts to protect biodiversity that have been made to date have focused largely on preserving large tracts of wild lands, that is, areas with minimal human disturbance. But in most areas of the world, especially in Asia, there are few places that remain uninhabited or unaffected by people. It is not surprising, therefore, that international experience has shown that in most places "effective, long-term conservation of biodiversity can be greatly assisted by 'putting people first.' This means listening to their concerns, encouraging their ability to organize themselves, and then addressing their needs by improving access to, and ownership of, natural resources" (Wilson 1996). The Biodiversity Conservation Network also suggests that "if humans can directly benefit from the biodiversity, they [may] then have the incentive to identify and take action against both internal and external threats to the biodiversity" (Biodiversity Conservation Network 1999b). Thus not only does protection of biodiversity increase the likelihood that development initiatives will be truly sustainable, but integrating development issues with conservation also increases the likelihood of successful protection of biodiversity (Jacobs and Munro 1987, McNeely 1990, United Nations Environment Programme 1995, Jeffries 1997, Brooks et al. 1998). In the end, neither conservation nor development can proceed in isolation, independent of the other – and protecting biodiversity must be a high priority if sustainability is considered important.

Summary (back to top)

The four themes discussed in this chapter – grasslands, pastoralism, sustainability, and biodiversity – form a backdrop that will be present throughout this dissertation. Sometimes only one of these topics will be discussed at a time, but usually it will be the interface or the interactions between these topics that will be of particular interest. Thus, as a study of linkages, this dissertation clearly is an ecological study. And as a study in search of practical solutions to better preserve the biodiversity and ecological integrity of the grasslands of the Tibetan plateau, it also is a study centered within the disciplinary boundaries of conservation biology.

CHAPTER THREE

The Human Environments of China: A Diversity of Scales, Frames of Reference, and Study Areas

Introduction (back to top)

The present work is concerned with ecology, or the relationships between organisms and their environments. Most important, these environments include not only natural environments (e.g., grassland ecosystems), but also the social, economic, cultural, and political environments (e.g., pastoral livelihoods, political ideologies, approaches to development) that surround and impact biodiversity on the Tibetan plateau. The dynamics of each of these environments operate at a variety of geographic scales, from the local to regional and even international scales.

At least four scales of analysis must be examined to discuss adequately and comprehensively the important issues that impact grasslands and grassland conservation in Qinghai, China. Each scale provides the basis for a variety of objective viewpoints (e.g., physical geography, population, biodiversity) as well as for more subjective frames of reference (e.g., how objective facts and "science" are understood and practiced differently by local pastoralists, national leaders, international development practitioners, and academic researchers).

The four most important geographic scales include the nation as a whole (China), the large biogeographic region (the Tibetan plateau), the administrative area (Qinghai), and the intersection of all three previous categories (the alpine grasslands of Qinghai, China). This second background chapter attempts to elucidate the broad patterns of grassland utilization that operate at each of these scales of analysis, and thus to expand upon the framework presented in the previous chapter. This expanded framework, both ecological and geographic in nature, will help to address many issues pertinent to grassland conservation in Qinghai, China. Together, these two background chapters provide much of the background information necessary to understand properly the basic premises – or the propositions upon which arguments are based and from which conclusions are drawn – that underpin much of the subsequent analytical chapters in this dissertation.

The People's Republic of China (back to top)

Physical and human geography (back to top)

With a land territory over 9.6 million square kilometers, or one-fifteenth of the Earth's land surface, the People's Republic of China (or China for short; Appendix I) is the third largest country in the world (after Russia and Canada; Yang 1989, Yang 1992a). With one-fifth of the world's population, around 1.2 billion people (estimated to stabilize at around 1.6 billion people by the year 2050; Brown 1995), China also is the most populous nation in the world (MiningCo.com 1999, Zhao 1994). The country is divided into 32 administrative units: 23 provinces, 5 autonomous regions (Guangxi, Inner Mongolia, Ningxia, Tibet, Xinjiang), and 4 municipalities (Beijing, Chongqing, Shanghai, Tianjin) (Figure 1). Each province or region is further divided into prefectures, counties, townships, villages, and natural villages. In pastoral areas, villages and natural villages usually are referred to as production brigades and production teams, or pastoral associations and cooperatives, depending on whether commune era or modern terms are used (Appendixes I-III). Finally, six political regions also are recognized: the Northwest, North, Northeast, East, Central South, and Southwest China (Wang 1985, Li 1987; Figure 1).

Figure 1. China’s administrative units: macro-economic (political) regions, provinces, autonomous regions, and municipalities (adapted from Pannell and Ma 1983, China Data Center 2000)

China’s topography is complex and includes high mountains, extensive plateaus, arid and semi-arid lands, rolling grasslands, large basins, and vast coastal plains. With elevations ranging from 154 meters below sea level in the Turpan Basin (in Xinjiang) to the 8,848 m summit of Mount Everest (on the border of Tibet and Nepal), China can be divided into three great topographic steps (Zhao 1994). The westernmost and highest of these steps is the *Tibetan plateau*, situated on average over 4,000 m above sea level. The second great step is the *Central Mountains and Plateaus* situated north and east of the Tibetan plateau, between 1,000 and 2,000 m above sea level. This region includes the Tarim and Junggar basins of Northwest China, the Mongolian Plateau, the Loess and the Ordos Plateau of North China, the Sichuan Basin, and the Yunnan-Guizhou Plateau of Southwest China. The third topographic step is comprised mainly of the extensive *East China Coastal Plains* that generally lie below 500 m above sea level. The three steps can be seen clearly in the digital elevation model produced by the Forage Information System, Oregon State University (1999) (Figure 2).

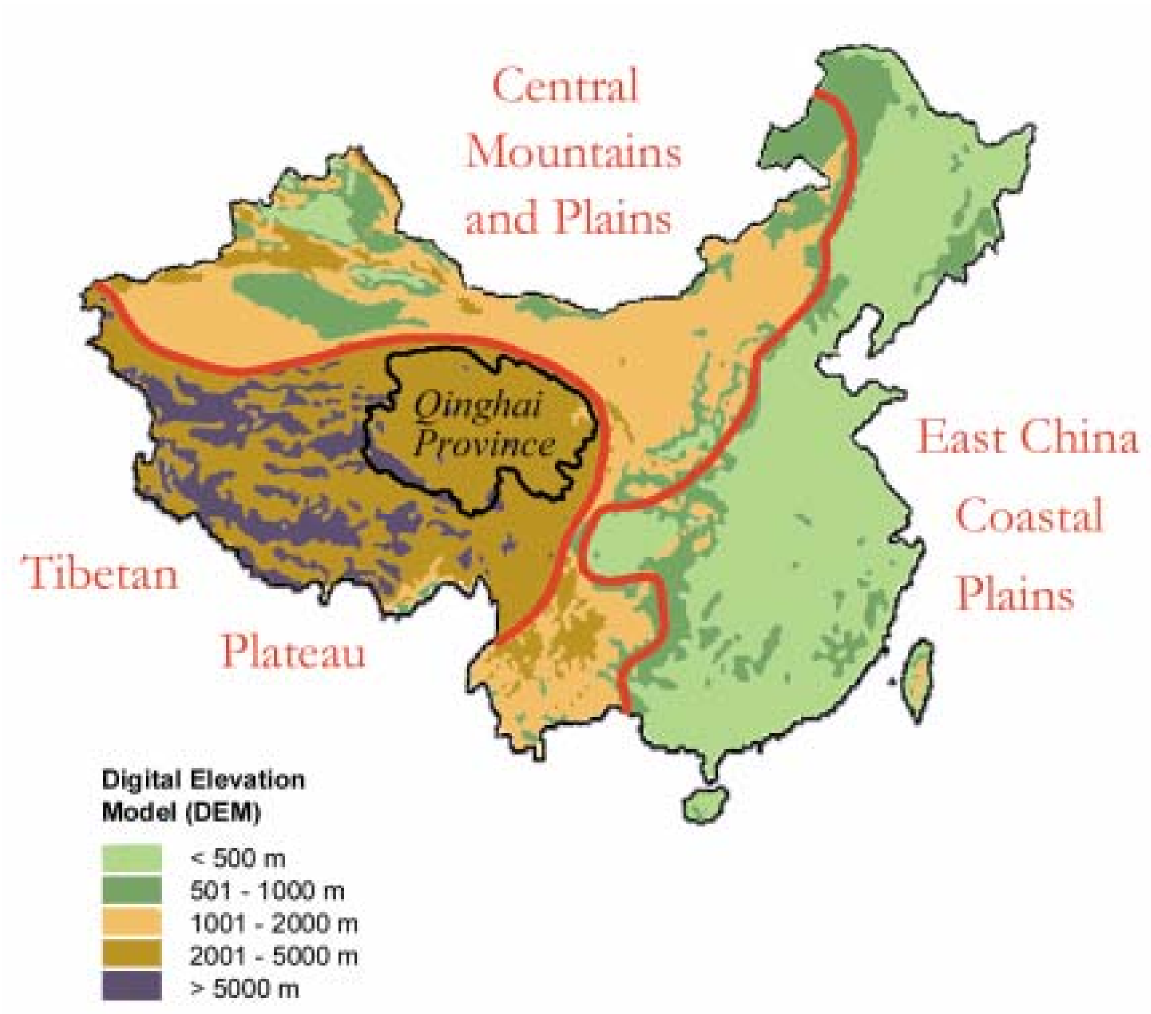

Figure 2. Digital elevation model of China, with demarcation of the three main topographic steps and Qinghai province (adapted from Oregon State University's Forage Information System 1999)

Based on geographic location, geology, climate, and long-term human impact, as well as topography, China also can be divided into three main natural realms (Yang 1992b, Zhao 1994; Figure 3). *Eastern Monsoon China* is the country's largest realm, covering around 45 percent of its land area, 89 percent of its farmland and 95 percent of its population. *Northwest Arid China* also covers a large portion of the country (around 30 percent) but comprises only 10 percent of its farmland and 4 percent of its population. Similarly, the *Tibetan Frigid Plateau* occupies around 25 percent of China’s total area but has very little farmland and a small human population (less than one percent each). Magellan Geographix (1999) has compiled and digitally enhanced satellite photographs of China to gives a realistic overview of the country’s natural realms (Figure 3).

Figure 3. China’s main natural realms (adapted from Magellan Geographix 1999)

The majority of China’s people, Han Chinese comprise around 92 percent of its total population (MiningCo.com 1999). Although over 400 ethnic groups formally applied for special recognition as distinct nationalities (minorities) shortly after the creation of New China, only fifty-five were officially recognized in the late 1950s (Ramsey 1987, Gladney 1998, Safran 1998). According to the most recent national census in 1990, large minority groups include the Zhuang (15.5 million), Man (9.8 million), Hui (8.6 million), Uygur (7.2 million), Mongol (4.8 million), and Tibetan people (4.6 million) (Consultants for International Management 1998, Gladney 1998; Figure 4). However, as Zhao (1994) explains, the Zhuang “acculturation and assimilation processes with the Han have been nearly complete [and] it is now rather difficult to distinguish a Zhuang from a Han." Zhao (1994) also explains that the Man (Manchu) "have now nearly lost their identity and have become culturally absorbed into the Han," and that Mongolians "have been gradually adopting Han culture and getting closer and closer to the Han." Such observations are clearly both descriptive of the present-day situation in China (as seen through Han eyes), and, as the implied inevitability and even desirability of acculturation and assimilation lead us to note, also informative of a general belief in Han cultural superiority over other ethnic groups in China. This attitude is not new. In fact, as Heberer (1989) has noted, "Confucianism, the ideology of the state throughout all the Chinese dynasties, [has always] called for a policy of nonviolent assimilation through the imposition of Han-Chinese values… These Confucian ideas run consistently throughout the history of nationality relations in China." Political ideology and cultural relations are equally important today, in communist China, as they were last century in imperial China (Wang 1985).

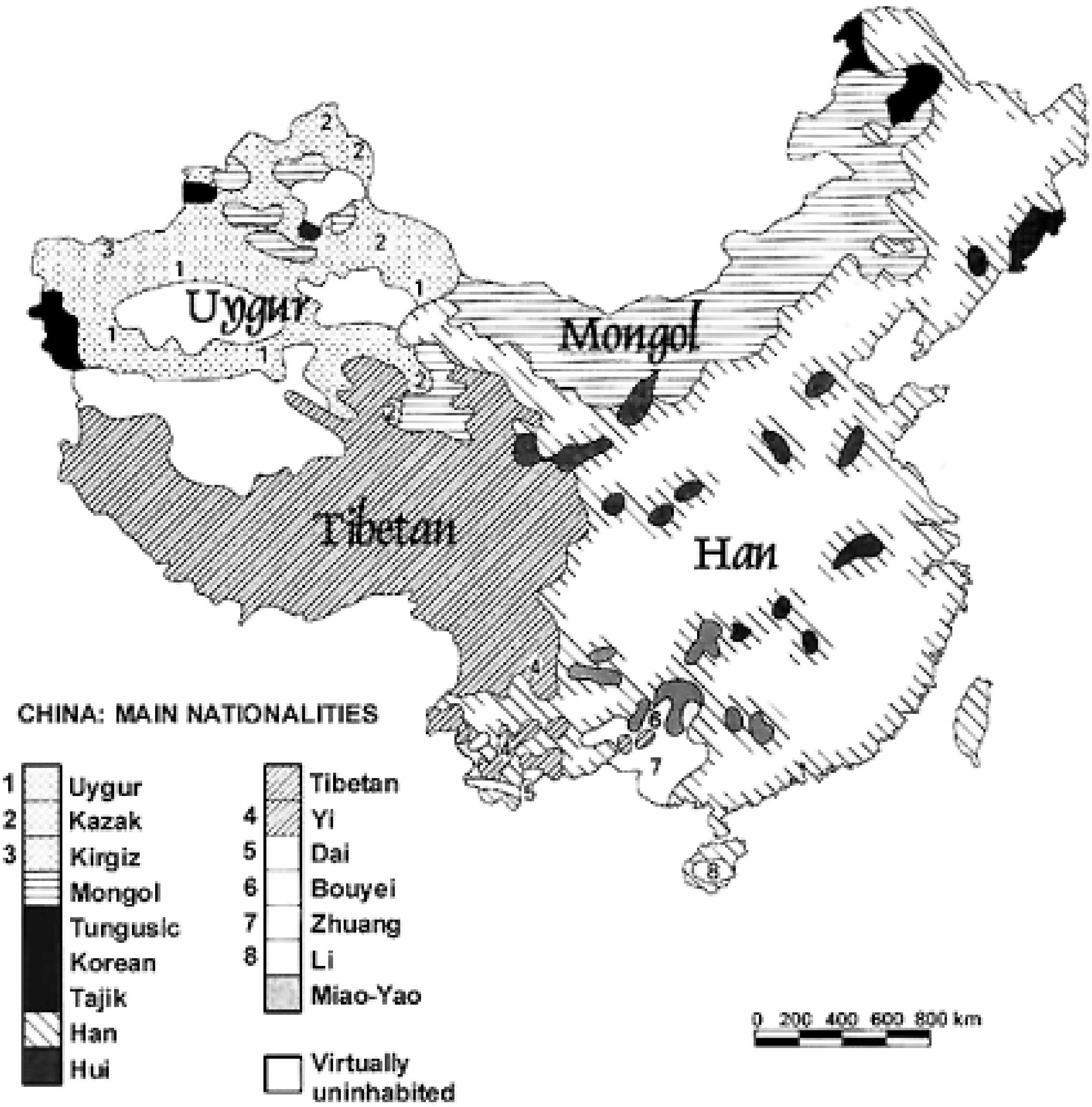

Figure 4. China's main nationalities (adapted from Mackerras 1995)

Particularly relevant to modern China's national development is the uneven geographic distribution of its human population. According to He (1991), 83 percent of the population lives in only 36 percent of the territory (in the east), while only 17 percent of the total population inhabits the remaining 64 percent of the land (in the west). Heberer (1989) makes the same point even more dramatically by dividing the country in two nearly equal halves: 96 percent of the population lives in eastern China while only 4 percent lives in western China (Table 1). The very unbalanced distribution of people has led to numerous proposals for the resettlement of Han (from eastern China) to the sparsely populated western regions. Indeed, resettlement, or internal migration, has become a normal and, it is argued, even a necessary part of the country's overall population policy (Heberer 1989; Figure 5). However, as already noted, China's western regions traditionally have been inhabited by a high proportion of local minority (non-Han) ethnic groups.

The main reasons behind much of the internal migration observed in China in recent decades are found in the basic characteristics of western China: its abundant natural resources, its sparse human population, and its proximity to several strategic neighboring countries. As Heberer (1989) explains, "the outlying and border regions [inhabited by ethnic minorities] are as important for their rich deposits of raw materials as they are for defense" (Heberer 1989). Indeed, nearly 90 percent of China's pasture lands lie in minority areas, and Tibet, for example, "has proven deposits of some 60 mineral products: chromite the richest, and such others as lithium, copper, molybdenum, cobalt, gold, and silver" (Mackerras 1994). Another important reason given for Han migration is that nationality areas are on the whole much less densely populated than eastern China, and internal migration could relieve some of the burden on the latter to the benefit of both areas (Heberer 1989). The case for strengthening the defense of its borderlands also cannot be ignored. As Mackerras (1994) explains, the "government is undoubtedly concerned about its borders, and for all the rhetoric about the united family of nationalities no doubt feels more trust and confidence in the loyalty of Han people than in the commitment of Uygurs, Kazaks, Tibetans, Mongols" or any other of its minority nationalities. Heberer (1989) likewise notes that "the country's internal stability and its defense capacity are to a large degree dependent on the behavior of minorities." Han migration therefore is meant, at least in part, to increase "military security in the border regions [by facilitating] integration of minorities and their regions into the Chinese mainstream." However, the argument advanced most often and most overtly for large Han migration to minority areas is that it assists the minorities in their overall "economic construction."

Table 1. China's population distribution (Heberer 1989)

Region of China	Population (percent)	Land area (percent)	Population density
Eastern zone	1,001,090,000 (96 %)	4.6 million km^2 (48 %)	207 people / km^2
Western zone	44,230,000 (4 %)	5.0 million km^2 (52 %)	6 people / km^2

Note: The western zone includes Xinjiang, Tibet, Gansu, Qinghai, and Ningxia.

Figure 5. Chinese internal migration (Heberer 1989)

While recognizing the importance of all the reasons given for developing western China, it is the latter reason – to assist the minorities – that will serve as the basic premise, or the starting point, of this work. Thus, while resource exploitation for the benefit of the whole nation is important, as is strengthening national security and relieving population pressures when and where possible, it is the well-being of local, mainly minority, people that will be kept at the forefront of this dissertation. "Assisting the minorities," alone and unencumbered by the other rationales for development, at least provides a solid foundation and some common ground for meaningful discussion on long-term sustainability and grassland conservation in Qinghai, China.

Reality, however, quickly resurfaces, because local needs and aspirations do not always coincide with national economic goals. This inequity is where most rhetoric on local autonomy truly is put to the test. Heberer (1989) continues:

> "While the state [has] a legitimate interest in developing the minority regions and in utilizing their resources, the minorities [remain] apprehensive of being inundated by the Han. … The Han Chinese complaint that a 'commodity economy' has not developed in these areas and that the inhabitants are not interested in 'production for the market' has little impact on these peoples. Progress is therefore often rigorously imposed from above…."

Furthermore, despite the national government's enormous effort to develop the western regions, including huge investments in the way of finance, technology, manpower, and skilled personnel,

> "the gap between minority [western] and Han [eastern] regions is growing. Eastern China, which is already more developed, has better conditions for economic growth (more integrated infrastructures, proximity to the coast, relatively well-developed industrial centers, technology, skilled manpower, etc.). It [also] has the most foreign contacts and receives the lion's share of aid from Western countries" (Heberer 1989).

This gap translates into inequalities in industry and infrastructure, in health services, in education, and in many other areas (Mackerras 1994, 1995). Thus not only is China's human population unevenly distributed across the country, but its entire infrastructure (transportation and communications network) and levels of social development (education, healthcare, household income) are unbalanced as well. With little technical, institutional, financial, or other capacity for development, the western region lags increasingly farther behind the coastal and central provinces. A vicious circle of development and underdevelopment thus ensues, resulting in a growing East-West divide both in terms of socio-economic development and of environmental protection (Edmonds 1994). Virtually all disparities are compounded even more for local minority people compared with Han people living in the same area (Mackerras 1994). All these imbalances (as well the absolute social and economic conditions themselves) have grave implications for social stability in minority areas, and hence for national security in China as a whole – which brings us back full circle to this most fundamental reason why China senses the need to develop its own Far West.

To compensate at least partially for the way in which national goals are met in China – such as promoting internal migration to western regions (Figure 5), which is sometimes resented by minority people – a degree of autonomy has been given to many national minority areas throughout the country (Heberer 1989, Safran 1998). Five regions (including Tibet), 30 prefectures (including six prefectures in Qinghai), 124 counties, and nearly 3,000 townships have been classified as "autonomous" in China (Heberer 1989, Administrative Centre for China's Agenda 21, 1994). These areas cover about 6.1 million square kilometers, or 64 percent of China's territory, and comprise a total population of 142.5 million people, including over 62.5 million minority people. According to Heberer (1989),

> "minorities have enjoyed an autonomy (*zizhi*) defined by territory and nationality since the fifties. At that time, regions inhabited by one or several minorities were united into a single administrative unit (be it autonomous region, autonomous prefecture, autonomous county, or autonomous township) and bodies of self-administration were established. … In these regions, the language(s) and writing(s) of the region's autonomous nationality (or nationalities) should be used; administration must (or should) be in the hands of functionaries from the minority population; the regions can promulgate their own laws and regulations, draw up their own production plans (within the bounds of the central state plan), and choose their own path of economic and cultural development (within the lines of the constitution). Furthermore, the autonomous regions can administer local finances themselves (within the framework of financial planning for the state as a whole), and can have their own local security forces."

Without such autonomy, whether purported or real, it is likely that minority people in China would feel disempowered, and hence that social discontent would increase. However, with an administrative system that allows for some local autonomy for minority people, China can better maintain the social stability that it needs for national economic development to continue, and also to ensure its own security.

Development and national security (back to top)

The combined spatial patterns of resource availability, transportation networks, population distribution, and ethnicity in China raises important questions about which development priorities the government should adopt. With uneven development (increasing disparities) within and between regions in China, internal risks to its national security clearly are on the rise. Indeed, it has not been long since economic development alone was at the forefront of most government leaders' agendas.

Yet as natural resources are depleted and environments degraded, and as ethnic tensions occasionally surface in some parts of China, the idea of an internal threat to national security has begun to gain wider recognition. The two main areas of internal threat are environmental degradation and nationality-related social unrest. Presently, virtually all plans in China are assessed first in light of their direct contributions to social stability, and then subsequently in light of other standards, including environmental impact. The state of the environment, however, impacts the livelihoods of many national minorities in China, including Tibetan pastoralists, and thus also affects their overall welfare, and, ultimately, their level of contentment within the present administrative system. The environment therefore should be given at least equal status with other potential internal threats (such as a lack of social stability, Dorje 1997) and perhaps greater importance even than many more traditional external threats (such as military confrontations) (Smil 1995, Renner 1996).

A brief overview of China's development over the past two decades will help to clarify further some of the above linkages, in particular the politicizing effect that internal security issues such as social instability and environmental degradation have on the otherwise seemingly neutral arenas of grassland sciences, rangeland development and conservation, and the protection of biodiversity in China.

First, to set the stage, as noted in a short excerpt from a speech made by Hu Yaobang (the former general secretary of the Chinese Communist Party) on 1 September 1982, the official purpose of development in China is to promote economic growth of the nation as a whole. As explained by Hu (cited in Wang 1985),

> "the general objective of China's economic construction for the two decades between 1981 and the end of this century is … to quadruple the gross annual value of industrial and agricultural production. This will place China in the front ranks of the countries of the world…."

This general objective stands in contrast to a more people-oriented "basic needs" approach to socio-economic development (Streeten 1979, Lélé 1991), a style or type of development that takes into account more localized needs as well as those of the larger national entity.

The present economic reforms, the foundation for almost all developments in China for over 20 years, began in late 1978 when the central government began to shift away from a Soviet-style centrally planned economy to a more market-oriented economy, though one still firmly under Central Communist Party control. The leaders' first steps towards economic liberalization included the introduction of a "household responsibility system" which provides incentives for agricultural production instead of the former system of collectives; an increase in local autonomy at many government levels; an increase in the incentives for the growth of small-scale enterprises; and a greater openness for foreign trade and investment in China. The new economic system was officially termed a socialist market economy in 1993 (Barnett 1993, Consultants for International Management 1998).

The economic results of these changes have been stunning – China has quadrupled its per capital income over the past 20-year period (Woo 2000) – but, as already noted, there has been large variation in success between provinces and regions (Bramall and Jones 1993, Knight and Song 1993). For example, although overall gross domestic product grew over 10 percent annually between 1992 and 1995, this was due primarily to economic expansion in China's coastal provinces, whereas inland China saw very little growth during the same period. It is only in the late 1990s that China truly began to shift its development focus westward (Consultants for International Management 1998, Fauna and Flora International 2000). Furthermore, large-scale efforts to focus the public's awareness on this new shift westward (as opposed to continuing to develop the east only, with little hope for any significant "trickle-west" effect) became obvious only in late 1998 or early 1999 in Qinghai. Further, the national economic growth of the last 20 years has decreased in the last two to three years (Woo 2000).

Throughout the 1990s, one of the greatest challenges in Qinghai and elsewhere in China was to keep large state-owned enterprises afloat, most of which remained inactive or inefficient while the rest of the country saw huge economic expansion. Many of these enterprises finally were shut down or privatized in 1998 because of inefficiency or, in some instances, corruption. Although these closures were necessary, they had the effect to increase unemployment, the very problem the government had tried to avoid by providing large subsidies to keep these enterprises afloat in the first place. Even prior to closures of inefficient state-owned enterprises, the official unemployment rate in China was 4 percent in urban areas (though many analysts estimated the actual rates at around 8-10 percent), with substantial unemployment and underemployment in rural areas as well. Overall, 60 percent of the total labor force of around 688.5 million people works in agriculture and forestry, 25 percent in industry and commerce, 5 percent in construction and mining, 5 percent in social services, and 5 percent in other occupations (MiningCo.com 1999).

China's migrant population also is enormous, estimated at over 100 million people and comprised largely of unofficially employed people (e.g., many street vendors). The presence of such a migrant population, like unemployment, is cause for considerable concern in a control state like China.

Equally challenging, and possibly even more of a threat to national security because of its subtle, sometimes insidious character, is environmental degradation (Goldstone 1996). Air pollution, soil erosion, and the steady fall of the water table continue to worsen living conditions in northern China, and the amount of arable land continues to decline because of soil erosion and rapid urban development (in total, by over 15 percent nationwide since 1949) (Smil 1993, Edmonds 1994, Brown 1995, Becker 1998). Environmental tensions of all sorts – almost all tied to China's development – are likely to continue rising over the next few years in the country's highly centralized system (Consultants for International Management 1998).

That China's environmental degradation is in some cases most severe in its ethnically diverse hinterlands only adds to a growing sense of unease. Now not only must these regions supply their raw materials for the development of China's eastern coastal zone (where the majority of the population lives), they even are losing the very foundation of their local economies and hence their ways of life because of widespread environmental degradation. Some Chinese researchers and government leaders have even begun to talk of "ecological refugees" in degraded grassland areas. A price clearly is being paid for China's development, but the burden is not even. And tensions, ethnic this time, continue to rise.

Ironically, then, it is the ethnic (or minority) question that may equally provide China with one of its strongest motives to promote rapid economic growth. Not only must authorities expand their ability to feed a rapidly growing population (estimated to stabilize at around 1.6 billion people in the year 2050; Brown 1995), they also must pay special attention to providing real improvements in the quality of life of minorities in order to offset some of their possible discontent or unrest, and preferably even to shift their thoughts toward entirely new hopes and aspirations and a more materialistic (versus ethnicity-based) future.

As discussed in the previous chapter, quality of life includes not only economic prosperity but levels of educational attainment, health status, and several other basic rights as well. It is well understood in China, though, that poverty alleviation will continue to play a key role in achieving social stability. Indeed, promoting social stability through poverty alleviation is an explicit goal at the national level, and it is further refined at the provincial and lower levels as specific plans, programs, projects, and activities (Dorje 1997). Thus the crucial question now is whether or not such plans will lead to sound environmental practices. And if not, the most important work ahead may be to find how these plans can be improved and made to contribute to, or even be integrated with, an ecologically sound notion of sustainability (Johansson 1993).

Environmental protection (back to top)

Fortunately, national leaders and the public in general have begun to recognize the need for environmental protection (nature conservation) in China (Qu 1987, United Nations Environment Programme 1990, National Environmental Protection Agency 1992, 1994, Smil 1993, Administrative Centre for China’s Agenda 21, 1994, Edmonds 1994, Maxey and Lutz 1994, State Planning Commission and State Science & Technology Commission 1994, Carey 1996, Drake 1997, McElroy et al. 1997, Yan 1997). It is especially significant that China’s Premier Zhu Rongji and several other prominent leaders now are beginning to gain a better understanding of the relationship between development and the environment, and hence of the importance of protecting China’s biodiversity. At a recent meeting of the China Council for International Cooperation on Environment and

Development, Premier Zhu stated unambiguously that although many priorities had taken precedence over environmental protection in the past due to historic and economic reasons, now the environment is a "key priority" for China (China Council for International Cooperation on Environment and Development 1999c). This is extremely important because to date most development activities and policies in China have been implemented with little consideration of their environmental impacts. Already this has given rise to substantial environmental harm, to the detriment of both the environment itself as well as for future development potential (Pannell and Ma 1983, Smil 1984, 1993, He 1991, He 1997, Jahiel 1997, Muldavin 1997, Liu 1998, McCarthy and Florcruz 1999).

While China is known as a "treasure house" of many rare wildlife species, with more than 2,100 species of terrestrial vertebrates and an estimated 27,150 species of plants (Li and Zhao 1989, Zuo and Xing 1992, Edmonds 1994, Carey 1996, MacKinnon and Hicks 1996), government-supported environmental protection began in earnest only quite recently. The first nature reserve in China was established in Guangdong in 1956, and active wildlife management began with protection of the giant panda, the golden monkey, and a few other rare animals in 1959 (see Appendix IV for the scientific names of animals mentioned in the text; also see Tables 20 and 21). Furthermore, it is only in 1973 that the *Provisional Articles for Natures Reserves* was passed, and it was only in 1975 that China's State Council outlined specific plans for the establishment of nature reserves (Wang et al. 1989). Substantial development of China's nature reserves therefore did not truly begin until after 1979. Edmonds (1994) continues:

> "With the total area of nature reserves equaling only 0.17 per cent of the national territory in 1980, China was way behind the leading nations. [Furthermore] as the country was embarking on new economic policies at this time, nature reserves were often seen as burdens on local budgets. In particular, people living around the reserve areas felt burdened as the state did little to compensate them for their loss of resources when a reserve was established. However, the state soon became aware of the problem and began to work on methods for compensation."

As Table 2 shows, the total number of nature reserves increased rapidly from the late 1970s to a total of 708 reserves by the early 1990s, covering nearly 6 percent of the national territory (Edmonds 1994, Carey 1996). However, the regional coverage of these reserves remains very uneven, with the Tibetan plateau region the least well represented (Figure 6). The administration of reserves also is not uniform with different reserves administered by different organizations at a variety of government levels. There is therefore a great variety of emphases and styles of administration among nature reserves, with some bureaus administering reserves only to “protect those aspects of the environment which are beneficial to their own bureau’s interests” (Edmonds 1994), and others providing no management at all. Some reserves exist in name only (Wang et al. 1989).

Table 2. Development of China’s nature reserves (Edmonds 1994)

Year	Total No. of Reserves	National Reserves	Other Reserves	Total Area (km^2)	Percent of National Area
1965	19	n/a	n/a	6,500	0.07
1978	34	n/a	n/a	12,600	0.13
1980	72	12	60	16,000	0.17
1983	262	9	253	156,000	1.62
1985	310	10	300	167,000	1.74
1987	481	31	450	237,000	2.47
1991	708	61	647	560,000	5.83

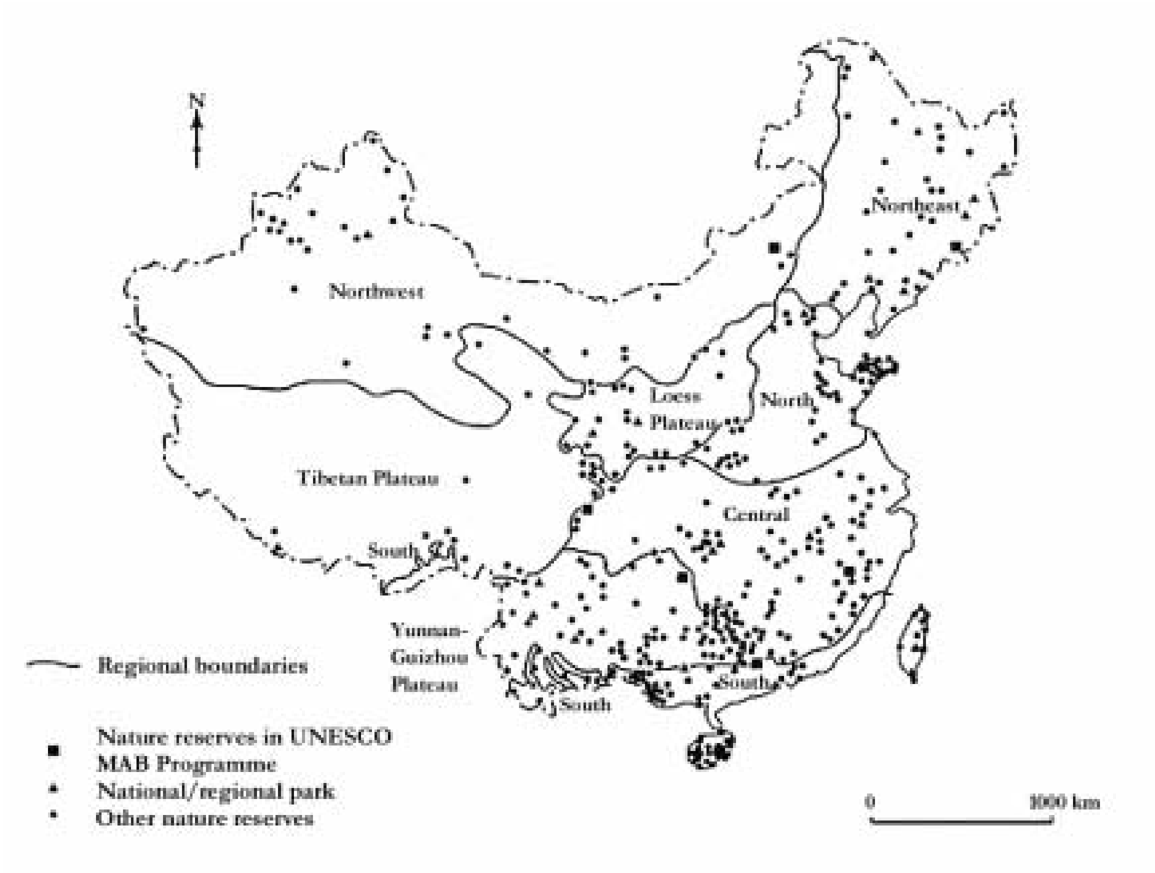

Figure 6. China’s nature reserves (adapted from Edmonds 1994)

One obvious hindrance to environmental protection in China is the lack of adequate financing to help integrate longer-term conservation goals with more immediate socio-economic needs. During the 1980s and early 1990s, China spent less than 1 percent of its gross national product on environmental protection. Therefore many nature reserves have had to search for ways to make money themselves, such as through tourism. To date, however, the experience of integrating nature conservation and tourism (ecotourism) has been mixed at best (Edmonds 1994, Gunn 1994, Barkin 1996, Rai and Sundriyal 1997, Mowforth and Munt 1998). In some remote areas, though, few alternative income generation strategies have been found.

On a more positive note, there are several contemporary trends in China that demonstrate its awareness of both the need for and many of the challenges facing the integration of conservation and development. Indeed, China is one of the first countries of the world to implement its national Agenda 21 following the United Nations Conference on Environment and Development (Administrative

Centre for China's Agenda 21, 1994; see, e.g., *Chapter 14: Conservation and Sustainable Use of Natural Resources*, URL: http://www.acca21.edu.cn/chnwp14c.html). At least nationally if not at all lower levels, China now recognizes that conservation and development will either succeed together or fail together – that is, in the long-term they are inseparable.

Considering the Tibetan plateau in particular, an early version of the Action Plan for Protected Areas in East Asia (drafted by the Commission on National Parks and Protected Areas, a branch of IUCN - The World Conservation Union) highlights the need to initiate "eco-development" projects around conservation areas, and to promote applied research programs to help develop and implement sustainable use of the rangelands of the plateau. The action plan also draws attention to the need to restore degraded habitats, to reintroduce wildlife, and to expand existing protected areas (Wang 1995). The China Council for International Cooperation on Environment and Development also has begun to provide a framework to facilitate cooperation between China and the international community in the fields of environment and development. Premier Li Peng indicated his willingness to listen to the China Council's advice and recommendations and stated that "China will put more emphasis on environmental protection in drafting its Ninth Five Year Plan (1996-2000) and its 2010 long-term plan for social and economic development" (China Council for International Cooperation on Environment and Development 1995). Significantly, one branch of the Council, the Biodiversity Working Group, has specifically indicated that protected areas should be established in China's grasslands in localities accessible for ecotourism and used as demonstration projects "with returns to local pastoralists to pay for reduction in stocking rates of livestock" (Biodiversity Working Group 1995). The Priority Programme for China's Agenda 21 (State Planning Commission, and State Science & Technology Commission 1994) similarly emphasizes the "conservation of special habitats and ecosystems and coordinating conservation needs with sustainable use of living resources," as well as the need to "establish demonstration projects that consider both protection of biological resources and … sustainable utilization [of] species, protected areas, and ecosystems."

A final way in which the Chinese national scene impacts grassland biodiversity is through government legislation. From a conservation perspective, the Rangeland Law, promulgated in 1985, is one of the most important laws since it directly affects over half of China's vast territory. Specifically, it forbids farming (cultivation) and any other land use that damages the rangeland. According to Reardon-Anderson and Ellis (1990), the law should be implemented as a policy unfolding in four broad steps:

- • the distribution of livestock among individual households (now complete);
- • the distribution of grazing lands among individual households (still in progress);
- • the assignment of "optimal carrying capacities" for each piece of land (in progress); and
- • the implementation of incentives and sanctions to persuade pastoralists to limit their herds to the assigned carrying capacities (in the future).

The key feature of the Rangeland Law purportedly is "to find and maintain a balance between animals and vegetation, and to arrive at this balance through local decision making and market mechanisms" (Li Yutang, Chief of the Grasslands Division, Ministry of Agriculture; cited in Reardon-Anderson & Ellis 1990). It is debatable, however, whether the privatization of semi-arid grassland, or at least a compartmentalization of the land, is a measure that truly will benefit local pastoralists in the long-term. It also is questionable whether the law itself was determined with or without local consultation or the active participation of all stakeholders. Climatic variability is intrinsic to many grassland systems, and pastoralists often have found ecologically sound and practical ways – other than privatization or individual land leases – to live in such contexts. It is extremely important, therefore, to consider local realities and perspectives, both about the regional ecology and the local cultures and livelihoods in the target areas where conservation and development is planned (Ghai and Vivian 1992, Friedmann and Rangan 1993, Johansson 1993, Miller 1995, Bernard and Young 1997, Miller and Craig 1997, Carpenter 1998).

The Tibetan Plateau (back to top)

Biogeography of the Tibetan plateau (back to top)

The Tibetan plateau is the highest, most extensive, and youngest plateau in the world (Molnar 1989, Harrison et al. 1992, Yang 1992b). The Himalayas, Karakoram, Kunlun, Qilian, Hengduan, and other mountain ranges surround the plateau on all sides, and the continental Taklimakan and Gobi deserts border it to the north (Figure 7). With an average elevation 4,000 - 5,000 meters above sea level and many mountain ranges over 7,000 meters, the climatic conditions on the plateau's 2.5 million square kilometers (about one-fourth of the total land area of China) generally are too severe for agriculture.

Figure 7. Main mountain ranges and deserts of the Tibetan plateau and western China

Nearly 70 percent of the Tibetan plateau is rangeland (Miller 1995). However, intense cold, high winds, seasonal unavailability of water (due to freezing as well as aridity), limited primary productivity, and lack of oxygen all combine to render survival precarious at best. In most areas, the local environment is favorable only to nomadic pastoralism (Hu et al. 1992). However, despite the inclement weather and extremely scant vegetation (Walter and Breckle 1985), the grasslands also support an astonishing array of native wildlife species, many of them endemic to the Tibetan plateau (Hoffmann 1991, Schaller 1998).

Overall, little scientific attention has been given to the Tibetan plateau region because of its inhospitable environment, remoteness, and rigid geopolitical situation (Jackson and Ahlborn 1996). The first detailed botanical study was conducted in 1974-76 by the Chinese Academy of Sciences. During this and subsequent expeditions, the harsh ecological realities faced by every living organism on the plateau were documented. A few simple facts can help to better grasp the extreme environmental conditions of the Tibetan plateau:

- • the mean annual temperature on the plateau is between -2^{o} and 0^{o} Celsius;
- • the temperature of the warmest month of the year is between 6^{o} and 10^{o} Celsius;
- • there is frost for 6 to 7 months of the year;
- • permafrost is widespread in the northern parts of the plateau;
- • there is a wide diurnal range of temperature, up to 40^{o} Celsius in a single day;
- • only 100 - 300 millimeters of precipitation falls in a year, most of it in hailstorms; and
- • winds are frequent and strong, with mean speeds of 15 meters per second.

Beyond the intrinsic value of the region’s native biodiversity, its ecosystems also are important because they form the headwaters of many of Asia’s major river systems, including the Yarlung Tsangpo (Brahmaputra), Salween (Nujiang), Mekong (Lancang), Yangtze (Changjiang), and Yellow (Huanghe) rivers; they provide unique habitats for many nationally and internationally important wildlife species; they are the natural resource base for millions of domestic animals, the main livelihood of Tibetan pastoralists; and they are home to several million people who to date have largely been neglected by development efforts because of their remoteness and nomadic pastoral way of life (Miller 1995). Unfortunately, some experts believe that the Tibetan plateau (and the Himalayan region in general) may comprise some of the most actively degraded ecosystems in the world (Ives and Messerli 1989, Cai et al. 1990). It is therefore exceptionally important to ensure that all natural resources of the Tibetan plateau be used sustainably and that concrete actions for biodiversity protection are adopted and implemented as soon as possible.

Moving in a clockwise direction, the Tibetan plateau is bordered to the south and southwest by the massive Himalayan Range, to the west and northwest by the Karakoram Mountains, to the north by the Kunlun Range, and to the northeast by the Qilian Range. The east and southeast of the plateau is more difficult to delineate, but it generally has been defined as running along the "snow mountain" complex formed by the Hengduan Range, the collective name given to a series of north-south ranges and gorges which encompass the upper reaches and tributaries of the Salween, Mekong, and Yangtze rivers. This complex generally is considered to extend to and encompass the alpine grasslands in the vicinity of the upper reaches of the Yellow River and Qinghai Lake. Another important range situated in the middle of the Tibetan plateau is the Gangdise-Nyainqen-Tangula Range in southern Tibet, a series of mountains that extend around 1,600 kilometers east to west and divide the Yarlung Tsangpo watershed in southern Tibet from the internal watershed of the Chang Tang in northern Tibet. Similarly, the eastern portion of the Kunlun Range (in Qinghai) separates the Qaidam Basin from the rest of the plateau and several key out-flowing rivers that wind through the Hengduan Range to Southeast and East Asia.

Based on the above physical geography as well as biological criteria, the Tibetan plateau has been divided into three or four main biogeographic regions. Vaurie (1972), for example, recognized the Northern Plateau (including the Chang Tang in northern Tibet and the Qaidam Basin and Qinghai Lake areas in northern Qinghai), the Outer Plateau, and the Southeastern Plateau. This classification scheme parallels the general distribution of the plateau's native wildlife, which many years earlier had led Schäfer (1933) to name these same regions Yak Steppe, Kiang (Wild Ass) Steppe, and Gazelle Steppe. It is Hoffmann's (1991) synthesis of many previous classifications, however, that I have followed most closely. The sub-regions recognized in this work are the Northern Plains (or Chang Tang), the Outer Plateau, the River Gorge Country (sensu Ward 1913), and the Qaidam Basin (Figure 8). Both the Outer Plateau and the River Gorge Country have external drainage systems, while the

Northern Plains and the Qaidam Basin have internal drainage systems. The Northern Plains also is the highest, coldest, and by far the most arid of the four sub-regions. Several deep river valleys that allow the monsoon rains to move up toward the plateau, on the other hand, dissect the River Gorge Country. The Outer Plateau is much more part of the Tibetan plateau proper (compared with the River Gorge Country), but it also is affected to some degree by the monsoon. Finally, the Qaidam Basin (as well as a smaller area north of the Kunlun Range in Xinjiang) is an important transition zone between the grasslands and mountains of the Tibetan plateau proper (i.e., the Northern Plains and the Outer Plateau) and the lower, super-arid Central Asian deserts (i.e., the Taklimakan and Gobi deserts) situated to the north.

Figure 8. Biogeographic sub-regions of the Tibetan plateau (adapted from Vaurie 1972, Hoffmann 1991)

Tibetan wildlife (back to top)

The Tibetan plateau supports a truly unique biodiversity. Several historic accounts give an indication of the former abundance of native wildlife on the plateau. Hillsides were “literally black with yak, they could be seen by the thousands” (Rockhill 1891). Grasslands had “a tremendous lot of wildlife … yaks, wild asses and gazelles … all quite easy to get near” (Migot 1957). “Antelope and yak in incredible numbers were seen” (Bower 1894). “As far as the eye could reach...were thousands upon thousands of doe antelope with their young … there could not have been less than 15,000 or 20,000 visible at one time” (Rawling 1905). Prschewalski (1884), Deasy (1901), Kozloff (1910), Schäfer (1933), and other authors all give similar accounts.

According to Zhang (1991), mammals distinctly characteristic of the high plateau include two carnivores (snow leopard, sand fox), a perissodactyl (Tibetan wild ass), seven artiodactyls (white-lipped deer, musk deer, blue sheep, wild yak, Tibetan gazelle, Tibetan antelope, argali), many lagomorphs (woolly hare and many pika species), and several rodents (Himalayan marmot, Tibetan hamster, a zokor, and a vole or field mouse), although several of these species do extend beyond the reaches of the Tibetan plateau proper.

Of the larger charismatic fauna, the Tibetan plateau’s ungulate assemblage is said to be ecologically analogous to that of East Africa’s Serengeti plains (Schaller and Gu 1994). However these ungulates and the predators that feed on them remain abundant only in very remote parts of the Tibetan plateau. Elsewhere they survive only in small numbers in isolated, inaccessible patches (Miller and Bedunah 1994). In Qinghai, the Tibetan antelope is now extinct in the eastern part of its range (Schaller et al. 1991). In many areas the snow leopard has been decimated or locally eradicated. Tibetan gazelle, perhaps once the most abundant ungulate on the plateau, survive only as remnants. Blue sheep, though still the most numerous and widespread ungulate, and argali, once common in rolling terrain, are both seriously threatened. Tibetan wild ass have been almost exterminated in the eastern third of the province and wild yak now occur only in low numbers in north-central Qinghai and in the Kekexili (Schaller et al. 1988, Schaller and Liu 1996). Further, musk deer populations have declined during the past decade (Harris 1991) and the distribution of Przewalski’s gazelle has shrunk to a small area around the northern half of Qinghai Lake. With less than 200 individuals surviving, Przewalski’s gazelle is the most endangered ungulate species in China and possibly the world (Jiang et al. 1994).

It is also noteworthy that more than two-thirds of the world's pika species occur on or around the Tibetan plateau (Smith et al. 1990). Pikas, along with marmots in summer, serve as important food resource buffers for carnivores such as the wolf, Tibetan brown bear and snow leopard (Schaller and Gu 1994, Schaller et al. 1988, Schaller 1998). The black-lipped pika (or plateau pika) is a keystone species of the plateau grassland ecosystem (Smith and Foggin 1999).

Our knowledge of the Tibetan plateau avifauna is even sparser than that of the mammal fauna. There are many birds that are endemic or highly characteristic of the high plateau (e.g., Himalayan griffon, upland buzzard, Tibetan snowcock, Tibetan sandgrouse, black-necked crane, Hume's ground jay, and a variety of redstarts, rose finches, snow finches, buntings, wagtails, larks, accentors, and shrikes). However, little more than mere physical descriptions and distribution notes are provided in the relevant literature (Vaurie 1972, Fleming Sr. et al. 1984, DeSchauensee 1984, King et al. 1995).

According to Carey (1996), major threats to biodiversity on the Tibetan plateau include especially the poaching of snow leopard, gray wolf, red fox, blue sheep, Tibetan antelope, and brown bear for their skins or their medicinal value. Fuel wood collection by the increasing human population also is resulting in serious damage to the sparse bush cover on the plateau. In Qinghai specifically, the white-lipped deer and wild yak also are endangered, as well as "a number of narrowly distributed [bird] species adapted to steppe and dessert habitats such as Pheasant Grouse *Tetraophasius obscurus*, Chinese Hazel Grouse *Tetrastes sewerzowi* and Chinese Monal Pheasant *Lophophorus ihuysi* [and] Black-necked Cranes *Grus nigricollis*." While many wildlife species are officially protected in China, this does not always translate into practice. Further, there is also a strong bias in official conservation legislation toward protecting primarily large charismatic wildlife species (Edmonds 1994).

Turning now to the plant formations of the Tibetan plateau, the most extensive vegetation type in the arid Northern Plains is the high-cold *Stipa purpurea* steppe, often with cushion plants (e.g., *Arenaria musciformis, Androsace tapete, Thylacospermum rupifragum*) also present in the community. Typically the plant coverage is less than 20 percent. In the northern part of the Chang Tang, high-cold desert-steppe plants (e.g., *Carex moorcroftii*, *Ceratoides compacta*) are dominant. *Kobresia* meadows also are present in some of the mountain ranges, and *K. pygmaea* and several mesic forbs also are common in the transitional zone between the high-cold steppe of the Northern Plains and the high-cold meadow of the Outer Plateau (Chang 1981, Wang 1988, Miller and Schaller 1996).

The Outer Plateau, on the other hand, including a large area of Qinghai (see Figure 8), consists mainly of

> "low-growing *Kobresia pygmaea* and *K. humilis*, usually associated with *Polygonum sphaerostachyum* and other forbs, including *Thalictrum alpinum, Anaphalis xylorrhiza, Leontopodium pusillum, Carex atrata* var. *glacialis, Meconopsis horridula*, *Polygonum viviparum, Potentilla stenophylla, Pedicularis, Gentiana*, and cushion plants such as *Arenaria musciformis* and *Androsace tapete*. High-cold evergreen sclerophyllous scrub, composed of microphyllous *Rhododendron, R. cephalanthus,* and *R. setosum* on northern slopes, and deciduous shrubs of *Salix* spp*., Potentilla fruticosa*, and *Caragana jubata* in valleys or on southern slopes, are always found in conjunction with the high-cold meadow. In level areas and swampy valleys there occur high-cold swampy meadows with a mound-like growth-form of *Kobresia littledalei*" (Chang 1981).

Furthermore, Chang (1981) also notes that

> "the high-cold *Kobresia* meadow [of the Tibetan plateau] differs in floristic composition, community structure, and other ecological features from the humid dicotyledonous alpine meadows of the Alps or other moist-temperate mountains, and the alpine tundras of higher latitudes. This vegetation is referred to as 'Tibetan high-cold meadow.' It has evolved under drier and harsher high mountain and plateau conditions with continental climates."

In the southern section of the Outer Plateau, drier and warmer conditions along the Yarlung Tsangpo permit "the cultivation of some crops and vegetables such as barley, wheat, buckwheat, peas, potato, rape, cabbage, turnip, and carrot" (Chang 1981). As elsewhere on the Tibetan plateau, the natural vegetation here is influenced greatly by altitude and a clear vertical zonation is present (Zuo 1990).

The unique character of the River Gorge Country lies in its high, parallel mountain ranges dissected by deep valleys. Many parts of this sub-region are forested. Main tree species include *Pinus, Quercus, Picea, Abies*, and *Juniperus*. *Rhododendron* scrub is common in the transitional zones between forests and alpine meadow, and *Kobresia* is common above the treeline (Chang 1981, Zuo 1990).

Finally, the Qaidam Basin region includes elements from the Northern Plains and Outer Plateau as well as from the Central Asiatic Temperate Desert (Cai et al. 1990, Zuo 1990). According to Cai et al. (1990),

> "major plant species [are] *Achnatherum splendens*, *Ceratoides* spp., *Salsola collina*, *Nitraria vannoides*, *Tamarix* spp., and *Ephedra przewalskii*. Some low marshy alkaline areas support reeds (*Phragmites communis*). The eastern part of the basin is not as dry as the western part and supports more vegetation. The western part of the basin has large expanses of nearly barren land, salt marshes, and salt domes (Zhu 1985)."

Obviously, more research still is needed on the wildlife (including vegetation) of the Tibetan plateau, as well as a proper assessment and ranking of conservation needs in the region. At present, one of the most comprehensive descriptions and literature reviews of the mammals of the Tibetan steppe (with a strong focus on the Chang Tang), including overviews of their present distributions and status, is given in Schaller (1998) (also see Harris and Miller 1995 and Harris et al. 1999 regarding the current status of large mammals in Wild Yak Valley in western Qinghai). The World Wide Fund for Nature (Carey 1996) and MacKinnon and Hicks (1996) also have provided a broad overview of biodiversity conservation needs. However, the most comprehensive attempt to date to prioritize conservation and wildlife management needs on the Tibetan plateau (though focused mainly on Tibet, not Qinghai, Sichuan, or Yunnan) was organized jointly by the Tibet Forest Bureau and World Wide Fund for Nature (World Wide Fund for Nature 1998). It is obvious, though, that much planning, research, ranking, and other conservation work still are needed urgently to safeguard the unique biodiversity of the Tibetan plateau.

Qinghai Province (back to top)

Physical and human geography (back to top)

Comprising the northeastern part of the Tibetan plateau, Qinghai is in an important Tibetan area of China (Figures 1, 4, 7). With a land area around 720,000 km^2, the province can be divided into three main zones (Zhu 1989). The agricultural zone in the northeast includes most of Haidong (Figure 9), which has an average population density of 10 people/km^2. However, in some counties near the capital, Xining, the population density can reach much higher, for example, 162 people/km^2 in

Huangzhong. Although Haidong covers less than 5 percent of the provincial land area, it comprises over two-thirds of the provincial population. The Haidong agricultural zone has received most development assistance to date because of its geographic accessibility and the national emphasis on agricultural development (as opposed to pastoral development).

Figure 9. Qinghai’s prefectures and counties

The Qaidam Basin lies in the northwest of the province and includes most of Haixi. Average population density in this zone is less than 1 person/km^2. It is to this desert part of the province that many provincial leaders are looking for the future economic development of Qinghai because of its abundant mineral, petrochemical, and other natural resources (Wang 1994). To encourage such development, the government has given large agricultural subsidies and enormous investments for infrastructure, yet almost all the benefits of development (e.g., company profits, jobs, and salaries) either have returned to urban economic centers in eastern China (Kelliher 1992) or to relatively recent immigrants to the province, most of which have come from Henan in the east (Heberer 1989). Few of the benefits of large-scale resource development have been directed toward local communities that, until recently, were comprised almost exclusively of Tibetan, Mongol, and Kazak pastoralists. Most resource development in Qinghai still aims to benefit urban centers and East China over and above the rural regions themselves (Chen 1992), even though the latter always will form the backbone of the provincial and national economy (Kelliher 1992).

Qinghai's third zone is comprised of the extensive alpine grasslands that are found in the north-central area and the entire southern area of the province. This zone covers the largest portion of the province (grasslands constitute 54 percent of the province's area; Jing 1986) and includes some of Haixi and virtually all of Haibei, Hainan, Huangnan, Guoluo and Yushu prefectures. Eighty percent of Qinghai is situated over 3,000 meters, and 60 percent is over 4,000 meters above sea level. The grassland region is inhabited mainly by Tibetan pastoralists, with a population density between 1 and 10 people/km^2 in the east and less than 1 person/km^2 in the west. Herds total over 22 million head of livestock, mostly yak and sheep (Drandui 1996). The main development pursued by the government in this area is to encourage pastoralists to "give up their traditional nomadic herding and turn to modern production methods" (Xie 1997). Thus the specific needs and desires of Tibetan pastoralists again largely are ignored in favor of provincial and national (predominantly Han) interests, expressed as externally-designed development goals (but see 'New reserves…' 2000, 'Qinghai to build…' 2000). It is this grassland zone that constitutes the geographic focus of the present work.

A cultural crossroads (back to top)

For many centuries, Qinghai has been a borderland for at least four great cultural spheres: the Tibetan, Mongol, Hui, and Chinese empires or spheres of influence (Ekvall 1939, Lattimore 1951, Schram 1954, 1957, Stein 1972, Sinclair 1987, Chen 1990, Geoffrey 1993, Smith 1996). This amalgamation has translated into many different people groups being represented in Qinghai today. Except for four counties (Ledu, Ping'an, Huangzhong, and Huangyuan), all the counties and towns in Qinghai are nationally recognized autonomous areas, accounting for 98 percent of the provincial area (Wang 1994).

The main national minorities present in Qinghai today are the Tibetan, Mongol, Hui, Tu, and Salar people. The Tibetans in Qinghai include the Amdo, Golog, and Kham Tibetans, each group speaking a very different dialect or language (Ramsey 1987, Geoffrey 1993, Smith 1996). Mongols include the Oirats in Haixi, the descendants of a tribe that moved from Xinjiang and Central Asia to greater Tibet in the 16th century (the Oirat are also known as Kalmyks; they are a different group from the Khalkh Mongols of present-day Mongolia) (Schwarz 1984, Smith 1996). A second group of Mongols lives in Henan, the southernmost county of Huangnan prefecture, though these Mongols have adopted many local Tibetan customs and now speak Amdo Tibetan. The Hui are a Chinese people who converted to Islam several centuries ago. Although they do not have their own distinct language, dress, literature, or music, they are a clearly recognized cultural group based on religion and their own self-identification (Gladney 1998). Hui people often are Qinghai's main businessmen, traders, truck drivers, and sometimes, along with the Salar, wildlife poachers. Almost invariably the Hui also are the most numerous restaurant operators in Qinghai, as in Ningxia and elsewhere in China. The Tu people are thought by some experts to be the descendants of the Mongol Army which once ruled much of China, while others believe that they actually are the original, indigenous people of Qinghai (Schram 1954, 1957, Schwarz 1984). Chinese authorities in the Qing Dynasty encouraged the Tu people to serve as border guards to protect Xining and the surrounding region from Mongol and Tibetan invaders. Therefore many Tu communities were relocated to their present locations at the base of strategic mountain passes in the Datong and Laji mountains to the north and south of Xining, respectively. The Salar people are a small Muslim group that migrated from Samarkand in Central Asia to present-day Xunhua in the 14th century (Schwarz 1984, Ma and Stuart 1996). Finally, some Dongxiang and Baoan people also live in Qinghai, though both of these people are much more numerous in neighboring Gansu, and several decades ago many Kazaks moved from Xinjiang to Haixi prefecture in northwestern Qinghai (Schwarz 1984, Gladney 1998).

The Qinghai Han also are recognized as distinct from Chinese people elsewhere in the country, in their customs as well as in their language (dialect). According to Dwyer (1998), the local provincial dialect

> "is a compromise, non-standard Standard Chinese which *partially* incorporates the sound system and vocabulary of the Qinghai vernacular (*tuhua*) into Standard Chinese. It is a local adaptation of Standard Mandarin Chinese that enjoys quasi-official sanction in the local broadcast media and state enterprises (including educational institutions), which refer to it as *Qing(hai) Pu(tong)hua*, 'Qinghai's Common Language'. … The existence of Qingpuhua constitutes a statement about the local identity and the limits of central government control."

Qinghai's population is now approaching 5 million people, of which 42 percent is comprised of national minority people (Wang 1994, National Census Bureau 1994). According to the 1990 population census data, there are 916,000 Tibetans, 642,000 Hui, 164,000 Tu, 77,000 Salar, and 72,000 Mongols that reside in Qinghai. Tibetans thus comprise about 20 percent of the total provincial population. Almost 90 percent of Tibetans are engaged in agricultural activities such as crop cultivation, animal husbandry, and forestry (Qinghai Census Bureau 1994). There also are major differences between agricultural and pastoral Tibetans (Ekvall 1968, Geoffrey 1993, Smith 1996). Although no data are available on the breakdown between different agricultural occupations by nationality, the proportion of the total workforce (all nationalities combined) engaged in each occupation is known for each county. Thus it is known that the proportion of the total working population (with 95 percent confidence intervals) engaged in animal husbandry is 53.1 (±10.6) percent in the alpine grassland zone, compared to only 8.6 (±8.8) percent and 0.7 (±0.4) percent in the Qaidam Basin and Haidong district, respectively (Qinghai Census Bureau 1992). Clearly, then, most Tibetans – the most numerous people in the alpine grassland regions of Qinghai – are engaged in a distinctly pastoral livelihood. In terms of livestock, Qinghai has 22,101,500 head of domestic animals, excluding pigs. Of these, 5,751,000 are large livestock (cattle, yak, horses) and 16,350,500 small livestock (sheep, goats) (Drandui 1996).

As one of the more ethnically diverse provinces of China, Qinghai has a very special and unique character. Yet over most of its area – in its alpine grasslands – Qinghai remains largely a Tibetan environment, even though an environment that is also influenced by Han immigrants from eastern China, by local Qinghai Han, by Hui, by Salar, and other people as well. Almost all non-local (non-Tibetan) people are entrepreneurs and government officials, while those that work the land, the pastoralists, are almost invariably Amdo, Golog, or Kham Tibetan people.

Poverty alleviation and development (back to top)

In order to improve the well-being or "quality of life" of its rural population, the Chinese government launched a national poverty alleviation program in 1985 that focused on the country's mountain and pastoral areas, home to around 45 million people who still live in extreme poverty (Liu and Wang 1998). In line with this initiative, many provincial and regional governments have similarly made the alleviation of poverty one of their highest priorities (Liu and Wang 1998). Every province, including Qinghai, is now encouraged to include in its plans as many of the following poverty alleviation components as possible:

- the provision of small loans to poor families (micro-credit schemes);
- a reorientation from emergency relief to long-term development assistance;
- a focus on households (families) as basic units for assistance and training;
- the improvement of infrastructure (transport, communication, rural health, etc.); and
- resource protection and the establishment of resource-based sustainable development.

The specific implementation of these proposed priority actions, however, including their interpretation and application to each local context, remains the exclusive responsibility of provincial and lower levels of government. Thus many principles of ecologically sound and sustainable development and social equity may be missed as remote, poor, and sometimes less educated regions pursue rapid (short-term) economic development, often with little thought to the multitudinous factors that affect long-term sustainability. Overall, the alleviation of poverty (or income generation) is planned and implemented in China following a very specific administrative structure, at multiple levels, as illustrated in Figure 10.

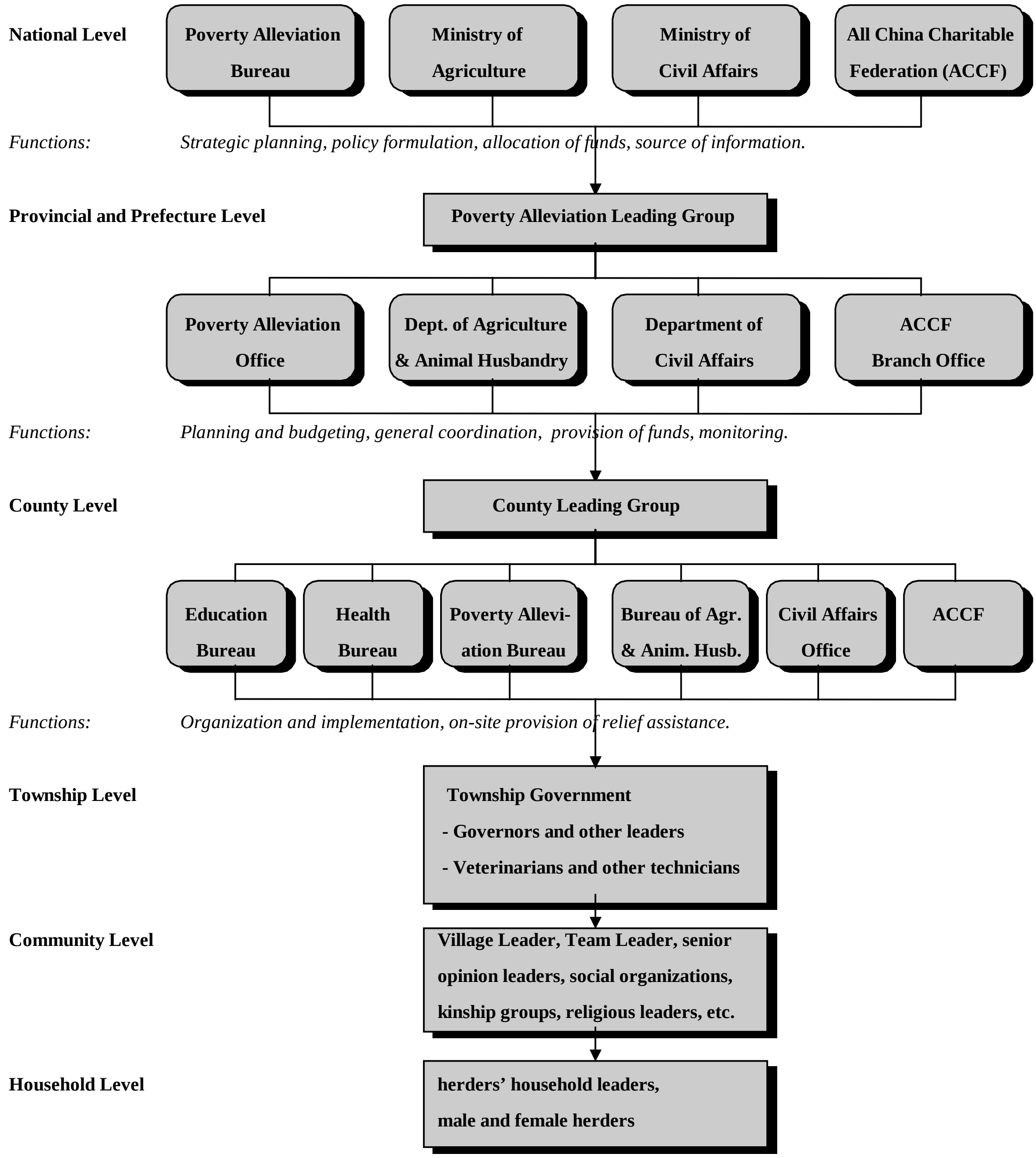

Figure 10. Administrative structure for poverty alleviation in pastoral areas of China (adapted from Liu and Wang 1998)

Although Qinghai covers 7.5 percent of China's territory, it accounts for only 0.2 percent of the country's total agricultural output, and thus ranks 26th among China's thirty provinces in terms of average rural net income (Ho 1999). Almost every development project in the province therefore has poverty alleviation as its main focus. This thrust is the case in agricultural as well as pastoral areas of the province. According to Liu Guanghe, a provincial vice-governor, the government is seeking international support for its poverty alleviation program as well as to invigorate the provincial economy, education, and environmental protection (Wu Y. 1997). Over half the counties and 221 townships in Qinghai are designated as poverty areas with per capita incomes of less than $ 70 USD per annum (Qinghai People's Government 1999). Even more townships are classified as poor at the provincial, prefecture, and county levels as well.

The Alpine Grasslands of Qinghai Province (back to top)

General development plans and priorities (back to top)

China's foremost priority, as already discussed, is to maintain overall social stability and national security. Furthermore, the most effective way to ensure overall stability is to engage in rapid economic development and poverty alleviation. In an extensive study recently published by the Tibetan Studies Center in Beijing, some of the country's foremost researchers explain:

> "If the majority of people in a region are in poverty and cannot help themselves, this *de facto* inequality will threaten overall economic development and social order will be difficult to maintain. … Backwards regions and people in poverty therefore should be supported as much as possible" (Dorje 1997).

The Chinese government therefore recognizes that "the foundation of … stability is farm [agricultural] land" (Gao and Chi 1997a). However, despite this, attention is given to the agricultural sector mainly for the benefits that can be derived for large urban centers, not for the rural areas themselves (Kelliher 1992). Furthermore, agriculture is still the weakest part of the economy. Some leaders believe that "if this trend continues, then not only will a solid foundation be lacking to ensure rapid overall economic development, but there also will be sharp social conflicts that will seriously influence national economic development and social stability" (Gao and Chi 1997b). Thus the pursuit of economic development and the alleviation of poverty in China are explicitly linked tightly with the pursuit of overall national stability.

A provincial leader in Tibet similarly emphasizes that "historical evidence [has proven] repeatedly that agricultural stability brings economic stability, with economic stability bringing national stability, and national stability enabling smooth promotion of reform and opening [and] faster development" (Holzner and Kriechbaum 1999). Although stability is important everywhere, it is even more important in minority areas where the cultural distance between the government and local people can be large. In such places, if the local population feels both political and economic disenfranchisement, powerless or without adequate sustenance or a satisfactory livelihood, then poverty could be the little spark that leads to vocal criticism and active discontent. This threat can be especially acute in remote mountain and pastoral areas of China where minority populations and poverty often coincide, areas that also may be situated in already sensitive border regions of China.

In pastoral areas, it also is recognized by herders and government leaders alike that habitat (or landscape) degradation is a key factor affecting people's wealth and livelihoods. To date, however, most attention has been given to potential "technical solutions" for this problem. On the other hand, very little attention has been given to the equally important social and ecological dimensions of grassland degradation. The main categories or types of development activities that are presently being pursued in Qinghai's pastoral areas are summarized in Table 3.

Table 3. Pastoral development priorities (or main types of development presently pursued) in Qinghai's alpine grasslands

Types of Development	**Short-term Goal(s)**	**Ultimate, Long-term Goal(s)**
1. The Household Responsibility System	private incentives	economic growth, social stability
2. Restructuring production (toward a "ranching" system)	commodities production (esp. meat and wool)	new market economy (changing demands), economic growth
3. The Four In One Scheme (or sedentarization)	social welfare	poverty alleviation, social stability
3.1. Building houses for nomads	social welfare	sedentarization, ease of governance
3.2. Building livestock shelters	livestock survival	poverty alleviation, social stability
3.3. Planting forage crops	livestock survival	poverty alleviation, social stability

Since it may be some of the types of development activities or policies described in Table 3 that are in fact causing the greatest or most significant changes in Qinghai's alpine grasslands, each of these categories will now be discussed in turn.

The Household Responsibility System (back to top)

The Household Responsibility System is a legal system (or contractual agreement) whereby individual families or households are made responsible for the land they operate and remuneration is linked to output (Gao and Chi 1997a, 1997b). Before this system was introduced, families simply had to meet government quotas and remuneration was not linked to production. According to Longworth and Williamson (1993), the Household Responsibility System

> "was first tried in the early 1960s [in Gansu]. The system began to take shape in Linxia Hui Autonomous Prefecture but in 1965 it was criticised and stopped. In 1979 when government policy was relaxed, the people in this prefecture quickly began to apply [the Household Responsibility System] once again. Indeed, the Linxia Hui Autonomous Prefecture, an agricultural area, was one of the first areas in all China to adopt [the Household Responsibility System] in 1979. The system was introduced in pastoral areas later than in agricultural areas."

This "responsibility system" clearly is the "most far-reaching and progressive factor in China's [modern] reform of the countryside… Through legal contracts families [are] made responsible for the land they [operate] and for the first time remuneration [is] linked to production. … In the past few years the contracting period [has been] extended [to 30 years] and property rights reform [now permits] the transference of land use rights" (Gao and Chi 1997a). Gao and Chi (1997b) describe the three major stages in China's agricultural reform, from the end of 1978 to 1994, as follows:

> "The first stage was from 1978 to 1984, when China set up and gradually implemented the contract responsibility system based on the household and with remuneration linked to output in the rural areas. The second stage was from 1985 to 1991, when China reformed the system of state monopoly purchase and quotas, and gradually lifted controls from the market and prices of agricultural products. The third stage was from 1992 to 1994, when the country started the transition to the rural market economy in an all-round way."

In Qinghai, like elsewhere in China, the basic land contract now lasts 30 years without change. However, if land is used for agricultural purposes, or if reforestation or grassland seeding is undertaken to decrease the rate of desertification, the contract period will be extended to 50 years. By the mid-1990s, 48 percent of winter-spring pastures and 42 percent of summer-autumn pastures already had been contracted to individual households, and, in some instances, to whole villages. Estimates of the total grassland area in the province range from 358,209 km^2 to 364,494 km^2, and estimates of the grassland area that is used regularly (or the "usable" area) range from 240,000 km^2 to 316,103 km^2 (Wei 1993, Ma et al. 1995). The overall proportion of grassland classified as winter-spring grassland and as summer-autumn grassland is almost identical in the province (Wei 1993). Land has been classified by type and quality (and assigned for different seasonal uses) based on "comprehensive zoning" surveys conducted in the early 1980s, and some pasture surveys date as far back as the 1960s (Lang et al. 1997).

At the same time that the Household Responsibility System was being promoted throughout the country, the Rangeland Law also was introduced. The Rangeland Law is an important legislation that affects all grassland areas in China, forbidding the practice of land uses that damage rangeland (see above). In this way the law relates closely to one of the more pressing challenges that the Qinghai government is attempting to address, that is, the perceived "contradiction" between livestock numbers and forage availability (Lang et al. 1997, Wang et al. 1992).

According to Liu and Wang (1998), speaking of the situation in Dari, the implementation of the Household Responsibility System generally has followed the following pattern:

> "During 1983-1994, the collective animals had been contracted to herder households, but the pasture was not. Since the pasture had … not been allocated to herders, there was a free access to the grass land, every herder want[s] their herd to graze on the luxuriant grass area, but there [are] no measures to protect them. After ten years [since] the decentralization, the environment was seriously deteriorated. … After 1994, … the winter-spring season pasture was allocated to herder households, and herders have started to manage them well… From 1994-1997, the summer-autumn pasture still [were] left as common goods. Starting from 1998, the summer-autumn ranch land is being allocated to herder households."

Thus a quasi-privatized, small-scale (household) livestock production system already has been introduced in most of Qinghai's grassland areas.

Restructuring production (toward a "ranching" system) (back to top)

Closely related to the issues of property rights and land contracts described above are the many other ways in which the government also is encouraging a shift from the extensive land use system currently practiced on the Tibetan plateau toward a more intensive form of grassland resource utilization. In this regard, many of the different types of development activities described below fall into the present category of a planned restructuring of the production system by means of government interventions and subsidies. These interventions or subsidies can take various forms from government support for poverty alleviation loans to building houses for nomads to the creation of artificial grasslands and massive fencing schemes.

Drandui (1996), for example, suggests that Qinghai's pastoral economy could be improved significantly by strengthening "grassland management." Liu and Wang (1998), Lang et al. (1997), Drandui (1996), Ma et al. (1995) and others suggest in particular that herd species composition, herd sex and age structures (with turnover rates geared toward markets), and the breeding and selection of livestock should become priority foci for action. Investment in infrastructure development (or "grassland construction"; see Gangcha County People's Government 1997) also is thought to be exceptionally important by most government leaders (e.g., building or improving animal shelters, fencing, winter forage production, communications, and transport routes). Underlying most of these changes, however, is an assumption that the main (if not sole) purpose of animal husbandry is to produce commodities such as meat and wool. This focus is significant for regional to national level economies, but may be somewhat less important for local, mainly Tibetan economies where livestock also fulfill many other significant roles.

The Four-in-one Scheme (back to top)

The most important development program undertaken in the name of poverty alleviation is the Four-in-one Scheme, a nationally sanctioned program adopted widely throughout China's pastoral regions. As one international development agency explains, this scheme aims "to provide each family with a permanent winter house, a barn to protect the animals, grassland which can be used to grow winter feed and fencing their own land" (Christian Action 2000). This scheme also has been described as comprising "four countermeasures for enhancing the risk [management] competence of the households" (Liu and Wang 1998). Theoretically, 50 percent of the investment is paid by the government and 50 percent by the poor households themselves (Liu and Wang 1998), although in reality the government sometimes subsidies over 80 percent of the total costs (Schaller 1998).

The Qinghai government spent $ 33.75 million USD between 1986 and 1990 to fence grasslands, build livestock sheds, and implement a variety of other (so-called) grassland improvements (Drandui 1996). The government also has invested considerable effort and funds in order to help herdsmen adopt a sedentary lifestyle ('Old ways …' 1994).

The Four-in-one Scheme is recognized to contribute positively to strengthening grassland management and improving infrastructure in Qinghai's grassland areas, and thus to strengthen "sustainable development of animal production" in the region (Lang et al. 1997). The real long-term impacts of changing regional land use patterns, however, are not so easy to predict, and may not be as benign as assumed. The shorter-term changes, however, particularly improvements in living conditions, are positive and easy to grasp.

Building permanent houses for nomads

One of the four components of the Four-in-one Scheme is to build permanent winter houses for pastoral people. Now over 50 percent of herders in Qinghai are said to have adopted a sedentary lifestyle, or to have "settled down" (Yan et al. 1994). This is despite the fact that, traditionally, Tibetans neither had fixed sheds for their herds nor houses for themselves (Liu and Wang 1998). Winter houses are meant to help protect them in times of snow disasters and to improve general living conditions (Liu and Wang 1998).

One Tibetan social scientist found that

> "many ethnic Tibetan herders have settled into winter quarters where they [spend] three or so months every year…. Young Tibetan adults appreciate the winter food stocks for the animals and the improved access to medical care and education their children have in the winter quarters. Older Tibetans [however] dislike the winter settlements, seeing them as a break with Tibetan traditions. … The old people and the children remain in the winter quarters for schooling when the younger adults move out and travel with herds during the warmer months" (Environment Science and Technology 1998a).

Nearly all the technological improvements introduced to Qinghai's pastoral areas since the adoption of the Household Responsibility System in the 1980s focus on activities or constructions on the privately managed winter grazing area (Cincotta et al. 1992). Overall, the summer ranges now tend to receive much less attention and active management than the winter pastures, although the greatest risk of overgrazing is present in summer pastures where livestock graze the vegetation during the short active growing season. Building houses removes both attention and scarce financial resources from range management activities in winter and summer pastures, and also increases the probability of year-round grazing (with concomitant resource degradation) in the vicinity of the new fixed structures. This latter risk is common to all the components of the scheme.

Livestock shelters, forage crops, and grassland fencing

Livestock shelters, around 40 m^2 each, help to protect herders' livestock from the normal winter cold and from the periodic snow disasters that affect the Tibetan plateau (Liu and Wang 1998). According to Lang et al. (1997) animal shelters are proven to reduce energy loss in winter and hence to increase adult live weight (in some experiments by 2.1 kg), to increase lamb survival rates (by 11.7 percent) and to reduce mortality in adult sheep (by 4.5 percent).

Where winter forage crops are grown, they are planted on one-third to two-thirds of a hectare for each household (Liu and Wang 1998). It also is planned that around 20 ha of grassland will be fenced for each household so that they can harvest hay or graze their livestock in winter (Liu and Wang 1998). In total, fenced grassland covers an area in Qinghai of around 7,500 km^2, virtually all of it enclosed since 1985 (Drandui 1996, Yan et al. 1994). Although it is mainly winter pastures that are enclosed at present (Schaller 1998), in the long-term fencing is planned for winter and summer pastures alike. Fencing is used both for range management (livestock herding) and to help rehabilitate degraded vegetation and thus to restore grassland primary productivity (Lang et al. 1997). Furthermore, the rate of grassland fencing in Qinghai is likely to increase rapidly in the near future. The Japan International Cooperation Agency, for example, is considering a large $ 300 million USD development aid package that aims to strengthen pastoral development and grassland construction in Qinghai, with a large portion of the funds to be used for extensive grassland fencing.

Grassland improvement, grassland restoration (back to top)

Many factors are known or assumed to cause pasture degradation in the Tibetan plateau region. Among the most important or frequently stated examples of factors contributing to this degradation are

- • high stocking rates (Western Resources and Environment Research Center 1994, Miller and Craig 1997, Environment Science and Technology 1998b, Liu and Wang 1998, Ho 1999);
- • changes in grazing patterns, such as decreased mobility and flexibility in pastoral practices (Williams 1996, Miller and Craig 1997, Holzner and Kriechbaum 1999);
- • increasing aridity and associated changes in plant communities (species composition) and hydrological cycles (Miller and Craig 1997, Lang et al. 1997, Chen et al. 1998);
- • agricultural reclamation (plowing and conversion of grassland into cropland) (Western Resources and Environment Research Center 1994, Environment Science and Technology 1998b, Ho 1999);
- • forage competition and physical disturbance caused by small burrowing mammals and insects (Drandui 1996, Liu and Wang 1998);
- • resource harvesting such as the removal of turf (Holzner and Kriechbaum 1999);
- • resource management strategies with a lack of collective action (Ho 1999);
- • traditional ideologies that focus almost exclusively on the numeric growth of livestock herds (Lang et al. 1997);
- • inadequate extension services from technicians to pastoralists (Environment Science and Technology 1998b); and
- • a large a human population, vis-à-vis the underlying resource base (Ho 1999).

According to Wang et al. (1992) as well as the majority of leaders and researchers in Qinghai, the "contradiction between livestock and herbage is serious" and is increasing in severity. In order to counteract this loss of productivity, several measures are being taken in Qinghai's pastoral areas. Almost all of these measures, however, attempt to address the mismatch between the availability of grassland vegetation and the forage and nutritional requirements of the current livestock population exclusively from the perspective of too little vegetation. The "contradiction" (mismatch) between forage availability and livestock numbers rarely is addressed from the equally plausible perspective of too many animals in a fragile and finite environment.

Several of the main factors contributing to grassland degradation can be subsumed into a broader category termed “overgrazing.” This category includes more than livestock numbers. As Holzner and Kriechbaum (1999) again make clear, the causes of overgrazing are

> “complex and varied, and [are not so much] ecological but cultural, social and economic [and include an] increase of human population; changes in the pastoral system; loss of control or abandonment of the equilibrium between herd size/pasture size; change or abandonment of the seasonal grazing pattern (induced by changing political or administrative boundaries, or by stopping the migrations of nomads by low or economic stimuli like building houses).”

In order to avoid confusion about the exact meaning or implications of the use of the term “overgrazing,” these factors have been included in their own right in the list (above) of the contributing factors to grassland degradation.

The main activities undertaken by the government to improve natural grasslands or to restore degraded land include the “construction” of artificial and semi-artificial (seeded) grassland (Wang et al. 1992, Gangcha County People’s Government 1997) and the wholesale division, distribution, and fencing of the grassland, both in relatively small winter pastures as well as fencing larger tracts of land (Drandui 1996). Altogether over 8,000 km^2 of grassland was seeded between 1986 and 1994 and, as has already been noted, almost as much land was fenced during the same period (Drandui 1996).

The other main category of grassland improvement or grassland restoration activities in Qinghai (and elsewhere on the Tibetan plateau) is “pest control.” This issue will be discussed at greater length in the next section. The main purpose of these control activities is to increase the amount of available forage for livestock, whereas the removal of important elements of the Tibetan plateau ecosystem (such as the pika, the main target of numerous control programs in Qinghai) will in the long-term instead lead to a decline in overall grassland productivity and ecosystem resilience. Indeed, a local overabundance of pika is rather a symptom of, and not the cause of, overgrazing (Liu and Wang 1998, Holzner and Kriechbaum 1999, Smith and Foggin 1999).

Finally, it also has been suggested that the low productivity of the Tibetan plateau could be counteracted (improved) through fertilization (Lang et al. 1997). Scientists at the Tibetan Academy of Social Sciences (TASS) in Lhasa and at the Northwest Plateau Institute of Biology (NWPIB) in Xining also agree that "fertilizing the grassland to increase the primary productivity could be an important element in sustainable development." However, the practicality of fertilizing immense tracts of high-altitude grassland (in terms of effort, expense, or efficiency) has not even been discussed. Furthermore, and perhaps most importantly, several of these scientists simultaneously affirmed that "the emphasis in high and cold areas must [always] be to preserve the existing grassland" because it is simply "not feasible to grow high quality grass from seed in this environment" (Environment Science and Technology 1998b). The simple reason is that, unlike many other pastoral systems, the Tibetan plateau system is temperature-limited, and there is little, if anything, that one can do to change this condition (Scott and Kong 1990).

Disaster prevention and "pest" control programs (back to top)

One of the fundamental characteristics of the Tibetan plateau is its severe and unpredictable climate. The type of climatic event that is most detrimental to pastoralists' well-being is the periodic winter snowstorm that blankets large portions of the plateau. Up to one-third of a region's livestock can be lost in a single season, varying at the household level from minimal losses to 100 percent loss of livestock (Foggin 1998b, Liu and Wang 1998, Environment Science and Technology 1998c). Snowstorms can and often do force herders to change from a pastoral way of life to a life of begging. Clearly, risks are now very high for pastoralists, as indeed has always been the case for pastoralists living on the plateau.

All other disasters tend to pale by comparison and are considered mainly with regard to their relation to past or possible snowstorms. Both direct competition for forage and the loss of forage due to land degradation affect livestock winter survival and therefore are serious concerns to pastoralists and government officials alike. Less forage means less energy intake by animals and poorer body conditions. In a harsh winter, weak animals have a much greater likelihood of dying from a combination of exposure to the cold and starvation.

Other “disasters” or perceived risks in the Tibetan plateau region include an overabundance of small mammals in some areas, particularly pika and zokor; insect infestations; grassland fires; and animal losses due to disease, wolf predation, and theft.

Preparations for snowstorms

Herders and government officials both rank snow disasters as posing the greatest risk in terms of economic losses and overall negative effect on the population (Liu and Wang 1998). Liu and Wang (1998) also note the differential impact of snow disasters on yak and sheep according to the timing of snowfall: “If the snow disaster occurs in winter, yak is the first affected animal because yak can not unearth the snow to get the grass, [but if] the snow disaster occurs in spring, sheep is the most serious suffering animal because the ewe give birth to lamb in this season.”

Furthermore snow disasters and poverty are a recurring theme in the lives of many pastoralists. For example, in Dari County nearly 25 percent of families that have lost all their livestock and are subsequently assisted by the government (i.e., given new livestock) “will [later] be returned to poverty” (Liu and Wang 1998).

The main way in which the government is assisting people in pastoral areas to prepare for snow disasters is to encourage and facilitate implementation of the Four-in-one Scheme: building houses and animal shelters, planting winter forage crops, and fencing the grassland. Many other “buffering” mechanisms are encouraged as well, such as household and regional economic diversification, the formation of self-help family groups and improved extension training and other community social services.

Pika and zokor control programs

According to Drandui (1996), nearly 75,000 km^2 of Qinghai’s grassland was “controlled” (poisoned) between 1986 and 1994. The main target species of poisoning campaigns on the Tibetan plateau are pikas (not a rodent, but a lagomorph) and zokors. However, it is debatable whether small fossorial mammals are the primary cause of grassland degradation (the main reason given for conducting these campaigns) or rather one of the symptoms of this degradation. The repeated observation that "[in] undisturbed pastures pikas are practically missing [but in] pastures where … turf has been opened or destroyed by overgrazing, cutting or burning … they occur in high densities" (Holzner and Kriechbaum 1999) leads us to the latter conclusion (Smith and Foggin 1999). Furthermore, not only are the reasons given for control programs in question, the short- and long-term economics of such programs and their likely deleterious effects on other components of the local biodiversity (and on people) raise many concerns over their continued implementation (Smith and Foggin 1999).

Insect infestations and grassland fires

Other natural disasters include insect infestations and grassland fires. One species of caterpillar in particular is said to cause serious pasture degradation (Holzner and Kriechbaum 1999) and therefore is poisoned when possible. These caterpillars are said to be moving further northwest in Yushu prefecture each year, having originated in recent years in neighboring Sichuan. In the past natural events such as hail storms and local predators (e.g., corvids) sometimes have exterminated them in some regions (interview with an elderly pastoralist, July 1998).

Grassland fires also are known occasionally to consume valuable forage resources. Grassland fire prevention work (presumably awareness campaigns) have been reported in the northeast of the province (Gangcha County People's Government 1997), and a grassland fire in the southwest of the province, purportedly a serious fire which destroyed a large area of grassland, was reported in the spring of 1999. In the latter case, township and county officials were actively involved in the fire fighting, and an *ad hoc* monitoring and information network was quickly established since fires are said to be a grave risk in the spring when grassland vegetation is very dry and high winds are common.

Animal disease, wolf predation, and animal theft

Finally, although animal losses due to disease, predation, or theft are not disasters in the same sense as regional snowstorms, they nonetheless can represent a significant degree of risk to herders' livelihoods.

Although improved veterinary services (including extension training) would reduce disease and parasites in livestock, thus increasing both their productivity and the marketability of animal by-products, herders do not consider the risk of livestock diseases to be very important. Most government officials and technicians, however, disagree with the herders' assessment.

Economically, wolf attacks can take a great toll on livestock production, even greater than the economic losses due to animal thefts. Yet it is the latter that rates highest in herders' own perception of risk. This perception is probably due to the greater psychological effect that animal theft, and the social stress that it reflects, has on pastoralists. In Table 4, Liu and Wang (1998) report the relative risk attributed by government workers with herds (herders) and without herds (non-herders) to snowstorms, disease, predation, and theft.

Table 4. Rank comparison of risk perception by different government officials (Liu and Wang 1998)

Risks	County and township officials without their own herd	Township officials with their own herds
snow disaster	1	1
animal disease	2	4
wolf predation	3	3
animal theft	4	2

To combat all these risks, the government has adopted a simple, four-point risk planning strategy (Liu and Wang 1998): (1) to organize local meetings on risk management before winter; (2) to prepare fodder, medicines, clothes, and other emergency relief materials before winter; (3) to organize coordination meetings for emergency relief; and (4) to attempt to predict snow disasters in advance.

Agricultural production (crop cultivation) (back to top)

Until recently agriculture often was considered the most important direction for rural development in China, even in arid and semi-arid grassland regions. Although agriculture could be justified in part as a response to the provincial and national drive to diversify and strengthen local economies, it is not an ecologically sound option for the high grasslands of the Tibetan plateau. Recent history has confirmed the fact that agriculture (crop cultivation) is not sustainable in many areas of Qinghai, and it was even decreed by Premier Zhu Rongji in the autumn of 1999 that one-third of Qinghai's cultivated land should (must) be returned to more productive use as natural or semi-natural grazing land in the near future (personal informant, 25 November 1999). The Premier's visit to Qinghai came as the country now shifts its focus from the earlier development of its coastal provinces to the development of its vast interior provinces ('Development of West…' 2000, 'Top advisors…' 2000).

Indeed, vast areas of Qinghai's grassland have been converted to agriculture in the past. In the Qinghai Lake area alone, "[from] the end of the 1950s to the 1960s people began to plow endlessly. The total plowed area rose to [155 km^2] although only [29 km^2] were actually used. Most of the plowed land was quickly deserted. In the 1980s about [20 km^2] of plowed land was restored to grassland [but] most still does not have much vegetation" (Western Resources and Environment Research Center 1994). In the province as a whole, considerable land was cultivated soon after Liberation (in 1949), and the total cultivated area was rapidly enlarged to 1,333 km^2. Over three decades later, this area had risen to at least 5,789 km^2, and another 4,773 km^2 was classified as "reclaimable wasteland" (Zhu 1989). Researchers at the Northwest Plateau Institute of Biology (NWPIB) consider that the policy of "increasing food crop production during the late 50's and early 60's … by inappropriately demanding the conversion of grassland into cropland [was a serious] ecological disaster." According to their estimates, "between 1956 and 1959, Qinghai Province turned 670,000 ha [or 6,700 km^2] of grassland into cropland." However, most of this cropland "was quickly abandoned because of inadequate water supply and temperatures that are inadequate for crop growth. Thirty years later, these abandoned lands have not yet recovered" (Environment Science and

Technology 1998b). Overall, as Heberer (1989) notes, Qinghai has "suffered considerably at the hands of [the immigrants] who attempted to convert pastures into tillable fields. Pastureland retreated, the desert advanced, and the ecological balance was seriously disrupted."

Unfortunately not everyone has learned from experience. Even one of China's top economists has suggested recently that yet more "wasteland" should be "opened up" and privatized. He is of the firm opinion that "increasing the amount of cultivated land should be the focus for achieving agricultural growth and for developing the market economy [and that] policy and financial problems can be solved by offering outright land ownership or permanent use of the land to whomsoever transforms wasteland into cultivated land" (Baokan 1998). Fortunately, given China's system of governance, this has been contradicted (and hence counteracted) by Zhu Rongji's position, made public in October 1999, on the real value of Qinghai's grassland and on the potential harm caused by inappropriate cultivation (also see 'China to reduce…' 2000).

County and township-level economic diversification (back to top)

As elsewhere in China, the development of local economies is extremely important in Qinghai. Already over one-third of Qinghai's villages have set up various kinds of business enterprises (Ma et al. 1995). Further, "the central and local governments have [specifically] encouraged the semi-nomad herders [as well] to broaden their economic activity without increasing the intensity of grazing" (Environment Science and Technology 1998b). There are very few positive suggestions, however, of economic alternatives to livestock grazing. The most promising avenue may instead lie in developing further the processing (value-adding) and marketing sectors of the animal husbandry industry in Qinghai. Special attention should be given to building local capacity in the processing and marketing sectors and to developing local cooperatives and other social organizations (Liu and Wang 1998).

Forming collective economic groups (cooperatives) (back to top)

Collective economic groups (or cooperatives) are an example of an approved type of social organization. Pastoralists are being encouraged to form such groups at the township level. In this way, more expendable money is supposed to be made available and overall capital investment is expected to rise in the countryside. Already over $1.5 million USD have been invested by such cooperatives around the province (Ma et al. 1995).

Pastoralists also are encouraged to join together, several families per group, to jointly undertake in a variety of different animal husbandry practices. It is assumed that “consolidating herds [will] ameliorate hardship during bad snow spells. Therefore … nomads [are encouraged] to form five to eight family clusters with [joint] responsibility for livestock and grazing land; with common interest, they can help support each other and prevent grassland degradation” (Environment Science and Technology 1998b).

Further, similar to the discussion above on economic diversification, local cooperatives can also help with marketing since there are few non-governmental organizations or any other means for local herders to get fair prices on the market (Liu and Wang 1998). Herders usually do not sell their products in the city, but rather to Hui nationality middlemen. They are often unaware of current market prices. Establishing such social groups could help to increase economic returns and other benefits to pastoralists (Environment Science and Technology 1998a).

Provision of community social services (back to top)

The government also desires to improve the provision of social services in its remote pastoral areas. Already more than 900 local community service centers (of which 306 are veterinarian centers) have been established in townships throughout the province, in addition to 140 “cultural centers” and 19 larger community centers in the counties (Ma et al. 1995). Real and effective “extension” of technical and other information from these centers to the pastoralists is an area of special concern (Liu and Wang 1998). Recently, more participatory approaches to traditional extension work have begun to gain acceptance in the province, such as with the Qinghai Livestock Development Project’s participatory workshops that were held in Guoluo in October 1998.

Provision of basic education and adult literacy (back to top)

Finally, providing basic education also is a priority in China, including in its poor, remote areas. The level of education and literacy rates in Qinghai's pastoral areas both are extremely low, much lower, for example, than the national illiteracy rate of 22.8 percent (Zhang and Huang 1996).

The main purpose of education in China, however, remains simply "integration" into national culture. Meng et al. (1999) give a quick overview of the history of education in Qinghai and state clearly its main purpose. According to them,

> "modern education only began to develop from the 1950s, although for a very long time there were only mobile schools in the region. …After the founding of New China, the government formulated the principle that 'the main purpose of education in the areas inhabited mainly by national minorities is to train cadres for the minority nationalities.'"

Meng et al. (1999) also state:

> "It is common knowledge in educational sociology that education facilitates social integration. … Education can help to integrate a particular culture in a national minority area into the universal Chinese culture, that is, education helps to eliminate narrow-mindedness and makes it easier for people to accept the mainstream culture of the Chinese nation. … The development of education in these areas will therefore accelerate their social integration with the mainstream in terms of both ideology and cultural psychology. … Education … initiates changes in the social structure. Obviously, such changes tend to enhance the homogeneity and compatibility of these areas with mainstream society, thus facilitating the integration of native areas with the hinterland."

Obviously, along with the other priority development activities described above, the government gives a high value to education. Two important challenges, however, are that parents in pastoral areas tend to have little enthusiasm (compared with farming areas) to send their children to school (Meng et al. 1999), and that the Chinese education system in general is not designed to encourage independent thinking.

Summary (back to top)

Many different factors affect the protection and conservation of Qinghai's alpine grasslands. These include the nation's socio-economic context, its political concern for social stability and security, and its commitment and capacity for environmental protection; the ecology and environmental conditions of the Tibetan plateau as a whole; the environment and cultural characteristics of the province; and the specific types of development that the government already is pursuing or planning for Qinghai's alpine grassland areas, from property rights policy to risk management and disaster avoidance to the underlying goals for education and literacy. All these factors contribute directly and indirectly to the potential for success of conservation measures designed to protect the native biodiversity of the Tibetan plateau in Qinghai, China. With these realities in mind, and with conservation recommendations duly tailored around them, there will be a much greater likelihood of success since the more appropriate (or relevant) the recommendation, the more likely it will be accepted, adopted, implemented, and continued in the long-term. Ultimately, sustainability depends on gaining an appropriate understanding of ecology and culture, both traditional and modern, not only on (so-called) ideal solutions that may be perceived as detached from reality by relevant government decision-makers or local communities. In the next chapter, I will examine the natural and cultural characteristics of one specific grassland region, the Qinghai Lake area, in an attempt to better understand how the various socio-economic and other contexts described in this and the previous chapter are translated into the real world.

CHAPTER FOUR

Pastoral Landscapes in the Qinghai Lake Area: Current Developments and Trends

Introduction (back to top)

Although the Qinghai Lake area was well known to many geographers and explorers of the 19th century, it has in recent times remained in relative obscurity outside China. Qinghai Lake, which means “Blue Sea” in Chinese, is also known by its Mongolian and Tibetan names with the same meaning, Kokonor and Tso Ngongpo, respectively. The larger surrounding region is known as Amdo, the name of the main Tibetan group that lives throughout much of the northeastern part of the Tibetan plateau. Amdo includes a large portion of present-day Qinghai and smaller areas of Gansu and Sichuan provinces.

This chapter – the first of several analytical chapters – begins by reviewing the physical geography and history of this little studied region of Inner Asia. It then proceeds to examine several Tibetan pastoral landscapes from a variety of geographic perspectives. Finally, the inter-related issues of power, poverty, tradition, and modernization are discussed, with an emphasis placed on the social and environmental impacts of modern development activities pursued in the Qinghai Lake area. The observations in this chapter include both the relevant literature, from Chinese and international sources and from published as well as unpublished (gray) literature, and my own experiences and observations (1994-99) of the pastoral landscapes of the Qinghai Lake area.

The primary method adopted in this chapter is landscape observation and analysis. In social geography, landscape analysis is the complex endeavor of observing and making inferences from the study of whole landscapes (Meinig 1979). Most landscape studies are descriptive in nature and focus primarily on physical or material elements (Cosgrove 1984). Furthermore, most landscape studies attempt to explain causality by linking temporal and spatial dimensions, but they rarely include any predictive component (Hägerstrand 1985).

To determine how present activities (e.g., pastoral development activities) will affect the local to regional landscape in the future remains an enormous challenge. Indeed, as Skånes (1997) clearly explains, any attempt to "predict the effects of political and socio-economic decisions on the physical landscape" must be made with extreme caution because many actions can "lead to events that [are] unforeseen, resulting in even greater complexity within the landscape." Nonetheless, any tool or analysis that can help to better understand current trends should be welcome as it will increase the probability of making sound development decisions in the future.

As people and governments pursue specific objectives such as economic growth, state security, environmental protection, or cultural preservation, even simple models of possible future scenarios can assist in choosing more sustainable courses of action. The simplest model to envisage is the course of inaction (Davidson and Dence 1988), which assumes that past and present trends, environmental and otherwise, will continue in the future. In this chapter, landscape observation and analysis is used to examine the present social and environmental conditions in the Qinghai Lake area, and thus to explore the possible not-too-distant future of its alpine grasslands and pastoralists, both locally and in the greater Tibetan plateau region as a whole. Based on the present observations, the impact of status quo development is discussed in the context of Qinghai's alpine grasslands (i.e., the future scenario that could result from inaction, or from a general inertia in the development trends currently being promoted in the province). Overall, the continued intensification of land use and reduction in herders' mobility is likely, and this has many potential dire consequences for grassland quality and ecosystem integrity. In contrast, economic diversification and the promotion of activities and types of pastoral production that increase mobility and the ability of pastoralists to respond rapidly to short-term environmental changes could increase the overall long-term productivity of the grasslands. Change is occurring on the Tibetan plateau, but the future is still uncertain, and it will depend largely on whether development stays its present course or if it chooses to better adapt itself to the ecological conditions of the Tibetan plateau.

Landscape observation and analysis (back to top)

What exactly is meant by the term “landscape”? Sauer, a pioneer of landscape studies since the 1920s, has influenced the discipline perhaps more than any other person (Sauer 1924, 1931, Leighley 1962). Significantly, Sauer promoted the notion of man as separate from nature, a view that has become ensconced in the popular understanding of landscape. This can be seen, for example, in the common distinction made between natural landscapes “untouched by man,” and cultural landscapes that are the result of “various cultural factors” (Keisteri 1990). This duality has been maintained for decades and often has led to a false division into discrete social and natural realms. This division can be observed in many disciplines, and also in the clear partition made between the “social” and the “natural” sciences (Wilson 1998). Fortunately, a more integrated view of landscape has begun to emerge, an understanding, or at least an acceptance, that there really is no such thing as “a purely cultural landscape … since nature provides the foundation for human activity,” and that, simultaneously, there is “no such thing as a purely natural landscape [since] human influence has become global in its scope” (Keisteri 1990). Skånes (1997) similarly argues that “natural and cultural landscapes are not mutually exclusive. Instead, the cultural landscape is [simply] superimposed on the natural [landscape] in layers of varying transparency and degree of amalgamation, hence [both] sharing the same space without canceling each other out.” Clearly, then, we should adopt an integrated view of landscape. Understood in this way, that cultural elements in the landscape do not negate but rather build upon the natural elements, Cosgrove’s (1984) definition of landscape attains its fullest and richest meaning: “landscape is [simply] a consequence of [the] collective human transformation of nature.”

An examination of several other definitions helps us to expand even further our understanding of the notion or concept of landscape. In the context of a historical presentation of the cultural geography of China, Tuan (1970) depicts landscape as “the tangible context of man’s association with the earth.” The historical geographer Roberts (1987) explains how

> “each generation inherits a landscape [and] uses [it], changing it, adapting it to new needs, new demands, so passing it through a filter of use. Thus the inherited landscape … will contain a mixture of features, some of them relatively old, some relatively new, and by

> adding some completely new elements and changing or wholly destroying inherited elements, each generation bequeaths the present to the future."

Skånes (1997) draws attention to the importance of spatial scale, stating that "given a long-time perspective and a [regional] scale, the natural forms and features of landscapes might be dominant, whereas on a shorter time perspective and local scale, human impact might dominate the landscape organization." Finally, there is also a growing interest on the part of some cultural anthropologists (Bender 1993, Hirsch and O'Hanlon 1995) and historians (Schama 1995) in symbolism and psychology in the landscape, and the underlying processes that they may reveal (Cosgrove 1984, 1985, Ley 1987, Cosgrove and Daniels 1988, Norton 1989, Barnes and Duncan 1992).

The study of psychological landscapes in particular is critical. Indeed, even the simple recognition that psychological landscapes exist helps to better understand many of the root causes and fundamental processes underlying landscape change. As Keisteri (1990) explains, "changes in values are reflected in cultural landscapes [and] the alteration in values in people's minds will lead in the long term to changes in their activities, and in this way to more pronounced changes in the visible landscape." Thus ideas and other psychological factors – whether it be people's values, their mindset, or political ideology – also are a part of the whole landscape, the sum-total of what has been inherited from previous generations and will be presented to the next (Roberts 1987). Clearly, then, a variety of unseen (psychological) factors must be considered to understand the present physical landscape. These factors also are critical to predict and to help direct the future of these same physical landscapes.

Skånes (1997) is particularly helpful with the "how to" of landscape observation and analysis, especially in his discussion of the "generative forces" that have built the landscape that we now observe:

> "By using time as a vertical process, an inherent chronology is attached to the landscape structure, regardless of the type of objects studied. This chronological perspective gives valuable information not only about the quantity and age, it also provides data on the qualities of elements in the present-day landscape, in terms of former functional relationships among present-day fragmented patches, vegetation successions, and continuity of land use. Hence, a retrospective time perspective is essential in the interpretation of potential biodiversity and cultural aspects of landscapes. With the focus

> placed on origin and evolution, a retrospective method provides the theoretical means to reconstruct the past by regressing from the relatively well-known present (Norton 1989). Only when the original functions of ecological objects in the present-day landscape are known do we have the knowledge to preserve and manage them sustainably for the future."

Thus, in studying the landscape in order to predict and better manage the future, we can (and perhaps must) integrate both the natural and the cultural, the material and the psychological, and the past as well as the present in a holistic study of the observed (studied) landscape. In our attempt to decipher the complex generative forces that have been at work to shape the present-day landscape, we simultaneously increase our ability to recognize those factors that likely will have an important role in the shaping of the environment of tomorrow.

The emergence of a new mixed landscape (back to top)

An important premise of this chapter (and of this dissertation) is that Tibetan pastoralists do not live in isolation from and uninfluenced by their Han Chinese neighbors. Despite this fact, only "model type" Tibetans are portrayed in most socio-cultural studies of Tibetan people. There has been very little research published on the Tibetan people, on their pastoral livelihood, or on their environment that explicitly considers cultural interaction with Han Chinese as part of most Tibetans' normal life (but see, e.g., Ekvall 1939, Clarke 1987, Goldstein and Beall 1990). This general oversight has had the effect to relegate many studies to an outdated "noble savage" genre, or at best simply to render such studies nearly irrelevant in relation to the "real world" issues discussed here. Or, put differently, there are few studies on modern Tibetan life in China – whether an examination of their culture, their environment, their livelihoods, or their hopes and aspirations for the future – particularly with reference to the present-day realities of China: its huge population and geography, its multi-ethnicity, and its need and desire to rapidly become a "more developed nation." The two background chapters of this dissertation (chapters 2 and 3) have attempted to shed some light on these realities.

Starting with the work of the renowned explorer-ethnologist Stein (1972), three main "types" of Tibetans are identified in terms of geography, traditional culture, and livelihood. Specifically, every person in cultural Tibet is said (by Stein) to belong to one of only three possible categories: (1) pure pastoralists; (2) pure agriculturalists; and (3) semi-pastoralists or semi-agriculturalists (the latter being people who either individually practice or whose families practice a combination of pastoralism and agriculture). In Stein's (1972) own words:

> "First, and distinct from the remainder of inhabited Tibet, there are the great stretches of grassland where herdsmen with their tent-dwellings range over a given area. In the north and north-east, particularly, there are no trees, just grass and, in the way of animal life, the wild yak and [wild ass]. Domesticated animals comprise the yak, yak-and-cow hybrids, goats, sheep and Mongolian ponies. From the region north of Saka in the west as far as Koko Nor or Amdo in the east such conditions are the general rule. … Against this type, there are a few regions where there is no sign of grazing or stock-breeding, only cultivation: the Gyamda district of Kongpo, the Kyichu plain, and indeed such other plains as there are. Nearly everywhere else, inhabited places extend down valleys in zones corresponding to the altitude, with pastures [on] upper slopes and fields chiefly along the valley bed."

While each of these categories has merit, no individual or community in present-day China can be represented accurately as living independently of or untouched by national affairs. A fourth type of landscape must therefore be considered, one that is neither purely Tibetan nor purely Chinese, namely a mixed Tibetan - Chinese landscape.

Everywhere in the Qinghai Lake area, and in most other parts of the Tibetan plateau as well, immigrants from elsewhere in China have begun to settle (Heberer 1989). And where they have not settled in person, they nonetheless still play an important (if not paramount) role in administration, decision-making, and generally guiding the future. Thus, very little if any of the Tibetan plateau remains a purely Tibetan landscape. It is this emerging, mixed cultural landscape that forms the socio-cultural focus of both this chapter and this dissertation as a whole.

An urgent need for environmental protection (back to top)

Finally, before turning to a more detailed description of the Qinghai Lake area, there is one more crucial backdrop to this study: the urgent need for grassland environmental protection. Many independent research programs have concluded that the current productivity of Tibetan plateau rangelands is around 30 percent less than the productivity measured only two decades ago. From 1949 to 1994, the livestock population in Qinghai increased drastically and in some areas overgrazing rates increased from around 12 to 103 percent (Long and Ma 1997). In one comprehensive study of land use which investigated both the social and ecological situation of over one hundred sample villages in Hainan prefecture, a relatively productive area of the plateau south of Qinghai Lake, Lang et al. (1997) explain in detail their findings:

> "Degraded areas of temperate grassland, of alpine grassland, and of temperate desert grassland are 45.12 %, 33.56 % and 32.28 % of their respective total utilizable areas. The degradation of these types of pasture not only causes enormous loss to the prefecture's animal husbandry, but also causes, on a large scale, the desertification of the land, finally leading to the deterioration of pasture environment. ... Pasture loss caused by desertification is the most wide-spread form of degradation and is increasing fast. ... Comparing the result of sampling on the grassland in Changmu township, Guide county, with that sampled at the same site 15 years ago, it is astonishing that the above-ground biomass decreased by 73.3 %, of which the Graminae decreased by 71.1 %, Cyperacae decreased by 79.5 %, legumes decreased by 93.6 %, whereas toxic plants and weeds increased 5.6 times. Pasture degradation increasingly threatens the human way of life and human production activity. The grazing system is getting ever more unstable and fragile. ... Overgrazing and indiscriminate reclamation means that denudation has passed the self-renovation threshold of the pasture eco-system. In many areas the pasture eco-system has collapsed and a lot of herders in some areas in this province can be described as ecological refugees. This is by no means alarmist talk."

And, in the immediate vicinity of Qinghai Lake as well, the average forage production dropped between 20 and 35 percent from 1959 to 1983, resulting in an annual loss of around 600,000 tons of grass forage in the entire Qinghai Lake region, equivalent to the forage requirements of approximately 420,000 sheep units. Over roughly the same period, every sheep lost an average of 3-4 kg total weight, including 400 g wool, and yak lost 10-15 kg (Qinghai Census Bureau 1994).

In a world of rapid change, where the alteration, degradation, and ultimately the destruction of habitats is a leading factor in the decline of species worldwide (Ehrlich and Wilson 1991, Heywood 1995), it is essential to consider and to evaluate all possible future scenarios. Otherwise, irreversible loss of biodiversity may too easily become reality for many of the world's unique and special habitats for a simple lack of forward thinking and planning. Clearly, the alpine grasslands of the Tibetan plateau, including the Qinghai Lake area, are facing tremendous risk of (possibly irreversible) damage. The potential to utilize these lands sustainably for the benefit of local pastoralists, both now and in the future, may soon disappear. In search of the main causal factors of current social and environmental trends in Qinghai, the pastoral landscapes of the Qinghai Lake area are examined in this chapter. A clearer idea of the potential costs of inaction (i.e., the *status quo* of development priorities, plans, and projects) also is necessary to help decipher what change or changes would be most advantageous to make now, for the sake of long-term ecological, social, and cultural sustainability.

General Description of the Qinghai Lake Area (back to top)

Physical geography (back to top)

Qinghai Lake is located in the northeastern part of the Tibetan plateau. The lake's drainage basin covers around 30,000 km^2 (around 4 percent of the provincial area), with elevations ranging from around 3,200 m to 5,174 m above sea level (Figure 11). The Qinghai Lake area is typical of many parts of the province, over two-thirds of which is comprised of grasslands situated over 4000 m above sea level (Zhu 1989).

Figure 11. Qinghai Lake drainage area (adapted from 'Map of Qinghai' 1995)

According to Wittke (1996), Qinghai Lake "developed in the Early Pleistocene when [the] tectonic movements [which formed the Tibetan plateau] blocked the course of the through-going ancestral Buh He [Pu River] which now enters the northwest side of the lake. [The lake's] water is now brackish [since it] has been shrinking for at least the last 8000 years.” Qinghai Lake’s decreasing volume, and hence its decreasing depth and surface area, are caused by a combination of a changing climate and of an overuse of water resources (Western Resources and Environment Research Center 1994, Wittke 1996, ‘Water slowly disappears…’ 1998).

According to the Western Resources and Environment Research Center (1994), the ecological history of the Qinghai Lake area can be divided into several main periods based on pollen analysis:

> “After the Ice Age around 10,000 years ago, the global climate became warmer and the vegetation in the Qinghai Lake area was comprised mainly of *Artemesia* and grasses… Around 9,000 years ago, the area comprised of needle-leaf [coniferous] trees and broad-leaf trees expanded, covering most hills and mountains around the lake, but then decreased again, probably because of a dry climate. … Then, about 8,000 years ago, the forest area expanded again…
>
> From 8,000 to 3,500 years ago, the climate in the Qinghai Lake area was relatively moist, and this influenced the vegetation [such that] the forests and grasslands thrived. … Then, starting around 3,500 years ago, the area of needle-leaf trees began to decrease [and] shrub and grass pollen increased continually from then until 1,500 years ago. At that time, the tree pollen content had dropped to less than 20 percent, but the grass and shrub pollen content had increased to 75 percent.
>
> Finally, from 1,500 years ago to the present, forests in the lake area decreased even more. The warm-moist forest vegetation environment thus changed into a high-cold [alpine] shrubland and high-cold [alpine] meadow grassland environment…. The decrease of the forest area around the lake was probably caused by a combination of the natural environment [climate change] and human activities. That is, historic human behavior such as tree cutting, war, livestock herding and vegetation burning were the main factors that destroyed the forest.”

At the present time, the Qinghai Lake drainage basin includes portions of four counties in three different prefectures. As discussed in the previous chapter, the human population distribution in Qinghai is extremely unbalanced with an average population density in the lake area less than 5 people per square kilometer, and even lower in the alpine grasslands. The total human population, total geographic area, grassland area, and the amount of cultivated land in the four counties are provided in Table 5.

Table 5. Summary information for the four counties in the Qinghai Lake drainage basin (Qinghai Census Bureau 1992, Wei 1993)

County Name	Prefecture Name	County Area (km^2)	Grassland Area (km^2)	Cultivated Area (km^2)	Proportion in Basin	Number of Households	Total Population
Gonghe	Hainan	14,364	12,878.8	278.8	approx. 1/4	26,114	130,773
Tianjun	Haixi	25,953	15,378.3	--	approx. 3/4	3,146	14,794
Gangcha	Haibei	9,110	6,906.4	143.2	approx. 3/4	8,795	41,853
Haiyan	Haibei	4,173	3,049.2	29.9	approx. 1/2	7,097	34,978

Note: Hainan, Haixi, and Haibei mean south, west, and north of Qinghai Lake, respectively.

Two images, both taken from the Space Shuttle, provide an overview of the region. The first of these images was obtained from the Office of Earth Sciences at the NASA - Johnson Space Center website (URL: *http://eol.jsc.nasa.gov*) (Figure 12). The image has been digitally enhanced to increase the overall ease of visual interpretation and main towns, roads, and railways have been added to facilitate cross-referencing with administrative maps. The most obvious elements in this image are Qinghai Lake in the center, Caka Lake (southwest Qinghai Lake), and the Longyang Reservoir on the Yellow River (southeast of Qinghai Lake). The Datong Mountains are seen to the north, the Riyue Mountains to the east, and the Nanshan Mountains immediately to the south and west of Qinghai Lake. Further to the south are the foothills of the Amnyemaqen Mountains. The Qinghai-Tibet highway traverses the narrow strip of relatively flat land between the lake's southern shore and the Nanshan Mountains, while the Xining-Golmud railway transects the plains that extend northward from the lake. The Pu River is the largest inflowing river and enters Qinghai Lake near "Bird Island" on its central western shore. A sandy desert is situated northeast of the lake. Finally, the main road to Yushu and Sichuan extends south and southwest of Qinghai Lake.

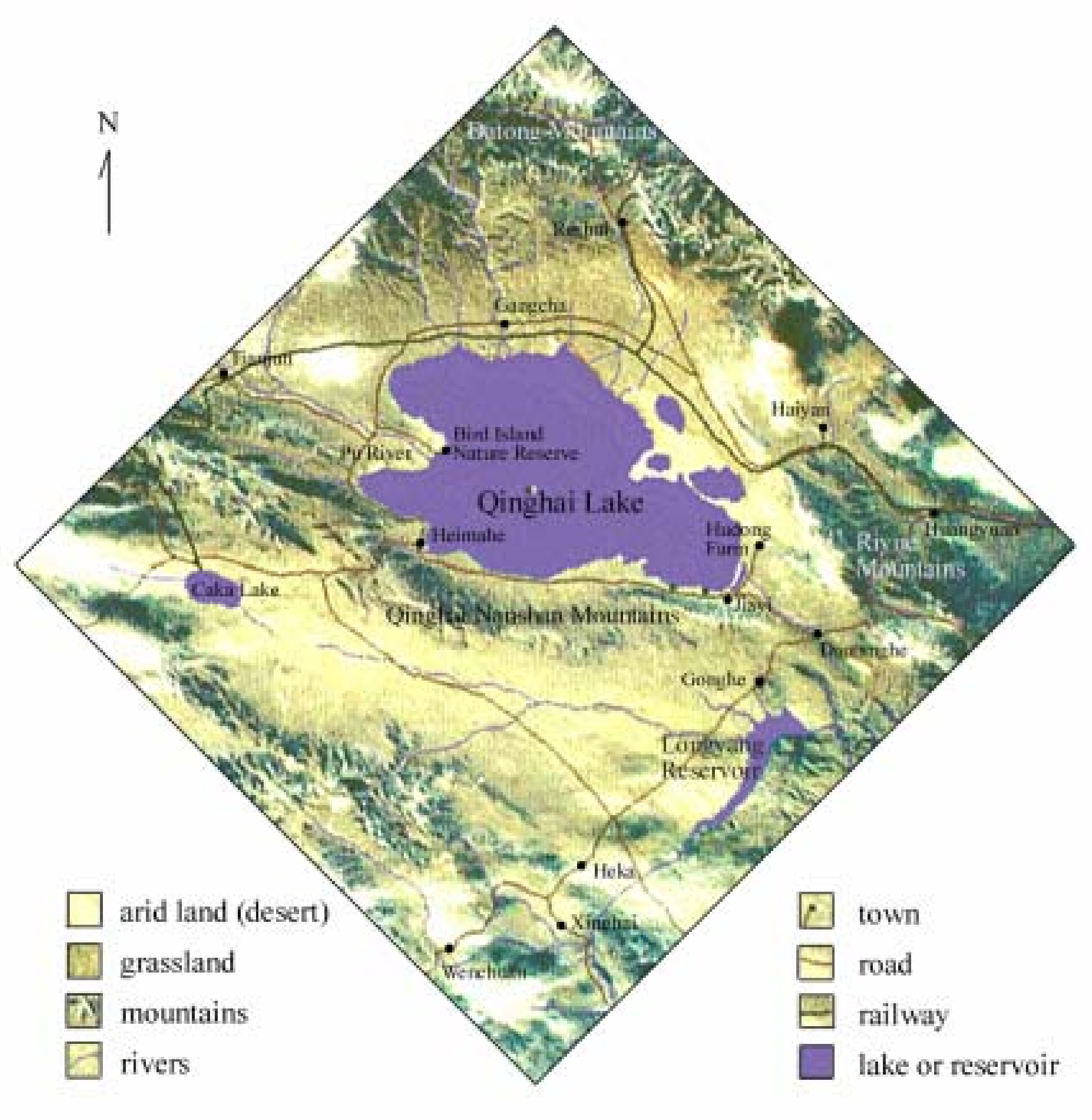

Figure 12. Space Shuttle photograph of the Qinghai Lake area (adapted from the Office of Earth Sciences, NASA - Johnson Space Center 1998)

The second image, found on Wittke's (1996) webpage (URL: *http://vishnu.glg.nau.edu/people/jhw/Tibet/Qinghai.html*), gives a closer view of Qinghai Lake (Figure 13). Clearly visible are the sand dunes northeast of the lake, and the cultivated fields in Gangcha (especially in Ha'ergai, Shaliuhe, and Quanji townships; also see Figure 14). Cultivated fields are also seen in the vicinity of the Pu River and Bird Island in the west, and in the eastern half of Qinghai Lake's southern shore. Together, the broad spatial overview provided by these figures helps to situate geographically much of the following discussion on the Qinghai Lake area.

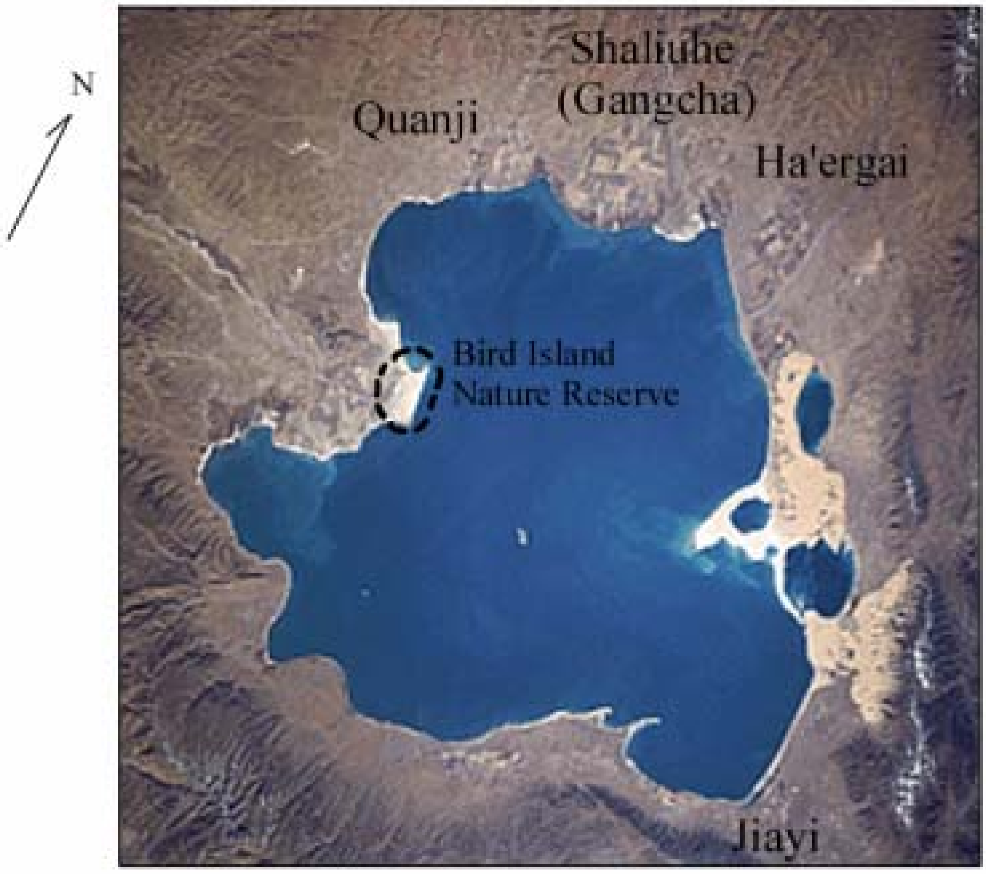

Figure 13. Space Shuttle photograph of Qinghai Lake (Wittke 1996)

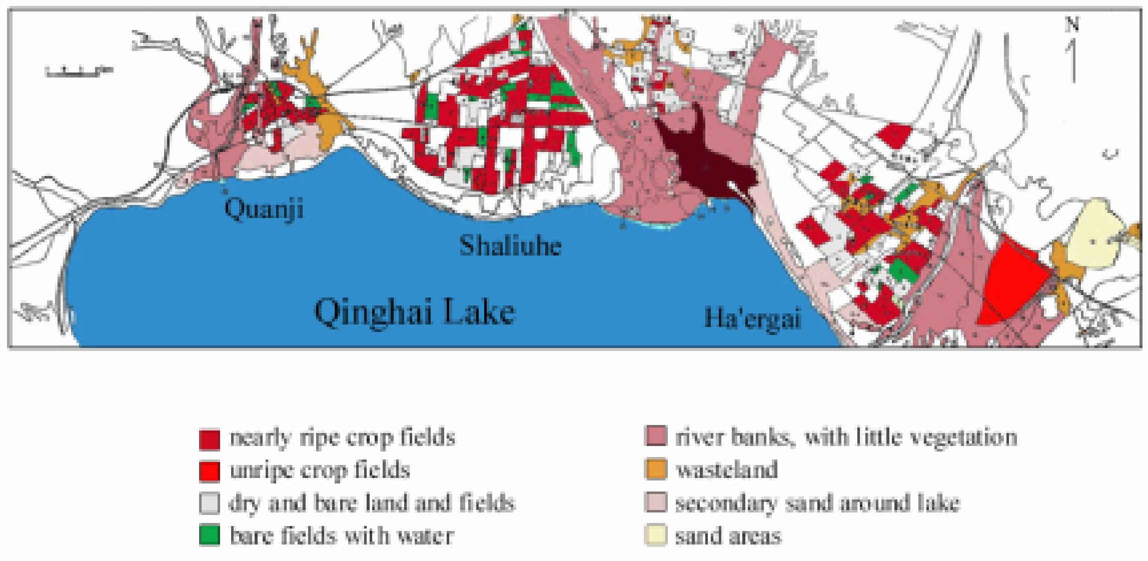

Figure 14. Cultivation on the northern shore of Qinghai Lake (north is to the left; adapted from Western Resources and Environment Research Center 1994)

From tribal history to modern politics (back to top)

Based on cultural remains and ancient art forms found on the Tibetan plateau, from the discovery of lithic and microlithic industries to the discovery of bronze ware and pottery, Hare (1998) has suggested recently that Neolithic agricultural communities inhabited the Tibetan plateau as early as 5,500 years before present, but the sedentary farmers were replaced by steppe nomads (pastoralists) with a bronze culture sometime between 2,000 and 3,000 before present. The nomads that replaced the incipient agriculturists came from the Qinghai region where pastoralism has remained constant into contemporary times (Zhao 1992, Hare 1998).

Many myths also abound about the origin of Qinghai Lake. One well-known Tibetan story explains how the rebellious Monkey King took power in heaven and drove the defeated god, Erlangshen, to a miraculous spring in Amdo. On seeing the spring, the hungry and thirsty Erlangshen hurriedly began to cook a meal and ordered his servant to collect some water from the spring. However, the spring had to be covered with a lid or else water would pour out from it endlessly. The servant was so hungry, though, that he forgot to replace the lid after collecting water. No sooner had he put salt into the pot that the magic spring quickly became a swelling current, then a terrible flood. It further happened that at this moment the Monkey King also appeared. Erlangshen was so alarmed that he instantly jumped to his feet, kicking the pot over, and immediately fled for his life scrambling up into the clouds. Qinghai Lake is thus said to have come into existence, and it remains a large saline lake to this day (Combe 1989). Other stories also include references to subterranean passages from Lhasa (Rockhill 1891, Huc and Gabet 1928), a rock thrown from Mt. Kailash to stem a regional flood in which 10,000 families drowned (Combe 1989), the impression of Pedma Sambhava’s hand holding down an evil spirit which he had cast into the lake (Combe 1989), the tears of the Chinese Princess Wencheng as she traveled to Lhasa to marry the Tibetan King Songtsen Gampo (Stein 1972, Shi 1991), and even the simple creativity of the youngest son of the Dragon King of the East China Sea (Stein 1972).

The Qinghai Lake area is of significant historic importance in Inner Asia as well, for it is here that Genghis Khan’s grandsons, Guyug and Godan, held their headquarters in 1244 when they invited the great scholar Sakya Panchen to help them purge religious heretics from greater Mongolia. It also is on the shore of Qinghai Lake that the Mongol ruler Altun Khan bestowed in 1575 the title Dalai Lama on the Tibetan leader of the time (Geoffrey 1993).

Much earlier, in 121 BC, the Han Chinese had made their first inroads into the area when the General Huo Qubing of the Western Han Dynasty set up a stronghold, Xipingting, in the location of present-day Xining. Two important prefectures, Xihai and Heyuan, were established by the time of the Sui Dynasty (518-618 AD) and another prefecture, Xining, in the Song Dynasty (960-1279 AD). Present-day Xining, however, only became the provincial capital when Qinghai’s present boundaries were formally established in 1929 (Wang 1994). Furthermore, although a large part of present-day Qinghai has in theory been under Han Chinese rule for many centuries, real or effective control remained almost exclusively in the hands of local tribal leaders, both Mongol and Tibetan, at least until the 1720s (Geoffrey 1993, Smith 1996).

One of the most significant episodes in the tumultuous history of ethnic relations in Qinghai is the great revolt of 1723 (Schram 1958, Smith 1996). Though quickly suppressed by the Qing Dynasty, one consequence of this revolt was the cultural and geographic remaking or reconfiguration of the province. First, the entire region then known as Kokonor (the Mongol name of the greater

Qinghai Lake area) was formally made into a Chinese province in 1724 (Stein 1972). Then, as explained by Smith (1996), over the next few years the government

> “reorganized the administration of Kokonor and made clear [its] intention to exercise more direct control there. The Tibetan and Mongol tribes ... were reorganized into units responsible only to the [Qing Dynasty] administration ... and were allotted fixed territories and were forbidden to infringe upon the territories of others.”

The *amban* – the highest representative of the Chinese government resident in Xining – thus entered into Chinese legal history many new tribal names and geographic boundaries. And, by this simple act of “mapping” the rebel tribes, the *amban* greatly increased his power and control over them (see Stone 1998). Although before the revolt it had been tribal leaders who made all major decisions pertaining to such activities as seasonal migrations between summer and winter pastures, the power structures were now so altered that, by the middle of the eighteenth century, official permission was needed from the Chinese authorities in Xining even for such traditional activities as pasture use and management.

Combe (1989) also describes this important period:

> “[It was a] troublous period in the first half of the eighteenth century, when the Chinese were threatened by a combination of Tibetans [and] the Oelöt [Mongol] tribes of Ili, over the identity of the seventh Dalai Lama. The Chinese were obliged to acquiesce in the Tibetan choice, although Yo Chung-chi’s expedition against Tibet met with little difficulty. That was in 1720. Subsequently, in 1732, when the tribes south of Koko Nor [Qinghai Lake] were reorganised, 39 clans, [comprising] 4,889 families, were placed under the jurisdiction of the Sining [Xining] amban, to whom they [now] paid an annual tax….”

Many of the tribal names and administrative divisions that were first penned into history in the 1720s and 1730s are still repeated today in numerous local (county), provincial, and national history books, usually with no reference to any earlier state of tribal (Tibetan) affairs.

Another political strategy of the Qing Dynasty was to move whole tribes to new areas. For example, Chen (1990) specifically describes the origin of the Tibetan pastoralists now living in the Qinghai Lake area:

> “The Guide district [south of Xining] controlled more than 80 Tibetan tribes of various sizes. Their pastures were not sufficient while the Mongols north of the Yellow River [in the Qinghai Lake area], now in decline, had an abundance of land. [Therefore, in 1858,] a Qing official redrew the Mongol pasture boundaries and allowed the Tibetan tribes to go north of the river and graze around the lake, thus creating the ‘Eight Tribes Around the

> Lake.' In addition, other Tibetan tribes from the Tongren, Xunhua and Hualong districts have also moved into [the lake area] over the last hundred years."

But despite all the political maneuvering of the Qing Dynasty and subsequent administrations, most simple or routine affairs were conducted in traditional ways and largely independent of the government. For the most part, in practice, the tribal system of governance continued "up until the democratic reforms of 1958 when the system was formally eliminated" as part of a broad socialist reorganization of society (Chen 1990). According to Li (1992), the "Eight Tribes" of the greater Qinghai Lake area were comprised of 47 clans and 16,100 families in the late 1800s, and almost every tribe and clan practiced pure pastoralism (Table 6).

Table 6. Population of the "Eight Qinghai Lake Tribes," circa late 1800s (Li 1992)

Tribal Name	No. of Clans	No of. Families	Region Inhabited	Main Livelihood
Wangshidaihai	8	3,000	Tianjun county	pure pastoralism
Rian	2	600	Hainan prefecture	pure pastoralism
Dawuyu	4	2,000	Haibei prefecture	pure pastoralism
Gangcha	8	3,000	Haibei prefecture	pure pastoralism
Qianbulu	6	1,500	Hainan prefecture	pure pastoralism
Arike	4	2,000	Qilian county	pure pastoralism
Duxiu	7	1,000	Hainan prefecture	pure pastoralism
Acuohu	8	3,000	Hainan prefecture	agro-pastoralism

Since the founding of the People's Republic of China in 1949, there are several key events that stand out in both local and national history (Wozencraft 2000). In a first instance, most areas of the Tibetan plateau were "liberated" in the late 1950s. This action was then followed closely by a severe famine associated in part with grave, ideologically driven mistakes made during the Great Leap

Forward (1958-62). Some physical evidence of that period remains to this day (e.g., abandoned plowed land, which can take decades to recover; Environment Science and Technology 1998b). The misguided policies of that period also led to several local revolts (Becker 1996) that have left some indelible psychological scars as well. Then, shortly after the end of the Great Leap Forward, the chaos of the Cultural Revolution (1966-76) began. Frolic (1980) provides an insightful first-person account of Chinese life in a frontier town in Qinghai, Gonghe, in the early 1970s. Finally, most recently of all, the agricultural reforms that began elsewhere in China (in 1978) also came to Qinghai. Although at first glance the latter reforms do not appear quite as dramatic as the other events or periods described, they may in fact have the deepest and longest-lasting impact of all, particularly on the traditional Tibetan pastoral way of life. Indeed, the agricultural reforms of the last two decades, as currently implemented through the Household Responsibility System and other official development schemes, are paving the way for a whole new, culturally bound land ethic (*sensu* Leopold 1949).

Writing about land tenure in China's pastoral areas, with particular reference to "risk management" (coping strategies) of individual herders, Liu and Wang (1998) provide the following broad historical overview for pastoral areas in Qinghai:

> "(1) Private land tenure and livestock ownership before 1956
>
> Before 1956, the tribal chiefs were owners of 80-90 % of pasture and livestock in the remote pastoral areas, like Qinghai and Tibet. There were no community and governmental organizations dealing with the risk management. Poor herders who didn't own any pasture and livestock, were hired by rich tribal chiefs and pasture lords. In such a slave system, the social and income disparity between rich pasture lords were extremely large. Herders were living in an absolute poverty and [were] the first victims of the natural risks;
>
> (2) Collective pastoral land tenure and livestock ownership from 1958 to 1983
>
> [Because of] the political status of the minority area like Qinghai and Tibet, after the [liberation] in 1950 and 1951 the private pastoral and livestock ownership was continuously kept until 1958. In late 1956, the collective movement was spreading [throughout] rural areas of the country. Two years [later], in 1958, following national movement the pastoral areas also started the collectivization process. Herders had to put all animals together and merged the grassland by the three levels ownership, namely, people's commune [present-day township], production brigade [the *dadui*] and production team [the *xiaodui*]. In this period, all production and natural risks were collectively planned and managed by these organizations. In late time of this period heavy grassland degradation occurred due to the political mis-leading toward high number of livestock.

(3) Household-based pastoral land tenure and livestock production system since 1983

Following China's rural reform in 1982, the pastoral reform was initiated in 1983. The core measure of the pastoral reform was to contract the collective livestock (1983) and pasture (1994) to herders' households. Although the position of village leaders and production team leaders were still kept till now, the management and co-ordination functions of the community organizations are very weak. Generally speaking, the risks after 1983 were mainly managed by herders themselves under the assistance and co-ordination of governmental organizations and village leaders."

It is within the above context, with tribal histories and modern politics both still in living memory, as well as within the very specific geographical context of the alpine grasslands, that China today continues to define and to implement its pastoral development strategy.

Different values, different visions of the world (back to top)

The above overview of the geography and the cultural history of the Qinghai Lake area should help, in concert with the previous background chapters, to grasp better some of the key differences between Tibetan and Chinese value systems and worldviews. Many differences – from the people themselves with their varied affinities, cultural preferences, and beliefs, to their vastly different modes of production, environmental conditions, and natural risk factors – all these differences have given rise to very a variety of views or conceptions of the world. And these views of the world almost invariably translate to different understandings of development and the desired outcomes of development. Thus culture and many historical and geographical factors play a critical role in guiding the future, and specifically in creating or modifying physical landscapes.

When comparing Chinese and Tibetan people, it becomes clear that the very meaning and value of land is different. To the Chinese, land is both a place of belonging (e.g., ancestral homes) and a resource or raw material to be exploited. To Tibetans, however, land is first and foremost the home of a variety of spirits that must be propitiated, and only in second place is it also seen as a resource (or source of sustenance). How do such mindsets affect regional development in practice? An overview of Qinghai's recent history of cultivating (or attempting to cultivate) its alpine grasslands helps to illustrate this point.

Although the extensive conversion of Qinghai's alpine grasslands in the 1950s and 1960s was decried by a few discerning voices (Qinghai People's Government 1951, 'Open up…' 1956), the majority of leaders and immigrant-colonists from China's eastern provinces have maintained to this day a relatively narrow, utilitarian view of the value of natural resources. To most people in China, then as well as now, natural resources are only raw materials to be exploited as rapidly as possible to meet national (but not necessarily local or regional) goals and objectives. One could call this socialist utilitarian view China's "land ethic." Fortunately, however, a somewhat less ideologically based (i.e., more pragmatic) approach to development now is also gaining wider acceptance in China (see, e.g., Biodiversity Working Group 1999, China Council for International Cooperation on Environment and Development 1999b). The latter approach, the predominant approach adopted internationally, considers "safeguarding the environment" as a fundamental guiding principle of sustainable development, an essential component of poverty eradication, and even as one of the necessary foundations for peace (United Nations Foundation 2000). Both these views – a purely utilitarian view of resources, and a more integrated view of environment and development – also can be contrasted to the more parochial view common to the majority of Tibetan pastoralists. (This is only a reflection on the limited means and opportunities available to most pastoralists worldwide to consider regional patterns and trends of natural resource use and resource conditions; most pastoralists know their own grasslands well, sometimes very well, but they may not be so familiar with more distant regions). Each of these views of the environment (or of land, or resources) has a variety of implications for the way in which development is understood, planned, implemented, and evaluated. Clearly, then, resource use (and hence sustainability) is affected by peoples' views of nature, as well as their vision or hopes for the future (Bernard and Young 1997).

Also, regarding Tibetan views of nature, it is Vigoda's (1989) contention that "socio-cultural and religious factors have strongly influenced the Tibetan mode of interaction with their environment." This much can be agreed to. However, the oft repeated argument that religious factors have necessarily "fostered an ethos of environmental protection," even to the degree that Tibetans would supposedly never kill wildlife or misuse the land, is inappropriate (see Ekvall 1968, Huber 1990). Nonetheless, it remains true that where animism is practiced, such as in Tibetan areas, "it is not likely that the believers will indiscriminately destroy objects of nature because such activity would incur the danger of spiritual and social sanctions” (Moncrief 1970). As Combe (1989) explains, almost all Tibetans believe that “on every mountain in Tibet lives a spirit who is either good or bad. They have lived there from time immemorial and no one knows their origin… [If] regularly worshipped [bad spirits] will be beneficent; if neglected [these spirits] will send snowstorms to ruin the fields and destroy the yak.”

The main point is simple. As emphasized by White (1967), “What people do about their ecology [really does depend] on what they think about themselves [and] human ecology is deeply conditioned by beliefs about our nature and destiny.” (However, for a more accurate presentation of the Judeo-Christian perspective of nature, see Schaeffer 1972 and Granberg-Michaelson 1988).

Landscape Observation and Analysis (back to top)

Overland tour of the Qinghai Lake area (back to top)

To begin this chapter’s analytical section per se, an overland tour around Qinghai Lake is described. Starting in Xining, the provincial capital, we first follow the railway westward to Huangyuan, an old trading town on the road to Tibet. Huangyuan is now a county administrative center with an even mix of Tibetan, Hui, and Han Chinese people. Still below 3,000 m, the only way from here to the Tibetan plateau is upward, either west toward Gangcha (on the north shore of Qinghai Lake) or south over Riyue Pass (which means “Sun-Moon Pass” in Chinese) to Daotanghe. We opt for the latter route, and thus we will tour the lake in a clockwise direction.

Still on the north side of Riyue Pass, there are several agricultural villages typical of the plateau’s borderlands, particularly in the Amdo region of Qinghai and Gansu provinces. Mud brick walls enclose individual courtyards and houses. Communal threshing floors are scattered around the villages. Cultivated barley fields are found on nearby valley floors and on the lower hillsides. And livestock are seen as they are herded up and down the steep mountain slopes to the high alpine pastures in the summer, or in the plowed fields as they forage on the harvest stubble in autumn. Livestock generally are kept nearer to the village in winter and spring when they are fed supplementary hay fodder to maintain their energy reserves during the long, harsh cold season.

Riyue Pass is the definitive geographical and socio-cultural transition point between the Han Chinese lowlands to the north and the Tibetan plateau grasslands to the south. The pass is most famous as the locality where the Princess Wencheng cried as she left her native Chinese homeland behind, and began her journey across the vast Tibetan plateau to marry the Tibetan King, Songtsen Gampo, in Lhasa. It is said that the Princess' tears flowed down from the mountain pass, westward, eventually filling a large depression and thus creating Qinghai Lake. Since most rivers in China flow eastward, this unusual phenomenon is at the origin of the name Daotanghe (which means "Backward-flowing River"). Two large pagodas have been rebuilt at Riyue Pass, testimonial to the socio-cultural significance of this place. And, as on all mountain passes in the Tibetan region, many prayer flags flutter in the wind, and colorful "wind horse" paper offerings speckle the ground. These are all tangible reminders of the many other, lesser known stories that also are continually recounted in Tibetan areas, most notably stories of the multitudinous spirits that are known by all Tibetans to abound in the plateau's remote high places.

Leaving Riyue Pass behind us, we now drive onto the Tibetan plateau proper. The Swedish explorer Sven Hedin, who traveled extensively in the northern parts of the plateau a century ago, describes well its great beauty and the tremendous awe that it still can inspire today (Lhalungpa 1983):

> "Roads! There are no other paths there than those beaten out by wild yaks, wild asses and antelopes. We made, literally made, our way, while I charted the country and captured for the pages of my sketch-book as many views as possible of glorious mountain giants with snow-capped peaks and labyrinths of winding valleys. We penetrated deeper and deeper into the unknown, putting one mountain chain after the other behind us. And from every pass a new landscape unfolded its wild, desolate vistas towards a new and mysterious horizon, a new outline of rounded or pyramidal snow-capped peaks. Those who imagine that such a journey in vast solitude and desolation is tedious and trying are mistaken. No spectacle can be more sublime. Every day's march, every league brings discoveries of unimagined beauty."

The alpine grasslands of the Tibetan plateau are comprised of many different vegetation formations, some of them extensive and others spatially restricted. The *Kobresia humilis* sedge meadow formation, typical of the "high cold" zones of the plateau, is common in the vicinity of Riyue Pass. The dominant sedge is complemented by at least twenty other species. Descending toward

Daotanghe, salt flats also are scattered across the semi-arid valley floor. Tall grass tussocks characterize this area, in particular *Achnatherum splendens* and some *Stipa breviflora*. Pastoralists use the low-lying areas (i.e., the valley floors) here and throughout the Tibetan plateau mainly as winter pasture land. Walls of turf and barbed wire fences, some of them new, others in disrepair, more or less delineate the boundaries between household and village pastures.

The main center of activity southeast of Qinghai Lake is Daotanghe town, a sub-county (township) administrative center. Here, pastoralists, farmers, merchants, and government workers all interact closely as they trade products, technologies, news, and ideas.

Agricultural fields in this area are planted mainly with barley (*Hordeum vulgare* var. *nudum*) or rapeseed (*Brassica compestris*). Until recently cultivation was found only near village in the lower valleys and never was found in the nomadic pastoral areas. This situation has begun to change, however, starting in earnest in the early 1990s. The introduction of limited irrigation has allowed cultivation of spring wheat (*Triticum aestivum*), potato (*Solanum tuberosum*), and pea (*Pisum sativum*) in some sites, too, but only near larger towns like Gonghe. Gonghe is both the county's and the prefecture's administrative center, located around 40 km southwest of Daotanghe. It is situated south of the Qinghai Nanshan mountains in the arid Gonghe basin.

From the southeast shore of the lake, the edge of another desert area can be seen to the north. This desert extends from the foothills of the Riyue Mountains and continues around the east and northeast shore of Qinghai Lake. This desert area is home to Przewalski's gazelle (*Procapra przewalskii*). The Hudong ("East of the Lake") Agricultural State Farm, a former labor camp, is situated in the grasslands just south of the aforementioned desert area, also between the Riyue Mountains and the lake. In the vicinity of the State Farm, as in Jiayi village (see below) and all the way back to Daotanghe, crop fields and mud brick houses are scattered across the landscape. The entire Daotanghe township has a population of 8,780 people, around three-quarters of whom are Tibetan, and the annual per capita income in 1996 was $ 170 USD (Meng et al. 1999). The Qinghai-Tibet Highway that extends from Xining to Lhasa services the whole area south of Qinghai Lake.

As is the case with many "villages" in Qinghai's pastoral areas, Jiayi is not so much a concentration of dwellings as it is a relatively abstract administrative area. Yet at the same time this abstraction pertains only to the physical or material understanding of "village," not to its cultural or relational foundations. For the most part, households in Jiayi (or tentholds, as the case may be) are distributed widely across the land. However there is one small concentration of buildings centered around a small store and near a local monastery and primary school. The monastery is one of only two official religious edifices in Daotanghe township, which together are home to around 80 monks. The Jiayi boarding school now has over one hundred students. In total, the village has a population of around 1,300 people in 200 families.

Continuing westward along the south shore of Qinghai Lake, a state-owned "fish factory" enterprise stands in clear silhouette against the deep blue and green hues of the lake. At night, a dozen or more points of light reveal the presence of large trawlers on the lake that continue to harvest its aquatic resources. However, only a small fraction of earlier catches are now realized, and only relatively small fish are caught. Another nearby waterfront structure also catches the eye, the well-known tent-hotel situated at kilometer marker "151." This tourist destination attracts mainly Chinese tourists (and a few foreign tourists) who come to visit the lake. A platform lying several hundred meters offshore also is noteworthy as the remnants of a former torpedo testing site built during an earlier era of political isolationism and containment when national defense activities were of paramount importance to China. Qinghai was seen as the heartland of the country, and hence the center of much military presence and military activities (Wittke 1996, Spence 1999).

The Qinghai-Tibet Highway continues westward, passing more tents and houses, several road construction stations and a few more "village" centers. Fences are seen frequently dissecting the land, most evident where livestock trampling causes severe grassland denudation along the fixed herding routes up to the summer pastures. These fenced routes at least help to contain some of the more deleterious effects of livestock trampling.

And, as with the wholesale fencing of winter pastures, the conversion of the alpine grassland to fields of barley also expands further westward each year (but see 'China to reduce…' 2000, 'NPC deputies…' 2000). Over half of the southern shore of Qinghai Lake now has been cultivated to some degree, destroying much of the former productive grassland between the lake and the foothills of the Qinghai Nanshan.

Where the land has not been tilled, many pastoralists move to near the roadside in the spring, when winds blow the strongest. Here, away from the natural protection of the hills to the south, roadside depressions and low mud walls are used to provide some additional protection from the elements. Even sturdy yak hair tents provide little shelter on these open windswept plains near the shores of Qinghai Lake. Yet herders continue to bring their animals to these shoreline pastures because the wind helps to remove the snow in winter, thus providing ready access to the increasingly sparse vegetation. On the whole, fewer houses have been built here, quite possibly related to the longer distance to the county center (Gonghe). Yet even while most people continue to live more traditional lifestyles, the increasingly common dust storms that every spring afternoon reach high into the sky are but one of several key indicators that tractors and houses and many other new developments are approaching rapidly. Here, too, times are changing fast.

At Heimahe ("Black Horse River"), the Qinghai-Tibet Highway veers away from Qinghai Lake. A smaller road leads north from town, past the Pu River and Bird Island Nature Reserve, and on to the rolling plains of Gangcha on the northern shore of Qinghai Lake.

Livestock in the vicinity of Heimahe are grazed high in the Qinghai Nanshan in summer, at around 3,600 m and higher. In autumn, livestock are grazed by the lake shore, and in agricultural fields where these are present. Then, in winter and spring, livestock are grazed in closer vicinity to the permanent dwellings, which may be either close or far from the lake depending on local topography. Roughly the same seasonal pattern is still practiced elsewhere around Qinghai Lake as well, but with much greater distances involved north of the lake. To the east, south, and southwest of the lake, seasonal migration distances range between only a few hundred meters to around 20 km at most, while to the northwest and north of the lake, migration distances can be as much as 100 km or more (i.e., from Qinghai Lake's shore all the way to the Datong River valley far to the north; this route takes 3 to 5 days to travel with livestock herds).

In the middle of the northern shore of Qinghai Lake is Gangcha, the main administrative center in the region. The town's local name, Shaliuhe ("Sandy Willow River"), reflects the town's location on the banks of one of the county's larger streams as well as the specific (former) presence of riparian vegetation. The town is comprised of Han Chinese, Tibetan, Hui, and several other ethnic groups. About twenty kilometers to the north is a smaller town by the same name (Shaliuhe), the seat of the county's main monastery.

To the east of Gangcha town is the Sanjiaocheng ("Strategic") State Sheep Farm. According to Yang (1997), the farm was originally established by Wang Mang, an Emperor of the Western Han Dynasty, then managed by the warlord Ma Bufeng from 1940 until it was "liberated" and set up as a communal People's Farm in 1953. The farm is said to provide 13,000 sheep each year for market. It is best known, however, for the high quality "noble sheep" fine wool that it produces, reportedly the result of breeding management that dates back to 1956.

Another unique feature of the northern shore of Qinghai Lake is the Xining-Ge'ermu (Golmud) railway, perhaps the most important transport link between China and Tibet. Civilians, military personnel, and abundant subsidized goods are transported to Tibet by this major artery. A secondary rail line also extends 50 km to the north, to a coal mine situated near Reshui ("Hot Springs") town. Almost all workers in this town are Han Chinese immigrants, the roads are covered in coal dust, buildings are rundown, old trucks regularly ply the bumpy road – in sum, a rather remote and rowdy frontier town.

Finally, after driving along the north side of the sand dunes noted earlier (i.e., the desert area located behind the Hudong Agricultural State Farm), a barely perceptible mountain pass is crossed. A little further on, the steep descent toward the Chinese lowlands begins. A reservoir and hydroelectric power station are first seen, similar to (but much smaller than) the famous Longyang reservoir on the Yellow River southeast of the lake. Another noteworthy town is then bypassed, the new capital of Haibei prefecture, Haiyan, where China developed its first atomic and hydrogen bombs in the now-famous "Factory 221." According to Wittke (1996b),

> “The facility [Factory 221] includes 560,000 sq. m of buildings inside plant premises, 330,000 sq. m of production buildings, more than 40 km of special railway lines which converge with the Qinghai- Tibet Railway Line, nearly 80 km of standard highways, 1,000 six-digit computer-controlled telephones, and one thermal power plant with an annual generating capacity of 110 million kwh.
>
> “In 1987 the State Council approved the closure of the facility, and personnel were gradually shifted to other facilities. The former facility has [now] become the seat of the Haibei [Tibetan] Autonomous Prefecture Government of Qinghai Province. In June 1994 [the] Prefecture Government designated the site as a ‘small zone for national economy development.’”

From Haiyan, it is then a relatively quick drive back to Huangyuan, and hence all the way back to Xining. Following this brief overland tour, we now turn to three more localized settings: the pastoral landscapes near Jiayi village; the fields and pasturelands of Gangcha county; and the nationally renowned Bird Island Nature Reserve, which was designated as China’s first of six Ramsar sites in 1992 (Carey 1996).

Village scenes (Jiayi village) (back to top)

In contrast to the previous broad overview of the Qinghai Lake area, the following observations will allow us to focus not only on general impressions of the region – the Qinghai Lake area – but also on some of its more local and unique facets as well. However, how should the main features or elements of the landscape be organized for study? Every element, though interwoven tightly in space and time, will be examined first sequentially, in their order of appearance in the landscape, and secondly, by main type. The first method is called a historic or retrospective landscape analysis, while the second is the basis for a more traditional “elemental” landscape analysis (Skånes 1997).

As noted earlier, Jiayi is a village located on the southeast shore of Qinghai Lake, in Gonghe county, the largest of Hainan’s five counties (see Figure 9).

Retrospective landscape analysis

There are four main periods that can be seen in the Jiayi landscape:

- • the “early period” before people inhabited the area (the so-called natural environment);

- the “traditional period” when only pastoralists and hunters lived in the area;
- the “transitional period” of the past several decades under greater Chinese influence; and
- the “modern period” of the 1990s, an integration of all previous periods to date.

Every one of these periods has seen the introduction of new landscape elements, yet no element is static or stationary. The following descriptions therefore neither intend to describe life or material culture as they existed in the past, nor to describe their past form or spatial pattern, but they rather simply intend to help organize the landscape elements of today according to their historic development in the overall landscape.

Early period: The natural environment

Several natural elements stand out very evidently in the vicinity of Jiayi village. Within the few kilometers between the shore of Qinghai Lake (circa 3,200 m) and the ridge of the Qinghai Nanshan (circa 4,400 m) are several distinct vegetation zones. The main vegetation formations include the shoreline vegetation and some areas of localized sand dunes; the Daotanghe wetland area; a large expanse of productive sedge meadow on the slope between the lake and the base of the Qinghai Nanshan; areas of shrub land on steep north-facing slopes; the diverse (species-rich) alpine meadows that extend to the vegetation line at around 4,200 m; and the rock and scree summit areas where there is almost no vegetation at all. Many animal species also dwell in these varied vegetation zones. Woolly hares, Himalayan marmots, and plateau pika are the most common mammals. Birds of prey (Himalayan griffon, lammergeyer, golden eagle, upland buzzard, black kite), Hume’s ground jay, and several species of larks, buntings, redstarts, rosefinches, and snowfinches also are quite abundant. Furthermore, many migratory shore birds are seasonally present in the warmer season when they rest or breed by the lake shore or in the Daotanghe wetlands. China’s most endangered ungulate species, Przewalski’s gazelle, lives almost exclusively in the sand dunes beyond the Hudong Agricultural State Farm seen in the distance to the north (Jiang et al. 1994, 1995). And while the Tibetan gazelle, Tibetan wild ass, blue sheep, and several other large mammals are virtually extinct in the immediate locality, until just several decades ago they used to be very abundant, along with foxes, wolves, several wild cats, and even the Tibetan brown bear. However, the mere presence of pastoralists and cultivators, whose populations have increased dramatically in recent times, and the introduction of new land use practices have both had serious deleterious effect on wildlife populations, particularly in the past four to five decades.

Traditional period: Pastoralists and livestock

Of the cultural elements observed in Jiayi village, the first element to have arrived on the scene obviously had to be the people themselves (Figure 15). Although other people had lived in the Qinghai Lake area before, or at least had resided temporarily by the lake, the ancestors of present-day pastoralists arrived for the most part beginning in the late 1850s (Chen 1990, Li 1992). With them, of course, came their livestock and other items directly related to their traditional pastoral livelihood and culture. Today many herders still dress in traditional Tibetan clothes, though some also dress in Chinese-style or western-style clothes, and still others in a combination of the two. It is common, too, especially on festive occasions such as the annual horse race, archery, and tug-of-war contests that are held every summer in Jiayi, that Tibetan women will dress in their finest clothes and braid their hair with silver ornaments, turquoise, and amber (Figure 16). On such occasions, young Tibetan men wear western suits or studded leather jackets almost as much as local styles of clothing.

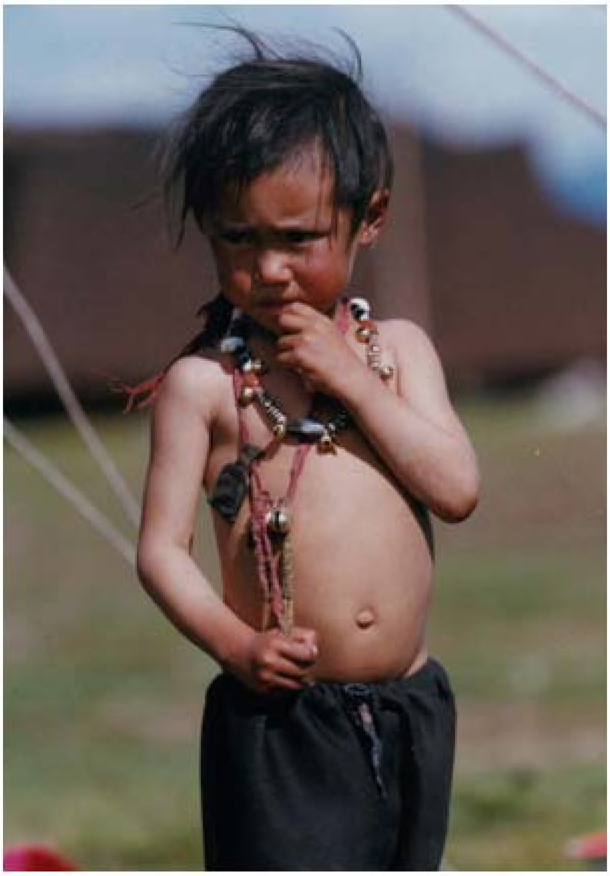

Figure 15. Young nomad boy wearing several amulets, yak-hair tent in the background

Figure 16. Headdress of nomad woman standing on the alpine grassland

The main activities of pastoralists also entail the use of some specific tools. For example, men commonly carry sling shots made from yak hair, long knives, and small leather pouches with flint and tinder, all part of their basic tool kit. And women, who do more of the household chores and milk the animals several times a day, carry with them sewing kits, ornamental silver “milk pail” hooks, and often a child strapped to their back.

The livestock is comprised of local breeds of yak and sheep. The pastoralists’ tents are made of tightly woven yak hair, each long cloth strip sewn tightly to the next. Yak also are used to transport supplies or people from one seasonal pasture to another (Figure 17), and are the pastoralists’ principal source of food (i.e., dairy products and meat) along with barley flour. Though less versatile than the yak, sheep also produce some milk and meat for the pastoralists. One advantage of sheep in the present socio-economic context is that they have significantly higher reproductive rates, and hence more sheep can be sold to market each year. However, yak remain better suited to local ecological conditions and can more easily survive the harsh winters.

Figure 17. Yak transporting nomads and their supplies by the Yellow River

Another essential “tool” in the pastoral economy is the somewhat more abstract knowledge that pastoralists have of their environment, a clear understanding of their domestic animals and of the cycles and rhythms of the seasons. This specialized knowledge of local vegetation ecology (of the emergence, growth, maturation, and senescence of plants), though itself an intangible or non-physical component of the landscape, can be observed in the way that pastoralists move their herds from pasture to pasture through the year, year after year. Pastoralists have known much about ecology since long before the introduction of “modern science.” This knowledge is itself a cultural phenomenon and has led to the long-term sustainable utilization of natural resources in the Qinghai Lake area, particularly through the local pattern of seasonal migrations between pastures. Such movements have allowed livestock, and hence the pastoralists, to utilize the land optimally. Other physical evidence of these seasonal movements includes the various improvements seen in the summer camping sites situated high in the Qinghai Nanshan, at around 3,800 m, such as low mud walls, earthen stoves, shallow irrigation ditches, elevated sleeping areas, and livestock corrals. Associated with these physical improvements are obvious localized changes in vegetation structure and species compositions caused by the intense livestock grazing around these summer camps.

Finally there also are many reminders of the pastoralists' almost ubiquitous belief in the supernatural. This, too, is a real part of their lives and the whole landscape. A small monastery, numerous prayer flags, and stone altars in the vicinity of Jiayi (Figure 18) all draw attention to the herders' dependence on the "unseen" to help explain the complex and unpredictable natural phenomena that sometimes so forcibly affect their lives – for example, the periodic snowstorm (Figure 19), hail, drought, or insect infestation that can contribute to sudden, drastic changes from a life of relative abundance to a life of poverty for the unprepared or unfortunate pastoralist. It is in these catastrophic situations more than in any other that Tibetans look to the supernatural for help to find a way forward, toward a better future, whether that future is in their present life or in their hoped-for next life.

Figure 18. Incense offering on a mountain altar, with "wind horse" offerings (prayers) on the ground

Figure 19. Herders and yak herd in search of uncovered range after snowstorm (Suojia, October 1999)

Transitional period: Land use practices in flux

There has been a relative uniformity in the principal livelihoods practiced by the inhabitants of the Qinghai Lake region for several centuries. Pastoralism, and to a lesser degree hunting and some trade of livestock and wildlife products, has long been the main economic activity. Since the 1950s, though, there have been major changes in local power structures and systems of governance, from traditional tribal organization to ideologically led external decision-making processes. In other words, the responsibility for decisions once made by tribal leaders, whose main concern was the welfare of their extended family and close neighbors, shifted in a short period of time to new leaders who served different interests. Above all else, these new leaders served the “greater good” of the new nation, the People’s Republic of China, a nation whose broader interests generally lay much farther to the east. To bridge this gap between local (Tibetan) and national interests, as already has been explained, the modern education system was introduced as a key means to reconcile differing interests by training ethnic minority government cadres (Meng et al. 1999).

The arrival *en masse* of Chinese immigrants in the 1950s and through to the 1970s, whether voluntary immigration or not, has most definitively anchored the majority of these changes into the modern pastoral landscape. Now, *de facto,* no longer are “local” interests solely Tibetan but to some degree Han Chinese as well. And the government must consider the latter people’s real aspirations and needs as well. Jiayi village and its surrounding areas thus have undergone drastic changes, particularly in relation to the ethnic composition of its population and the present system of governance. In both these respects, the entire region has been altered irreversibly. In fact, change has been pursued so actively over the past four or five decades that virtually every cultural element in the landscape now bears to some degree or other the mark of these recent historic events. Now, almost everywhere, roads are seen in the landscape – some literal roads but also many figurative in-roads of change, namely, modernization (e.g., building new livestock shelters; see Figure 20).

Figure 20. Traditional yak-hair tent with prayer flag, and a supply of logs to build a livestock shelter

The first large-scale external influence seen near Jiayi was the establishment of the (former) labor camp, the Hudong Agricultural State Farm. The construction of transport routes along the southern shore of Qinghai Lake and the wide-spread conversion (plowing) of grassland for agricultural development equally has impacted the local landscape immensely. But perhaps more than all other recent introductions to the area, whether of immigrants or roads or agricultural practices, it is the simple contact between different cultures that has led to and will continue to lead to the greatest long-term changes, for it is such contact that sparks new ideas and brings with it new ways to an area. And the physical evidence of these new ideas and new ways includes, beyond what already has been described, power lines and phone lines, veterinary and health care centers, research stations, boarding schools, and a whole array of modern goods and services.

Modern period: The present-day landscape

The most recent changes in Jiayi and its surrounding area are the result of such government policies as the Four-in-one Scheme. Following this plan, for example, permanent winter houses and livestock shelters are being built, forage crops are being planted, and fences are being raised around cultivated fields and winter pastures (Figures 21 and 22). And an increasing amount of grassland was being tilled and sown until Premier Zhu Rongji's visit to Qinghai in fall 1999. Furthermore, not only has considerable land been degraded by some of these ongoing activities, but there also are growing disparities in wealth and health. All of these features, from the "natural" environment to the present, combine to create the overall, present-day landscape of Jiayi village.

Figure 21. Winter house and small corral (built with *Kobresia* sod) for livestock

Figure 22. Winter house and livestock shelter

Each individual element now will be examined separately, in greater detail, in an attempt to gain yet more insight into the socio-environmental situation in the Qinghai Lake area today.

Main landscape elements

According to Skånes (1997), a landscape element is simply "the relatively homogeneous units or spatial elements recognized in a mosaic on any scale." Several broad categories are readily observed in the vicinity of Jiayi village, including a variety of elements pertaining to the themes of nature, ecology, and biodiversity; culture, sociology, and economy; and politics and modernization.

Nature, ecology, and biodiversity

Water, land, and sky are constants in the Jiayi landscape. Qinghai Lake is a constant backdrop (or foreground) to village life in Jiayi, and it is symbolically both source of life and death. Tibetans usually observe the lake with both a recognition for its immense beauty and some fear for the spirits that are known to inhabit its waters. The Chinese also consider Qinghai Lake to be an important natural resource to be exploited as well as a national scenic treasure. The lake is most famous as the largest salt-water lake in China and for the seasonal presence of many migratory birds. Everywhere, the sky is large, and numerous mountain ranges rim every horizon.

Mountains, grasslands, wetlands, and desert landscapes are all observed near Jiayi. Alpine grasslands can be divided into several main sub-types, from vegetation communities comprised of lichens, cushion plants, and other low-lying plants, to *Kobresia* sedge meadows, to taller steppe vegetation, and even to arid tussock grassland (Bian 1987). The local topography, altitude, slope, and aspect all play important ecological roles in determining which plant species grow where. Around Jiayi, only northern slopes are covered by shrubs or stunted trees. This feature may be due to micro-climatic differences related to solar radiation, temperature, and air moisture. However, according to Winkler (1995), the presence of trees and other woody plants almost exclusively on north-facing slopes also may be due, at least in part, to ancient deforestation by Tibetan pastoralists aimed to increase the availability of warmer south-facing pastures. Valley bottoms where moisture is available early in spring due to snow melt, as well as more permanent wetland areas, have a more vibrant plant life than on the steeper drier slopes of the Qinghai Nanshan (Riley and Young 1968). Pastoralists usually bring their flocks to these places first because, after each long winter, the growing season starts earlier here (Cincotta et al. 1991). One unique wetland area near Jiayi is located near the 6 km marker on the Jiayi-Hudong gravel road. This small wetland area is situated where the Daotang River enters a small lake immediately adjacent to (although once joined with) Qinghai Lake. And a few kilometers further north, shortly beyond the Hudong Agricultural State Farm, many large sand dunes extend across a vast area around the northeast shore of Qinghai Lake. Virtually no vegetation grows in the center of the desert, only near its edges and around a few oases, yet it is inhabited by several large mammals including, most notably, the Przewalski's gazelle. This gazelle is currently restricted (excluded) from the more productive surrounding grasslands by the rapid expansion of fences, an aspect of modernization that is encouraged and often subsidized by various levels of government. With fewer than 200 individuals surviving in the wild and none in captivity, this native species of the

Tibetan plateau is probably the most endangered ungulate species alive today – sadly, tomorrow it might become extinct, gone forever (Jiang et al. 1994, 1995).

The Tibetan plateau's biodiversity in general has received relatively little attention in favor of the richer (more diverse) ecosystems of the world such as tropical rain forests. Yet the mountain and grassland ecosystems of the Tibetan plateau are among the most unique in the world. The natural history of the Qinghai Lake region itself is also unique. The lake itself is home to an endemic carp (*Gymnocypris prezewalskii*). The lake's shores and its several islands are the home for several tens of thousands of migratory birds every breeding season, including the bar-headed goose, great cormorant, and black-necked crane. In the surrounding region, birds of prey include eagles, upland buzzards, hawks, kites, vultures, Himalayan griffons, and lammergeyers. Historically, mammals were also abundant and included most significantly the Tibetan wild ass, Tibetan gazelle, blue sheep, argali, wolves, foxes, brown bears, snow leopards, polecats, marmots, zokors, hares, and pikas. Last century, Prejevalsky (1876) wrote about Tibetan wild ass ranging throughout "Koko-nor, Tsaidam, and Northern Tibet [and] found in the greatest numbers in the first-named country," and about steppe-foxes [Tibetan sand foxes] "distributed over the whole of Mongolia, Kan-su, Koko-nor, and Tsaidam [but similarly] most numerous on the plains round Koko-nor." A few years later, Rockhill (1891) wrote about hillsides in some areas of Amdo being "literally black with yak, they could be seen by the thousands." More recently, Migot (1957) recalls "a tremendous lot of wildlife [near the source of the Yellow River with wild] herds of yaks, wild asses and gazelles … all quite easy to get near." Clearly, wildlife was abundant and diverse in the greater Qinghai Lake area, up until the not-too-distant past, and although many species are still present, now they occur only in small numbers.

Culture, sociology, and economy

Most inhabitants of Jiayi are Tibetan, and most are nomads (pastoralists), though some pastoralists also started to cultivate small parcels of land in the early 1990s. Several teachers at the village boarding school are Chinese, but most are Tibetan. Likewise, the sole shop owner in Jiayi is Tibetan, and the few monks in the village monastery are Tibetan.

The village monastery is located several hundred meters away from the village, nearer to the foot of the mountains. It has its own fenced land and its own herd of yak and sheep. Though a small monastery, it is a clear reminder of the worldview of most of the local population, influenced both by Buddhist teachings and earlier animistic beliefs. Perhaps as important as the monastery, however, are the numerous other concrete reminders of the great importance attached to religion in Jiayi: the turning of prayer wheels, daily offerings to the kitchen gods, the repetition of mantras, unending clockwise circumambulations around a variety of religious edifices, and many other practices as well. Folk religion also is very much alive, seen, for example, in the presence of numerous sacred sites that were not originally a part of Buddhism. Every hill or mountain top is thought to be the home of both good and evil spirits, thus a multitude of prayer flags are raised, wind horse paper offerings are thrown in the air, wooden spears and arrows are thrust into the ground, and offerings are burnt on alters to propitiate (appease) the local mountain gods. Inasmuch as water also is a home for spirits, Qinghai Lake is sacred and feared. One local informant, who had traveled to India and thus had a broader education than most, still expressed his doubt about whether or not thunder was indeed the roar of a dragon and lightening its flames. Clearly, there is a very specific "geography of spirits" recognized and accepted as real by the people of Jiayi and elsewhere on the Tibetan plateau (Ekvall 1968).

Although only a small village, it sometimes happens that travelers, traders, or pilgrims stop for the night in Jiayi en route to more distant destinations. And, sometimes, local Tibetans travel on foot or on horse to the county town across the Qinghai Nanshan, about 40 km away. However, it is only at the annual horse race in Jiayi that outsiders, including Hui and Han Chinese (and now some foreigners, too), come in large numbers to watch the festivities. Han Chinese and foreigners usually come to observe the minority cultures, Hui merchants set up temporary restaurants and shops, and some Tibetans conduct trade. Although archery, horse races, and tug-of-war games are all played, most Tibetans are said to come just for the fun atmosphere, and perhaps also to search for a husband or wife. Most Tibetans therefore come dressed in their finest clothes, some from places as far away as the distant western shore of Qinghai Lake.

Perhaps the most striking cultural element seen in the pastoral landscape is the black tent, the definitive mark of Tibetan nomads. The tent is made of long strips of woven yak hair (Figure 23), which is enlarged year by year lengthwise from in the center of the tent where a flap can be opened to allow smoke to escape. As the seasons come and go, the cloth strips age and their edges become tattered. Thus, if a family's herd of yak is large, the tent will grow, but if the herd is too small to produce sufficient yak hair, it will shrink in size. The greatest contribution of the tent to the pastoralist lifestyle is its mobility: it can be packed and transported to new pastures as often as necessary. However, the tent is but the most obvious of human ecological adaptations to the Tibetan plateau environment. Even the yak itself, apart from its own physiological adaptation to the altitude and other aspects of the local environment, is, as a domesticated animal, also part of human adaptation to exploit the local natural resources. Furthermore, the yak not only serves to convert inedible plant material to meat and milk for human consumption, it also serves to transport people and baggage, it can even be used as a living plow to help traverse snow-covered mountain passes in winter, it provides indispensable fuel (yak dung), and it also is the source of strong hair fibers. Yak hair is used to make ropes, slingshots, and saddlebags as well as tents.

Figure 23. Nomad woman weaving yak hair into a long strip to enlarge her family's tent

A variety of knives, milk pails, and some ornaments also appear on the pastoral scene, along with wooden saddles, butter churns, and sheep stomachs used to make and preserve yak butter. Other tools present include aluminum kettles, copper butter lamps, steel needles, and iron “dog whips,” each component being part of the material culture that helps the pastoralists to meet the needs of their livelihood in a high alpine grassland environment.

Perhaps the most important “tool,” though, is the pastoralist’s knowledge – his ecological knowledge of which livestock grazes what, when, and where, and consequently when and where to move his family or his satellite tents. Strategic decisions are made each day, but the most crucial decisions are made in the summer and autumn when, according to the success or failure of the family to adequately prepare its livestock for the next onslaught of winter, the herds’ (and hence the family’s) fate is largely determined. Indeed, the oft-repeated Tibetan proverb rings all too true even today: “animals gain strength in summer, fatten in autumn, lose weight in winter, and die in spring.” If the first two propositions of this proverb are not met, then the latter two will certainly take place.

Pastoralists’ ecological knowledge, whether explicit or implicit in their decision-making, leads to individual and communal active management of their herds and grasslands (Figure 24). Tibetan herders manage the ratios of male and female animals, the age structure of their herds, and the ratio of livestock types, including hybrids. Choices of summer and winter pastures and herd movements within these pastures also need to be made, but these are increasingly being removed from the hands of local pastoralists as local and regional governments strengthen the Household Responsibility System, effectively privatizing the land. Reading the climate, especially with a view to deciding when to make longer-distance seasonal movements, also is very important. In the case of Jiayi, however, summer and winter pastures are no more than 20 km distant, so the impacts of such decisions are not as significant. (Equivalent movements can reach 100 km north of Qinghai Lake, taking families and their herds up to 5 days to move between summer and winter pastures).

Figure 24. Household leaders meeting on the grassland to make communal decisions

Politics and modernization

Livestock (and grassland) management obviously has direct implications for grassland quality. Without arguing the different mechanisms that might lead to land degradation, for example whether resource overuse or climate change is most important (see Goldstein et al. 1990, Miller 1995, Miller and Craig 1997), it already has been shown that much grassland in Qinghai is degraded and that the area of degraded land continues to grow. In degraded pastures, a clear indicator of overgrazing is the prevalence of poisonous weed species such as *Stellera chamaejasme* (Figure 25). Such plants are most abundant in the winter and spring pastures near the increasingly settled pastoralists' winter houses (Figure 26), versus the higher summer pastures, in part because the so-called "winter" pastures are increasingly being grazed in the summer and autumn seasons as well. Year-round grazing can lead to the local extirpation of some plant species preferred by livestock, and concomitantly to the competitive release and increasing abundance of "weedy" plant species (plants that generally are not eaten by livestock). With a decrease in the overall amount of forage available in the Qinghai Lake area and a changing plant species composition unfavorable to the improvement of livestock conditions, human wealth is likely to be affected negatively. In a cycle of positive feedback loops, poverty in turn is likely to lead people toward shorter-term land management perspectives that could worsen their environmental and social conditions even further. Tightly linked with poverty are health, education, and economic opportunities. Thus, in Jiayi as elsewhere, environment, poverty, health, and education are all inextricably woven together.

Figure 25. Weed species, *Stellera chamaejasme*, near cultivated field in the Tibetan plateau borderlands

Figure 26. Winter home with small fenced field (for winter forage crop) in foreground

Before the arrival of Chinese administration in the 1950s, no cultivated fields were found around Qinghai Lake and virtually no fishing was practiced in it. However, this has changed (Figures 27 and 28). In late summer, the most striking vegetation in Jiayi is the flowering rape plant. Whole fields are covered at this time with bright yellow rape flowers, with fields extending over half the length of the south shore of Qinghai Lake, an area that in recent years has increased annually. Chinese immigrants opened many of the early fields, but a few Tibetans started to cultivate the land in the early 1990s when the government began in earnest to encourage a transition from pastoralism to sedentary cultivation. Though not all, many Tibetans now practice a combination of crop cultivation and pastoralism in the vicinity of Qinghai Lake. Concomitant with this agricultural development is the transition toward an increasingly sedentary form of animal husbandry. This type of pastoral development promotes the construction of livestock shelters, winter homes, supplemental winter fodder, and grassland fencing around fields and winter pastures – all part of the Four-in-one Scheme. Each of these items now is visible, and common, in the Jiayi landscape.

Figure 27. Cultivated fields in valley surrounding Gangcha's main town

Figure 28. Sheep herder with flock, cultivated fields and the Qinghai Nanshan in background

New roads, harmless in themselves and even associated with many potential benefits for the local population, also portray a continued shift in the overall balance of power. Even more dramatic, though, are the changes that the government is seeking to make through primary education. In many ways, the primary schools that dot the pastoral landscape, most of them boarding schools, are central to the future of the pastoral way of life throughout the province, since it is here that the next generation of educated pastoralists are being trained. Although some schools overtly aim to promote ethnic integration and to mold and train local "ethnic minority" leaders for the future (Meng et al. 1999), education at least can help to increase the number of Tibetans that are qualified in various practical technical fields. Currently, such positions are not being filled for a lack of trained people willing to live and work in the remoter parts of the Tibetan plateau. Local graduates, though, are on the whole more likely to return to their home villages. Thus primary schools, such as the boarding school observed in Jiayi, can have a very positive role to play in the lives of Tibetan pastoralists.

Grassland development (Gangcha county) (back to top)

Turning our attention now to the grasslands north of Qinghai Lake, we again find the same vegetation formations and similar pastoralists, but because the mountains and summer alpine pastures are situated much farther away from the lake, these pastoralists have maintained a more nomadic lifestyle. The five townships in Gangcha run along a north-south axis, thus enabling every village to have summer pastures on the slopes of the Datong Mountains in the north and winter pastures near Qinghai Lake in the south (Su 1993). These traditional patterns of grazing can be followed only because the modern administrative layout of the townships was patterned after the older, traditional tribal patterns. Such grazing patterns, however, are being challenged by relatively new land use policies that now are promoted in Qinghai and everywhere in China's grassland regions, particularly by a parceling of the land through the Household Responsibility System.

Potential (historic) biodiversity

Past and present development activities have impacted seriously the local biodiversity in the Qinghai Lake area. The grasslands between the Datong Mountains and Qinghai Lake are gently rolling plains, dissected by small valleys and streams that are bordered by wetland vegetation (Figure 29). However, many riparian areas have dried out considerably in recent years, largely due to unsustainable harvest of shrubs for cooking fuel (Western Resources and Environment Research Center 1994) (Figure 30). Until recently, these riparian habitats comprised one of the few areas of the Tibetan plateau where shrubs comprised a significant part of the greater grassland ecosystem. Loss of wetland habitat has affected the avifauna in particular, including such species as the rare and internationally endangered black-necked crane. The Datong Mountains, on the other hand, are typical of many areas of the plateau, with valleys comprised of *Kobresia* sedge meadow and high barren peaks. And further north, in the Datong River valley, an extensive marshy grassland type serves as the primary summer pastures for local pastoralists. In the gently rolling hills both north and south of the Datong Mountains, some mammals can still be seen, but their present-day distribution and abundance hardly can compare with that of only a few decades ago. Past intensive poaching of wildlife, increasing physical disturbance by pastoralists (that is, the presence of more and more herders), the dissection of the grassland with modern fencing, and an overstocking of pastures in some parts of the county are the main causes of these drastic declines. As one village leader explained in March 1997:

> "In 1955-56, we had herds of tens of thousands of wild yak and huge herds of Tibetan wild ass … and a lot of other wildlife. But now most are dead, killed by the [early] Chinese. … We still see a few wild ass … and Tibetan gazelle in the summer and spring pastures … but the wild yak are gone."

Some wild yak may still be found in north-central Qinghai, in Tianjun (see Schaller and Liu 1996), but it is evident that all wildlife species have undergone extreme pressures and that some species have been nearly decimated since the 1950s. Now only remnants can be found.

Figure 29. Flock of birds (pochards, *Aythya* spp.) flying over wetland area near Qinghai Lake

Figure 30. Shrubland recently harvested (destroyed) for cooking fuel

During wildlife surveys conducted in the vicinity of the Datong Mountains between 1996 and 1998 (for a total of 18 survey-days comprising several long-distance excursions on foot), the following mammals were observed: Tibetan wild ass, Tibetan gazelle, gray wolf, Tibetan sand fox, red fox, Himalayan marmot, and plateau pika (see Figures 31 and 32). Other mammals known to occur in or near the Datong Mountains (but only sighted elsewhere in the province) include the blue sheep, desert cat, Pallas' cat, woolly hare, zokor, and weasel. Regarding the avifauna, the following species were observed in grassland, shrubland, montane, and riverside habitats near Qinghai Lake in summer 1997 (this short list excludes the numerous bird species observed only on the shore of Qinghai Lake): bar-headed goose, ruddy shelduck, goosander, black stork, great black-headed gull, common tern, Eurasian tree sparrow, Oriental skylark, common rose finch, several redstarts, several snow finches, gray-backed shrike, horned lark, Tibetan snowcock, Hodgson's stonechat, Tickell's leaf warbler, robin accentor, Hume's ground jay, red-billed chough, long-billed calandra lark, hoopoe, crag martin, sand martin, Himalayan griffon, golden eagle, Eurasian kestrel, lammergeyer, and upland buzzard (also see Table 20). Obviously, the alpine grasslands of the Tibetan plateau obviously are a special ecosystem with a unique wildlife assemblage. However, much basic biological research still needs to be done to better understand the conservation needs of individual species or groups of species. Given the grave risks facing these ecosystems, the present broad study – with its landscape-based and multi-disciplinary perspectives – is a necessary first step to elaborate a sound conservation strategy for these grassland ecosystems.

Figure 31. Plateau pika, *Ochotona curzoniae*, a keystone species of the Tibetan plateau

Figure 32. Tibetan wild ass, *Equus kiang*, a near endemic ungulate of the Tibetan plateau

Development priorities and land use

As shown earlier in this chapter, agriculture already is widespread in the vicinity of Qinghai Lake. To date, most cultivation has occurred in Gangcha. However, according to one local informant, the government only began to encourage – actually, to require – that local families plow the land in the early 1990s. But already, only a decade later, the high winds of winter and spring have blown tons of nutrient-rich topsoil away, oftentimes in huge dust storms that shroud the landscape in darkness, sometimes with visibility so low that vehicles must stop on the road. In the fall of 1999, though, national recognition of the long-term environmental damage caused by inappropriate large-scale plowing of these fragile grasslands was brought home to Qinghai when Premier Zhu Rongji decreed that around one-third of the province's farmland was unsuited for agriculture and therefore should be restored to its original state. Thus it finally has been seen that such land would be more productive by contributing to animal husbandry.

There are nonetheless many other activities that continue to mark and change the pastoral landscape of Gangcha. On the plains and hills between Qinghai Lake and the Datong Mountains, for example, more modern extensive fencing is erected every year. In fact, many aspects of modernization, such as building livestock shelters, small fields of supplemental winter forage (fenced pastures, sometimes artificially-seeded grassland), mud-brick winter homes, even some artificial water sources (wells and irrigation), continue to be promoted.

Regarding seasonal migration patterns, pastoralists in Gangcha continue to move from winter to spring pastures around 5 June, and from spring to summer pastures around 15 July every year. They return to their fall pastures (the same as their spring pastures) around 5 September, and from there back to their winter pastures around 25 September. Thus pastoralists reside approximately 250 days each year (70 percent of the year) in their winter pastures, while they spend only 110 days (30 percent of the year) in their combined spring-summer-fall pastures. Winter grasslands (pastures), like livestock, are contracted separately to each family under the official Household Responsibility System. Not every family, though, has the financial resources necessary to fence their winter land, leading to increasing risk of becoming victims of the cheating behavior of other people. In one sense, once private management of the land has begun, an arms race begins – or rather a "fencing race" – with rich pastoralists protecting more and more of their land from cheaters, thus ensuring winter forage for their livestock, but poorer pastoralists suffering the additional burden of losing some of their winter forage to others. Summer pastures, on the other hand, are managed in common, village by village, with land allocated to each family by the village leader or a village committee. Although individual cheating is less likely to occur in the summer pastures where the entire community grazes its livestock together, between-village cheating is not uncommon if the opportunity allows (interview with a local village leader, Spring 1997).

Back in the south of the county's five townships, in the lower altitudes near Qinghai Lake, more land has been plowed year by year. Although the total area of plowed land remains relatively small, the rate of conversion has been rapid in recent years. For example, Gangcha set a target of 467 ha to be plowed in 1996, representing a single-year increase of 3 percent in the area of cultivated land (Wei 1993, Gangcha County People's Government 1997). The amount of financial investment poured into such kinds of development has of course been disproportionately high. Soft development, on the other hand, such as investment in adult training, extension services, basic education, or micro-credit programs, has received relatively little attention in Gangcha and elsewhere in Qinghai's pastoral regions. All too often, technological quick-fixes are still being sought to increase the overall productive capacity of the Tibetan plateau grasslands. Recent planning documents in Gangcha reported that "to strengthen basic construction of the animal husbandry sector, emphasis will be placed on improving (reseeding) grassland, building livestock shelters, and constructing irrigation works" (Gangcha County People's Government 1997). Furthermore, in the previous year (1996), the county government had already "built 200 livestock shelters (in addition to the 300 shelters built by the prefecture government), poisoned 34,680 ha of grassland to eradicate small mammals [most likely the plateau pika], reseeded 667 ha of grassland from airplanes, and … constructed new irrigation works" (Gangcha County People's Government 1997). Obviously, all such development priorities have left clear marks in the landscape. More importantly, though, these marks are the confirmation that official rhetoric spoken by local, provincial, and national leaders actually does translate into concrete reality. Thus policy, whether provincial or national in origin, does indeed affect pastoralists in even the most remote regions of the Tibetan plateau, as well as the grassland ecosystems themselves. And, considering China's clear stance on the extreme importance of biodiversity conservation in general and on the value of Qinghai's grasslands to the nation, there is grounds for optimism that, soon, more sustainable development approaches will be adopted.

A final landscape in Gangcha, this one a landscape of "power," is the county administrative center. All major decisions pass through this center, from economic and political decisions to decisions pertaining to education, disaster relief, health care, and any other bureau as may be present. Virtually all non-pastoral activities in the county – telecommunication services, transportation, business and trade, cultural centers – are centered in this, its sole town, known both as Gangcha (which is the county name, itself based on the name of a local Tibetan tribe) and as Shaliuhe ("Sand Willow River," the name of the largest stream in the county). Even at lower levels, power still tends to be spatially bound since it is almost always from township centers that extension workers head out over the vast grassland to find and reach local pastoral families, one family at a time. Thus, although Tibetan pastoralism is largely extensive in nature, power tends to be more confined in space. A crucial question, then, is whether traditional Tibetan land use (extensive pastoralism) and the present centralized system of governance are compatible with one another in the long-term, or whether it will be necessary for one of these two systems to adapt in order to accommodate the other. This question is very important since it has many socio-cultural, economic, and ecological ramifications, and it is reflected most clearly in the ongoing debate about household-based (versus communal) land management and the related process of sedentarization.

Nature tourism (Bird Island Nature Reserve) (back to top)

Finally, an examination of the landscapes surrounding Bird Island Nature Reserve also provides some insight into culture, society, and environment in Qinghai today. The biodiversity and potential for ecosystem restoration in the region are discussed briefly, followed by a short discussion of the possible role of tourism in integrated conservation and development in the Qinghai Lake area. In this as in all previous sections, the past and present (and to some degree, even the future) are discussed together, intertwined as they are in the present-day landscape.

Biodiversity and ecological restoration

Although “Bird Island” was once a real island, the receding waters of Qinghai Lake in combination with upstream soil erosion and siltation in the Pu River have created an isthmus that now joins the “island” to the mainland. Qinghai Lake’s water level has in fact dropped over 10 meters since the 1920s (Western Resources and Environment Research Center 1994). Soil erosion in particular has increased dramatically over the past several decades as human and livestock populations have increased exponentially, leading in some places to severe land degradation.

On and around Bird Island itself, there are numerous flocks of birds, many migratory. Most common are the bar-headed goose, great black-headed gull, brown-headed gull, and great cormorant. Several kilometers away from the public viewing area are also several black-necked crane. Many migratory bird species from across Central Asia can be observed at the reserve, some for breeding and others in transit to or from their winter ranges. Many birds also nest on several rocky outcrops in the lake and on Haixin, a rugged island in the center of the lake.

Less than a hundred years ago, even only fifty years ago, significant mammalian wildlife was abundant in the vicinity of Bird Island Nature Reserve and the Pu River valley as well. Prejevalsky’s (1876) account of the abundance of the Tibetan wild ass, Tibetan sand fox, and other animals in the area has been cited already. Also present in this area are remnants of a once large and widespread population of Przewalski’s gazelle. (The other current location of this species is the sand dunes on the northeast shore of Qinghai Lake). Today, however, mammalian wildlife is much scarcer than a century ago, mostly because of hunting by outsiders, particularly by the Chinese military in the 1950s and 1960s. I interviewed several herders in 1997, including one village leader, and they all agreed that the reintroduction of the Tibetan wild ass, for example, would be an endeavor that would receive the support of most local pastoralists. In their opinion, poaching would not pose any problem, but the availability of sufficient forage (to share with livestock) was still uncertain. While their short-term economic condition is obviously extremely important to them, pastoralists nonetheless also value overall grassland quality (ecosystem integrity) as well as its native wildlife. This perspective gives some solid ground for hope for the successful protection, and possibly the restoration, of grassland ecosystems on the entire Tibetan plateau.

Nature-based tourism in China today

The most memorable landscape in the Bird Island area, however, may in fact be the numerous busloads of national (Chinese) tourists that come every spring and autumn to see the nesting birds at this premier natural site. In China, though, nature-based tourism does not necessarily imply a peaceful appreciation of natural landscapes, but rather may refer to mass tourism to famous land formations or natural phenomenon. The authorities in charge of such tourist sites apparently hope to generate as much income as possible, often with as little investment, planning, or effort as possible. Most visitors to Bird Island Nature Reserve come on day-trips only, totaling around 10 hours in rented vehicles or buses from the provincial capital, Xining. Unfortunately, apart from the entrance fee to the reserve, almost all economic benefits return to the travel companies with their headquarters in Xining, Beijing, or even abroad. Furthermore, with little local supervision and a general lack of environmental awareness, it is not uncommon for visitors to actively disturb the nesting birds, even throwing rocks, at the cormorant colony. Thus visitors usually do not contribute significantly to, and may even detract from, efforts to preserve the habitat and to promote long-term sustainability in the area. Until natural resources are attributed greater intrinsic value, whether specific wildlife species or biodiversity as a whole, true sustainability (and hence the protection of biodiversity) may remain elusive and perhaps even unachievable. In the case of Bird Island Nature Reserve, as with all the grassland resources of Jiayi and Gangcha and elsewhere in the Qinghai Lake area, if environmental awareness does not increase both among local residents and outsiders (whether they be new immigrants to the area, or distant legislators and decision-makers), then harm may continue to occur and natural resources will become increasingly depleted and degraded, to the detriment of the entire nation.

Power, Poverty, Tradition, and Modernization (back to top)

Still more questions (back to top)

It is true that more questions than answers stem from the present landscape analysis. Yet almost invariably it is simple questions that can do most to set new directions for the future. As noted in the sub-title of this chapter, Current Developments and Trends, the changes currently taking place in Qinghai's pastoral regions, including the Qinghai Lake area, have a direct bearing on the future of both natural and human environments in these regions. Or in other words, chosen development priorities (and *de facto* priorities, that is, all sanctioned development activities) can and do impact the landscape in a large variety of ways, thus setting a trajectory for future environmental trends today. Ultimately, sustainability is simply a matter of long-term environmental trends. Therefore the question we should ask first is, Are current developments in the Qinghai Lake area sustainable? And secondly, equally as important, Which framework or perspective should we adopt to assess sustainability (both from the perspective of local pastoralists and of the nation)? These are two very difficult questions that raise many more questions! But they are the necessary starting point.

A reformulation of the second question is, What is the end-goal of development in China? The answer to this question – that the end-goal of development in China is to attain the greatest improvement in "quality of life" for the greatest number of people, and thus to maximize social stability in the country – at least helps to better understand, if not to entirely agree with, why the needs or desires of local people sometimes appear to be ignored in favor of the needs or desires of people from the more populous eastern parts of China. Although Tibetan pastoralists are real stakeholders in all new developments pertaining to land use in the Qinghai Lake area, they generally have not been consulted in the decision-making process. This perspective has been confirmed by the repeated statement of several Tibetans from the lake area that agriculture was introduced only very recently (for example, in 1993 in parts of Gangcha) and was accepted and implemented simply because it had already been decided by higher levels of government that agriculture should be expanded in the area. Yet now it is increasingly recognized in China, even in Qinghai, that in order to achieve ecological sustainability local conditions must be heeded, and that local people should be heard and respected. In the future, indigenous knowledge of local environments and their tried-and-true (tested) land use practices should be considered in concert with new development ideas. Furthermore, participation is likely to increase pastoralists' sense of ownership of new ventures and therefore is also likely to promote acceptance and assistance, as opposed to resistance, for new development activities introduced to the area.

One of the main ideological stumbling blocks for the Chinese government to accept to sit at the same table as pastoralists has been that, from a Marxist socialist perspective, neither grasslands nor pastoralism have been attributed much value since "grass grows on its own" and "pastoralists just let their animals graze." Land and livelihood in socialist China generally are perceived as valuable only when labor is added. Thus, since traditional animal husbandry does not require a total transformation of the land and is (wrongly) assumed to require little labor, it rarely has been considered as worthwhile or equally as valuable as agriculture. This view is the main reason why so much grassland was destroyed (plowed) in the past, with no regard for local pastoral traditions or even for the harsh ecological realities of the Tibetan plateau.

While it is evident that ecological sustainability is fundamental, a second aspect of sustainability is critical as well. Assuming that sustainability must be measured at least in equal part from the Tibetan pastoralists' perspective, not solely from a national perspective (e.g., development must be culturally acceptable), a key question becomes, Can extensive pastoralism and its associated traditional forms of decision-making survive within a centralized, spatially-bound system of governance such as present in China, or must one form ultimately be subsumed by the other? For a development activity to be truly sustainable, then, not only must it be ecologically and economically sound or viable, but it must be socially and cultural acceptable as well. The sole alternative viewpoint is to accept as inevitable the disappearance of some pastoral cultures in the name of progress and development. If the latter premise is untenable, as many would agree, then sustainability requires that systems of governance worldwide begin to adopt more flexible policies that adapt in part to pastoral livelihoods as well as the converse. Some significant examples would be to attempt to provide education, health care, veterinary services, and even financial credit in ways that are relevant and accessible to a (semi-)mobile population and in accordance with their seasonal (temporal) needs.

The modern pastoral landscape in review (back to top)

What kind of development is being implemented in the Qinghai Lake area? Land use intensification is noted in the construction of livestock shelters, fields for supplemental winter forage, grassland fencing, grassland reseeding projects, and even irrigation projects. Technological fixes, not education or changed attitudes, are expected to promote economic growth by increasing livestock production or converting the grassland to fields of barley. Furthermore, most pastoralists now live in fixed abodes for at least part of the year. The implications of all these changes are staggering. Crop cultivation has now been recognized as unsustainable and therefore inappropriate for most of the province's alpine grasslands. Winter houses and fences tend to encourage pastoralists to follow less and less flexible land use patterns, with some pastures now being grazed during every season. New livestock shelters, increased availability of winter forage, and improved veterinary services contribute to higher livestock survival rates, particularly of young calves and lambs. However, without a concomitant increase in autumn livestock sales, as the government (wrongly) assumed would happen naturally based on economic maximization theories, increased survival rates have translated for the most part into more, but not into better quality, animals. In fact, livestock quality has decreased drastically over the last few decades (Western Resources and Environment Research Center 1994). While most hardships do indeed occur in winter, particularly livestock starvation and death, the almost exclusive focus of current pastoral development efforts on the winter crunch season may be inappropriate. As the present trading habits of most pastoralists stand, however, any increase in herd sizes due to attempts to improve livestock conditions is not matched by an equivalent number of animals being sold to market in the fall (as planned or hoped by most government planners; Cincotta et al. 1991). Thus, if successful, although livestock improvements may assist the pastoralists in the short term, even this "success" can lead to increased stocking rates and concomitant overgrazing in some pastures. Warm season pastures in particular become overstocked and in some instances seriously overgrazed (Lang et al. 1997). Clearly, technological “solutions” alone are not sufficient to address the real environmental problems in the Qinghai Lake area. Social development, or participatory community development, is also needed.

The way forward (back to top)

With the demand for livestock products on the increase (because of the increasing human population), there will be more and more incentive for pastoralists to increase their herd size. A new approach to development therefore must be sought. Not only should the present winter focus of development be redirected to a more even division between cold- and warm-season grasslands, but the corollary of this shift is also important: there should similarly be a move away from a population-driven development focus toward a more land- or resource-driven focus. That is, on the whole, development should be planned more according to the availability of natural resources than according to (often unrealistic) desired outputs. Only by focusing on the grassland itself as well as on people and livestock, and on the summer as well as on winter pastures, does ecological sustainability have a chance to be achieved.

In considering the grassland, however, it is local pastoralists that may be in the best position to assist in determining how it should be managed. To prescribe how this resource should be used, pastoralists have many centuries of valuable cultural knowledge (indigenous knowledge) which should not be ignored. This knowledge base is but one of the many benefits gained by adopting a participatory approach to development. The most striking features of the grassland, of its climatic extremes and high variability, have led Tibetan pastoralists to adopt highly flexible grazing strategies. Translated into the language of modern rangeland science, pastoralists have long sought to find and to match as closely as possible the grassland’s “dynamic carrying capacity” (Miller 1995). Tibetan pastoralists can also be said to seek to minimize risk (Galaty and Johnson 1990) and to maximize reliability (Roe et al. 1999).

In contrast to traditional grazing strategies, however, the Chinese government has contracted virtually all the land in the Qinghai Lake area to individual households (through the Household

Responsibility System) over the past two decades. However, privatization and grassland fencing both limit grazing flexibility in an ecosystem where fast and flexible strategic responses can make the difference between prosperity and poverty, or worse, between life and death of livestock. Sedentarization of pastoralists likewise has a very poor track record worldwide (Bennett 1988). Where resources are already being used at or near their carrying capacity (for sustainable utilization), such as is the case for most grasslands in China, any land use intensification – whether privatization, sedentarization, or fencing schemes – carries with it an inherently high risk of increasing the rate of grassland degradation (Williams 1996). After all, there still remains, minimally, the same number of livestock trying to survive on the same finite grasslands.

Alternate less resource-intensive types of development that could be pursued include, for example, the promotion of value-adding enterprises (processing livestock products, as opposed to selling raw materials only), further development of the commercial sector (such as transportation, marketing, and sales), and the development of a nature-based tourism (ecotourism) industry with the returns remaining in the region. Equally important for pastoralists is the promotion of basic education and literacy as well as the provision of health care services. With any of these kinds of development, however, whether resource development (including animal husbandry) or the provision of basic services, long-term sustainability is only possible if all stakeholders, particularly the pastoralists themselves, are involved in the overall process of change. Participation and ownership, not ideologically correct or policy-driven development plans, are essential for the best likelihood of long-term social, economic, and environmental sustainability on the Tibetan plateau’s alpine grasslands.

CHAPTER FIVE

The Ecology of Grassland Enclosures and Changing Patterns of Livestock Grazing: A Vegetation Analysis

Introduction (back to top)

Large tracts of Qinghai's alpine grasslands currently are being enclosed (fenced) or undergoing other dramatic changes that affect how they are utilized by pastoralists (Luosan 1996). When ecologically important variables such as the total area of available grassland or the number of livestock are held constant, it is clear that fences affect, first and foremost, a change in the spatio-temporal pattern of livestock grazing. Even though fences can be used to limit livestock numbers in some areas for limited periods of time, they do not of themselves affect changes in overall grazing pressure. Clearly, with a constant total livestock population, if fewer animals are present inside fenced areas – as is generally the case, which is why fencing often has (wrongly) been equated directly with "grassland protection" – then livestock simply are more numerous outside such fenced areas, to the detriment of the unfenced lands. Unless the total number of livestock is decreased, fencing alone will do little to ameliorate the overall condition of the grasslands. As Holzner and Kriechbaum (1999) observed in Tibet, there are even real "dangers of fencing: as the pastures inside [are] protected, the areas outside (the pastures "where you can do what you want") are overgrazed automatically…. A preferable alternative would be an open, flexible system to treat *all* the pasture land in a proper way!" Thus the enclosure of grassland is an important variable that can, and indeed should, be examined independently of other variables such as total area of grassland or livestock numbers. This chapter focuses specifically on the ecological (botanical) impacts of fencing and of related changes in livestock grazing patterns.

The "fencing treatment" in this study represents not only the simple presence of fences, but more importantly the presence of a whole new grazing pattern: mainly winter-grazed grassland inside the fenced areas, and a more continuously grazed grassland (with both winter and summer grazing) outside the fenced areas. If continuously grazed grassland shows any sign of degradation, as ecological theory would suggest (Coughenour 1991, Humphrey and Sneath 1996, Miller 1996) and experience has shown (Li et al. 1993, Williams 1996), then a significant redirection of pastoral development funds away from fencing schemes and other aspects of land use intensification and sedentarization should be seriously considered. Yet enormous funds continue to be spent on enormous fencing schemes, both by local government bureaus in Qinghai and by large international development agencies (e.g., Japan International Cooperation Agency). To avoid further unnecessary (and possibly detrimental) spending habits, several important questions should be asked. In particular, How does fencing affect species richness, plant cover, and species composition of the grassland? Or, in more general terms, How does fencing impact grassland quality? This chapter examines these questions in one specific area near the southeastern shore of Qinghai Lake, an area that is representative of a large portion of Qinghai's alpine region (Bian 1987, Su 1993).

Methods and Results (back to top)

General methods (back to top)

In total, 194 plots (each plot 0.25 m^2) in alpine meadow vegetation were examined in the summer of 1997. The study area was located at the base of the Nanshan Mountains near the southeastern shore of Qinghai Lake (in Daotanghe Township, Gonghe County, Hainan Tibetan Autonomous Prefecture). Sixty-eight plots were studied between 6 - 12 June (in early summer) and 126 plots were examined around one and a half months later between 29 July and 12 August (in late summer). A further 38 plots were located in nearby but different habitat types for comparative purposes. In each plot, as many plant species as possible were identified in the field. However, when a species could not be identified, several specimens were collected and later identified by a research assistant, Simo Tolvanen, in Helsinki, Finland. Two identification guides were used, the five-part illustrated Flora of China, *Iconographia Cormophytorum Sinicorum*, and Hao (1938). When possible, plant identifications were checked by comparing with specimens available at the Helsinki Botanical Museum. On the field, the percent cover was estimated for each plant species in each sampling plot.

For analytical purposes, if a plant was noted as present but covered less than one percent of a plot's area, it was given an assumed value of 0.5 percent cover.

Plots were located on 37 different transects at 10 - 20 m intervals. One-third of the transects were paired inside and outside fenced areas in order to remove as many confounding factors as possible, thus providing a more solid foundation by which to compare the relative effects of seasonal (winter) grazing versus year-round (summer and winter) grazing by livestock. Further, to more adequately compare between plots and species, only the plots observed in late summer are included in most analyses (n = 118; this excludes eight plots that were heavily trampled along a travel route). The relative impacts of fencing and grazing patterns on biodiversity (species richness), vegetation cover, and species composition thus are studied in one area of alpine meadow near Qinghai Lake in the northeastern part of the Tibetan plateau.

Most statistical analyses were done with the Data Analysis Tool in Microsoft Excel (version 7.0), though factor analysis (principal components analysis) was done in SPSS for Windows (version 6.0).

Species richness (back to top)

A simple (though only partial) indicator of biodiversity is species richness, measured as the average number of plant species observed per plot. On average, 11.3 species were observed in the seasonally grazed (winter, fenced) plots, with a 95 percent confidence interval, CI, equal to 0.6 (sample size, n = 67 plots), while only 9.8 species were observed in the continuously grazed (summer and winter, unfenced) plots (CI = 0.7; n = 51). Because variances differ significantly (F-value = 1.7704, p = 0.0150), a t-test assuming unequal variances was done to determine if these average species richness values are statistically different. This test shows that the difference in average number of plant species observed inside and outside the fenced areas is statistically very significant (t Stat = -3.4939, p = 0.0007).

In total, over 40 plant species (in 12 families) were observed in late summer plots, including 3-4 sedges, 8-11 grasses, 4-5 legumes, and at least 25 other forbs (Table 7).

Table 7. Plant species observed in alpine meadow vegetation, arranged in approximate order of abundance in the study area (species identification by Simo Tolvanen; classification based on Hao 1938, Mitchell and Rook 1979, Missouri Botanical Gardens 2000)

FAMILY	Species	Notes
CYPERACEAE - Sedge Family		
	Kobresia humilis	Sedges are the most abundant graminoids in
	Kobresia sp.	The Tibetan plateau rangelands, especially
	Carex sp.	*Kobresia* species.
	an unidentified sedge	
POACEAE (GRAMINAE) - Grass Family		
	Poa tibetica	Most alpine grasslanad formations in
	Poa bulbosa	Qinghai are comprised of *Kobresia* spp. and
	Poa sp.	one or more grasses. *Stipa purpurea*, for
	Stipa purpurea	example, is a dominant whose center of
	Stipa capillata	importance is on the Tibetan plateau
	Stipa sp.	(Change 1981).
	Festuca ovina	
	Festuca sp.	
	Elymus nutans	
	Achnatherum splendens	
	an unidentified grass	
LEGUMINOSAE (FABACEAE) - Bean Family		
	Medicago ruthenica	Several *Astragalus* spp. Are endemic or
	Astragalus polycladus	native to China.
	Astragalus alpinus	
	Astragalus sp.	
	Oxytropis falcata	
COMPOSITAE (ASTERACEAE) - Daisy (Sunflower) Family		
	Artemisia campestris	China native
	Leontopodium nanum	China native

Leontopodium himalayanum
Taraxacum sp.
Anaphalis lactea
Crepis flexuosa
Heteropappus altaicus
Heteropappus hispidus
an unidentified compositae

THYMELAEACEAE - Mezereum Family

Stellera chamaejasme See Figure 25.

LABIATAE (LAMIACEAE) - Mint Family

Dracocephalum heterophyllum

ROSACEAE - Rose Family

Potentilla multicaulis
Potentilla nivea
Potentilla cuneata (P. ambigua)
Potentilla bifurca
Potentilla chinensis
Coluria longifolia

Potentilla multicaulis is endemic to China, and *Potentilla nivea* is native to China.

PLANTAGINACEAE - Plantain Family

Plantago asiatica

UMBELLIFERAE (APIACEAE) - Carrot Family

Bupleurum scorzonerifolium

CAMPANULACEAE - Bellflower Family

Adenophora gmelini

GENTIANACEAE - Gentian Family

Gentiana dahurica
Gentiana szechenyii
Gentiana sp.

POLYGONACEAE - Buckwheat Family

Polygonum viviparum

Polygonum sp.

Unidentified family

unidentified forb (no. 1)
unidentified forb (no. 2)

Species-area curves [(back to top)]

A fuller view of species richness can be seen in species-area curves, which display the cumulative number of plant species observed in function of the total area sampled. Species-area curves were obtained by randomly (re)sampling the same plots examined earlier for 15 iterations, each time taking note of the cumulative number of plant species observed in function of the total area sampled. Twenty plots (5 m^2) were examined in each set of iterations. Multiple iterations were needed in order to calculate 95 percent confidence intervals for the species-area curves. The species-area curves inside and outside fenced pastures are shown in Figure 33. "W-mean" is the average number of species observed in winter (fenced) pastures, "S-mean" is the average number of plants observed in summer (unfenced) pastures, and "Log" and "Ln" represent the logarithmic function. (It should again be noted that the unfenced areas denoted here as "summer" pastures traditionally have been winter pastures, but with the recent agricultural reforms – including the introduction of fences – traditional winter areas that have not yet been fenced have increasingly been grazed in the summer as well). The algebraic formulae for the two species-area curves also are given in Figure 33, where y is the cumulative number of species observed, and x is the total area (in m^2). Species richness in fenced and unfenced pastures tends to plateau at around 38 and 35 species. Table 8 also shows that differences in species richness between the two pasture types becomes statistically significant when around 3.75 m^2 (15 plots) of alpine meadow is examined.

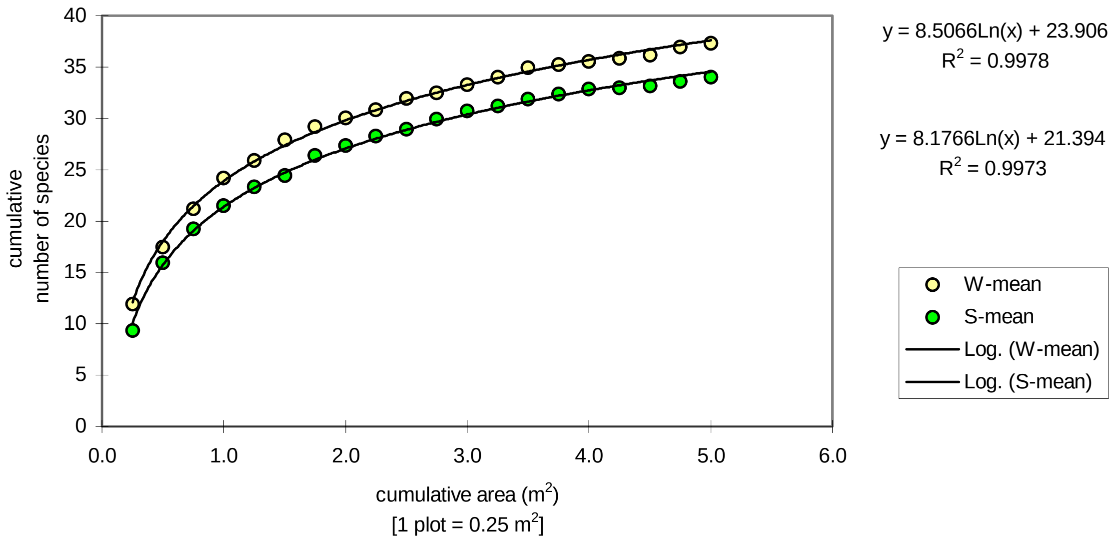

Figure 33. Species-area curves observed in fenced pastures (seasonally grazed, winter only) and unfenced pastures (continuously grazed, summer and winter) in alpine meadow vegetation near Qinghai Lake

Table 8. Cumulative number of plant species observed in sampled plots

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Area (m^2)	Plots (#)	Fenced Pastures (and 95 Percent CI)	Unfenced Pastures (and 95 Percent CI)	Level of Significance (*: $p < .05$; ns: not sign.)
0.25	1	11.93 (1.09)	9.33 (1.26)	ns
0.50	2	17.47 (1.40)	15.93 (1.15)	ns
0.75	3	21.20 (1.17)	19.21 (1.11)	ns

1.00	4	24.20 (1.40)	21.50 (1.03)	ns
2.00	8	30.07 (1.23)	27.36 (1.44)	ns
3.00	12	33.27 (1.42)	30.71 (1.04)	ns
3.75	15	35.27 (1.00)	32.36 (0.68)	*
4.00	16	35.53 (0.97)	32.86 (0.65)	*
5.00	20	37.33 (0.71)	34.00 (0.72)	*

The above measures of species richness represent α-diversity, or the diversity of species within a single habitat type. When other habitat types are also examined, many new plant species are observed. Inter-habitat diversity is called β-diversity. Several other types of vegetation are present in the vicinity of the present study area, including tussock grassland near the lakeshore, wetland habitat, *Salix* shrubland on the slopes of the Nanshan Mountains, and a different alpine meadow type near the summit of the mountains. According to Su (1993), the specific types of rangeland near the study area include "temperate forage improved grassland" as well as *Iris lactea* lowland meadow, *Achnatherum splendens* temperate steppe, *Stipa purpurea* high-cold steppe, and *Kobresia pygmaea* and *Kobresia humilis* alpine meadow.

Vegetation cover (back to top)

Vegetation cover also varies between fenced and unfenced pastures. On average, the seasonally grazed (winter, fenced) plots had 55.0 percent cover, while the continuously grazed (summer, unfenced) plots had only 40.5 percent cover. Because variances do not differ significantly (F-value = 1.0606, p = 0.4175), a t-test assuming equal variances was done to determine if the differences in percent cover are statistically significant. This test shows that the difference in average percent cover of plots located inside and outside the fenced areas is indeed statistically very significant (t Stat = 4.5126, p = 0.0000). However, it is still not known which individual species, or groups of species, contribute the most to the observed differences in plant cover between the different land management schemes.

To study the contributions of individual species or groups of species to total vegetation cover, a simplified dataset was used that includes only species with an average percent cover over one percent and that were present in at least one-quarter of the study plots. Despite the reduced number of species (22 species; Table 9), this list still accounts for over 90 percent of the total vegetation cover in both types of pasture. However, since the distribution of most species' percent cover in the sampled plots is not normal (i.e., most species have skewed distributions, with a very low percent cover in most plots, and much higher cover in only a few plots), it is not possible to calculate whether the observed differences between a species' cover in each of the two treatments is statistically significant (i.e., between the "inside" and "outside" fencing treatments, or between the seasonally grazed versus more continuously grazed pastures).

Table 9. Most common species in alpine meadow vegetation, with average percent covers and the proportion of plots with species present inside and outside the fenced areas

Species Name	Percent Cover of Species		Proportion of Plots w/ Species	
	Inside	Outside	Inside	Outside
Kobresia humilis	11.2%	11.4%	65.7%	60.8%
Medicago ruthenica	6.3%	4.7%	88.1%	84.3%
Poa tibetica	4.5%	0.6%	71.6%	21.6%
Stipa purpurea	3.3%	0.4%	37.3%	11.8%
Festuca ovina	3.2%	1.9%	79.1%	56.9%
Elymus nutans	3.0%	0.9%	53.7%	25.5%
Astragalus polygladus	2.5%	1.8%	68.7%	64.7%
Carex sp.	2.5%	0.4%	46.3%	17.6%

Artemisia campestris	2.4%	0.6%	58.2%	37.3%
Stellera chamaejasme	2.0%	0.9%	59.7%	41.2%
Potentilla multicaulis	1.6%	2.1%	61.2%	76.5%
Leontopodium nanum	1.6%	0.4%	17.9%	13.7%
Astragalus alpinus	1.3%	0.6%	20.9%	13.7%
Dracocephalum heterophyllum	1.3%	0.8%	37.3%	52.9%
Taraxacum sp.	0.9%	0.8%	44.8%	51.0%
Poa bulbosa	0.8%	0.6%	25.4%	19.6%
Kobresia sp.	0.8%	2.7%	13.4%	23.5%
Potentilla nivea	0.6%	0.4%	31.3%	31.4%
Potentilla cuneata	0.4%	1.5%	31.3%	58.8%
Potentilla bifurca	0.3%	1.8%	22.4%	43.1%
Plantago asiatica	0.2%	0.9%	14.9%	33.3%
Achnatherum splendens	0.0%	1.2%	0.0%	21.6%

Based on the above highlights, each factor has been defined according to main plant types (Table 11). Factor 1, for example, has an important sedge component, along with a legume and another forb, while Factor 2 includes an important grass component along with a legume and sedge. Transformation of the data with principal components analysis (PCA) provides statistically independent factors with normal distributions (as well as a reduction in the number of factors to be analyzed). If we consider only the factors that explain over 5 percent of the total variability in percent cover, the 22-species matrix is reduced even further to only 8 independent factors (Table 10). To increase the interpretability of each factor, all loadings were maximized using Varimax rotation on the entire matrix. Simple factor definitions are given in Table 11, and the entire factor matrix is shown in Table 12.

Table 10. Main principal component analysis (PCA) factors

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Variable	Eigenvalue	Percent of Variation	Cumulative Percent
Factor 1	2.3386	10.6	10.6
Factor 2	2.0470	9.3	19.9
Factor 3	1.9922	9.1	29.0
Factor 4	1.5334	7.0	36.0
Factor 5	1.4969	6.8	42.8
Factor 6	1.3366	6.1	48.8
Factor 7	1.2973	5.9	54.7
Factor 8	1.1384	5.2	59.9

Table 11. PCA factor definitions (based on the rotated factor matrix; see Table 12), with the statistical significance of the differences of each PCA factor between fenced and unfenced pastures

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Factor No.	Factor Name	Main Plant Species in PCA Factor	Differences Between Treatments
Fct 1	SEDGES-LEGUMES	*Carex* sp., *Kobresia* sp., *Astragalus polycladus*	p = 0.0239 (*)
Fct 2	GRASSES-LEGUMES	*Poa tibetica, Poa bulbosa., Astragalus polycladus*	p = 0.0232 (*)
Fct 3	GRASSES-FORBS	*Stipa purpurea, Taraxacum* sp.	p = 0.1181 (ns)
Fct 4	FORBS-GRASSES 1	*Potentilla* spp., *Achnatherums splendens*	p = 0.0027 (*)
Fct 5	FORBS-GRASSES 2	*Potentialla cuneata, Plantago asiatica, E. nutans*	p = 0.5517 (ns)
Fct 6	LEGUMES 1	*Astragalus alpinus*	p = 0.0000 (*)

Fct 7 FORBS *Stellera chamaejasme, Leontopodium nanum* p = 0.1087 (ns)

Fct 8 LEGUMES 2 *Medicago ruthenica* p = 0.0096 (*)

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Table 12. Principal components analysis (PCA) factor matrix after Varimax rotation (see Table 9 for full species names)

Species Name	Fct. 1	Fct. 2	Fct. 3	Fct. 4	Fct. 5	Fct. 6	Fct. 7	Fct. 8
K. humilis	.27122	-.48912	-.20599	-.10948	-.19046	.00157	-.18632	-.13473
M. ruthenica	.02738	-.01045	. 19644	-.12347	-.05313	-.11777	-.09907	.76830
P. tibetica	-.02974	-.77025	. 00630	-.17191	-.16887	.12625	-.08360	.07300
S. purpurea	-.02885	-05886	. 74286	.09286	-.12597	.13345	.16043	.05580
F. ovina	-.29255	.15125	-.25281	-.03071	-.46190	-.01110	.35895	.18520
E. nutans	.04761	.01424	. 28567	.01166	.51031	.09423	.17405	.37959
A. polycladus	.43698	.49723	. 11078	-.26151	.07970	-.49291	-.13228	.02404
Carex sp.	.69345	.05409	-.09986	-.16011	-.08069	-.13153	.09197	.20024
A. campestris	.53988	.1999	-.29342	.18668	-.11701	.14104	.04452	.16038
S. chamaejasme	.04523	-.01753	-.02279	-.12146	-.06546	.07452	.75672	-.02341
P. multicaulis	.05046	-.32211	-.00888	-.34931	-.10709	.04607	-.25049	-.40398
L. nanum	-.07347	-.01794	. 27347	-.12746	.01889	-.06319	.49751	-.46801
A. alpinus	.11019	-.01998	-.08707	.00950	.11333	.75506	.20357	-.03535
D. heterophyllum	-.09262	.16645	. 30408	-.06076	-.01301	.68917	-.34003	-.10296
Taraxacum sp	-.04794	.13357	. 73618	-.09016	.07349	-.06639	-.13899	.11347
P. bulbosa	.41984	.68692	-.08376	.03870	.04970	-.08444	-.02493	-.15515
Kobresia sp.	-.68488	.08437	-.13028	-.12090	-.06903	-.10717	.07832	.19838
P. nivea	-.11156	.12944	-.16946	.61758	-.26624	-.27741	-.09101	-.21665
P. cuneata	.04550	-.04145	-.19199	.29123	.68350	.03409	.07018	.01261
P. bifurca	.10879	-.07333	.07036	.73046	.02636	.33095	-.06026	.02637
P. asiatica	-.24453	.08864	-.04041	-.12352	.67180	.03347	-.18815	-.08582
A. splendens	.02329	-.12349	.01767	.55506	.22901	-.07528	-.11098	.02709

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How should each PCA factor be defined? To begin, each species can be examined to see if it is "loaded" mainly on only one or a few factors – a box has been drawn around the main loading(s) (see Table 12). Then, in a second step, each factor can be examined to see which of its component species have the highest loadings – these loadings have been shaded in Table 12 *[boxes and shading not available in web-format]*.

To increase further our confidence in the analysis of whether or not fencing (or the grazing pattern that fencing represents) has a significant impact on each PCA factor, a subset of the 118 plots examined to date (i.e., the 67 plots inside and 51 plots outside fenced areas) were paired in the sampling design in order to remove or to minimize as much as possible the effect of as many confounding variables as possible (e.g., altitude, short-term patterns of livestock grazing, proximity to water, proximity to tents). These paired plots (n = 76, or 38 pairs) provide repeated measures of percent cover (transformed through principal component analysis into factor values) in similar habitat types and at the same distance on both sides of the fences. The difference of cover between inside fenced areas and outside fenced areas was examined separately for each factor with a paired t-test. The significance levels of these differences are indicated in Table 11. Most strikingly, four of the five PCA factors that exhibit significant differences between inside and outside fenced areas have relatively important "leguminous" components (factors 1, 2, 6, and 8). As already indicated, Factor 1 also has an important sedge component, and Factor 2 a large grass component, while Factor 4 is comprised mainly of other forbs. It is evident, then, that fencing – and the changes in land use pattern that fencing tends to represent – has a measurable and statistically significant effect on a variety of plant species and plant types. Surprisingly, however, no significant difference was observed for one factor comprised mainly of two weed species (Factor 7). It is generally recognized, for example, that *Stellera chamaejasme* is a poisonous plant inedible by livestock, and thus a species that is likely to increase in the biota because of selective livestock grazing. This species can therefore serve as an indicator of overgrazing (Environment Science and Technology 1998b). Qualitative visual observations indicate that *Stellera chamaejasme* was more abundant outside of fenced areas, in the year-round grazed pastures, but the overall sample size in this study was too small to statistically detect this trend.

Another way to compare groups of species is to categorize them according to main types, that is, grasses, sedges, legumes, and other forbs. An examination of the paired dataset (n = 76) according to these four main types reveals in particular that grasses and all forbs combined (i.e., including legumes) have a significantly lower percent cover outside of fenced areas, but that the percent cover of sedges remains unchanged. Furthermore, regarding the individual contributions made by each plant type to the total vegetation cover, grasses tend to comprise a smaller proportion of the total cover outside of fenced areas, while sedges tend to comprise a larger proportion. Legumes and other forbs, on the other hand, contribute similarly to overall vegetation cover whether inside or outside the fenced areas (Table 13). When all plots are examined together (i.e., more than just the paired plots; n = 118), it also is noted that grasses and leguminous plants have significantly lower percent covers outside fenced areas. Finally, while grasses' contribution to total cover is significantly less outside fenced areas, the contribution of forbs tends to be higher (Table 14). Thus, on the whole, the treatment of continuous grazing (outside fences) does not appear to affect sedges very much, but it apparently leads to a decrease in the absolute percent cover of grasses and legumes, as well as to a decrease in the proportion of grasses in the overall vegetation assemblage. Based on Table 14, this treatment also appears to lead to a slight increase in the proportion of non-leguminous forbs in the overall vegetation assemblage.

Table 13. Average percent covers and contributions to total vegetation cover of four plant types (paired plots only, n = 78), with p-value of paired t-test for differences between fencing treatments

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Plant Type	Percent Cover of Each Plant Type			Proportions of Total Vegetation Cover		
	Inside	Outside	(p-value)	Inside	Outside	(p-value)
Grasses	12 %	5 %	(0.0013)	22 %	17 %	(0.1450)

Sedges	16 %	16 %	(0.8034)	30 %	37 %	(0.1187)
Legumes	10 %	7 %	(0.0127)	21 %	20 %	(0.6737)
Other Forbs	12 %	8 %	(0.0033)	27 %	26 %	(0.8963)

Table 14. Average percent covers and contributions to total vegetation cover of four plant types (all plots, n = 118), with p-value of t-test (assuming unequal variances) for differences between fencing treatments

Plant Type	Percent Cover of Each Plant Type			Proportions of Total Vegetation Cover		
	Inside	Outside	(p-value)	Inside	Outside	(p-value)
Grasses	15 %	6 %	(0.0000)	28 %	17 %	(0.0002)
Sedges	14 %	14 %	(0.9966)	26 %	32 %	(0.1919)
Legumes	10 %	7 %	(0.0040)	21 %	21 %	(0.9692)
Other Forbs	11 %	10 %	(0.4072)	25 %	30 %	(0.0956)

A final very important question is, Are all the above results simply artifacts of more livestock being grazing outside of fenced areas in the late summer when most plots were observed, or are these results truly indicative of longer-term impacts? If short-term effects were most important, then it would be expected that opposite conclusions would be drawn from the observations made earlier in the summer – that is, in early summer when livestock still were inside the fenced pastures (or just recently had moved away), relatively more vegetation cover would be observed in the still largely ungrazed pastures outside of the fenced areas. However, the data do not support this hypothesis since there is no significant difference in vegetation cover between fenced and unfenced areas in early summer, and the direction is similar to that observed in late summer. On average, fenced and unfenced plots had 60.4 and 53.7 percent cover, respectively. Measures of species richness (the average number of species per plot) also are not significantly different between the two treatments in early summer (10.5 and 11.0 species per plot inside and outside fenced areas, respectively). And, finally, the species richness values measured in both seasons (i.e., in early and late summer) are not significantly different (t-test, $p = 0.8970$). These few simple observations indicate that the observed patterns of vegetation cover, species richness, and species composition are unlikely to be caused solely by recent grazing events (i.e., short-term effects), but they are rather likely to result from the joint effect of both short-term and longer-term land use management practices.

General Discussion (back to top)

The observations and analyses presented in this chapter indicate that grassland degradation is occurring in measurable ways at a very local level as well as at the broader scale that is more readily observed when traveling through the province's vast alpine regions. This degradation takes the form of species loss, changes in plant species composition, and a decrease in average vegetation cover. Furthermore, these changes are impacted by fencing, which is tightly linked (correlated) with new land use patterns, particularly with decreased seasonal mobility and increased year-round grazing in some pastures (Sheehy 1993, Williams 1996, Fernández-Giménez 1997).

In principle, the move to fence grasslands is tied up with the quasi-privatization of land in China (through the Household Responsibility System). The endeavor to fence grassland is meant to lead toward a more uniform grazing pressure on the land, with each individual family using resources more proportionate with their own needs and their livestock's needs. In this scenario, grassland fencing, land privatization, the construction of permanent houses, and even the shift toward a market-driven economy are all a part of a single drive to make the Tibetan plateau grasslands more productive within the larger socio-political context of China's national economy. Raising fences also is so tightly linked with building houses and other aspects of the sedentarization that its full impact may neither be entirely predictable (Skånes 1997), nor in the desired direction of change in these ecologically fragile grassland habitats (Li et al. 1993, Williams 1996).

The strong linkages between fencing, increasingly sedentary lifestyles, and resultant changes in livestock grazing patterns cannot be stressed sufficiently. A recent newspaper article gives a glimpse into the depth and the degree of these interactions in present-day Qinghai:

> "Provincial government officials … hope that herdsmen can gradually give up their traditional nomadic herding and turn to modern production methods. … The province will concentrate on infrastructure construction in the grassland … planting new grass, setting up fences…, building sheds to prevent animals from suffering illnesses from the cold or freezing to death, and constructing homes to help bring herdsmen into permanent settlements. … A total of 423 million yuan ($51 million) was invested in grassland infrastructure development from 1992 to 1996. Half the funds were raised by herdsmen themselves and through bank loans. … So far, 10.4 per cent of herding families in the province have benefited from these projects and 66,800 herding families, or 67 per cent of the total number of families in the province, have settled down" (Xie 1997).

However, as Holzner and Kriechbaum (1999) maintain, "if nomads move into houses from tents, … the result will be the overgrazing of the surrounding areas," as can be seen in many localities on the Tibetan plateau and around the world. And regarding the specific impact of fencing,

> "enclosures, as implemented through village level social context, actually compound grazing problems for most residents and the wider ecosystem. Expanding household enclosures intensify hyper-critical stocking ratios on highly vulnerable rangeland, exacerbating wind and soil erosion process across vast territories only to protect small isolated fields dedicated to poorly financed fodder cultivation" (Williams 1996).

The main argument generally used in favor of fencing is that, although livestock are now owned and managed by individual households (and sometimes by schools, villages, or other corporate entities), it remains extremely difficult for individuals to ensure that their grassland is never used by outsiders (i.e., cheaters) unless it is permanently guarded – which is virtually impossible – or, alternately, physically enclosed or fenced. Most of the social mechanisms that traditionally guarded against cheating were lost during the intense upheavals associated of the recent past, including "liberation" in the 1950s, the Great Leap Forward (1958-62), the Cultural Revolution (1966-1976), and the commune era in general (Goldstein and Beall 1990, Geoffrey 1993, Becker 1996, Smith 1996, Wu N. 1997, Wozencraft 2000).

The second main argument commonly used to promote grassland fencing is that it protects the grassland from overgrazing. However, this argument is based on the erroneous assumption that the mere presence of fences is sufficient to protect natural resources. A simple analogy is found in the national parks of the world, which have become small islands of less degraded land within a larger matrix of land where “anything goes” and where resources are degraded or depleted in unsustainable ways (McNeely and Thorsell 1991, Whelan 1991, Noss and Cooperrider 1994, Stevens 1997a, Mowforth and Munt 1998, Holzner and Kriechbaum 1999). A more accurate view of fencing is to consider it as only one of several tools that can be used to manage grassland ecosystems. Presently, fencing schemes in China are used as much to intensify land use as they are to promote the long-term protection of grasslands. As already stated, fencing ultimately leads only to a redistribution of livestock on the land, not to a reduction in their total numbers or in overall grazing pressure. Thus, in and of itself, fencing affects only the temporal and spatial pattern of livestock grazing in an area.

In promoting a uniform and spatially fixed presence of herders on the Tibetan plateau’s alpine grasslands, local governments and international development agencies alike also (wrongly) assume that these ecosystems have fixed carrying capacities. However, not only is it very difficult to determine with certainty any carrying capacity, even in more stable ecological environments, but such “capacities” may not even exist in most of the plateau’s extremely variable (unpredictable) environments. Successional theory and equilibrium-based land management strategies likely do not apply in arid and climatically variable environments (Coughenour 1991). Specifically, Qinghai’s alpine grasslands are more likely to operate as a state-and-transition system (Westoby et al. 1989a, 1989b) or to have a “dynamic carrying capacity” (Cincotta et al. 1992, Miller 1995, Miller and Craig 1997). The variability of these grasslands’ environment also requires that as much flexibility as possible be maintained in any grazing system, whether traditional or modern, in order to allow herders to respond rapidly to the normal fluctuations in seasonal and annual primary productivity, as well as to periodic catastrophic events. Overall, flexibility is crucial. However, flexibility is limited by fences as well as by individual legal titles (contracts, leases) to the land.

While livestock grazing was traditionally very seasonal, with distinct summer and winter pastures, now only the summer pastures (usually situated high in the mountains) tend to be grazed in one season only. With all the "improvements" recently brought to the winter areas, including permanent dwellings and livestock shelters, these areas – the traditional winter pastures – are now increasingly being used to some degree in every season of the year. According to Cincotta et al. (1992), almost all the "technological improvements that have entered this production system after household responsibility was assumed [have focused] around activities on the privately-managed winter grazing area." This is certainly the case in the Qinghai Lake area, and in most other parts of the province as well. However, it is only fenced winter pastures that are truly managed as private land – if unfenced, most pastures are treated simply as "free access" land, with all of the associated pitfalls (Monbiot 1998, Ho 1998, 1999, Holzner and Kriechbaum 1999). Furthermore, despite the Chinese government's effort to "eradicate poverty," there are still large differences in wealth even among pastoralists. It is such differences that originally led to some pastures in the vicinity of the study area being fenced in 1985, and to other pastures not being fenced. (The "snapshot" presented in this chapter was thus taken approximately 12 years after fences were built). Today, encouraged by the government, wealthier pastoralists (or the poorest, aided by government loans and subsidies) are continuing to make the transition toward a more intensive grazing management system, with new infrastructures, grassland "improvements" (artificial grasslands), and new management strategies (Su 1993, Wei 1993, Western Resources and Environment Research Center 1994, Ma et al. 1995, Drandui 1996, Dorje 1997). As noted earlier in this study, however, any improvement observed inside fenced areas is usually paralleled by some degradation outside the fenced areas.

Fencing *all* the grassland also is not the answer, since this would only render the entire grazing system dependent on external government subsidies, as well as lock the pastoral population into a sedentary grazing system that cannot respond adequately to high environmental variability. The deteriorating conditions of grasslands in the vicinity of settlements in Mongolia's grasslands give a vivid example of what could happen if more mobility is lost in pastoral systems – and just as Mongolia is re-considering the value of traditional grazing patterns, so to should the government and international development agencies capitalize more on time-proven, flexible livestock grazing strategies (Li et al. 1993, Mearns 1993, 1995, Sheehy 1993, 1996, Müller 1995, Germeraad and Enebisch. 1996, Williams 1996, Fernández-Giménez 1997). Indeed, as Holzner and Kriechbaum (1999) explain,

> “the causes of overgrazing [are] complex and varied, and are not [only] ecological but cultural, social and economic … [including] change or abandonment of the seasonal grazing pattern (induced by changing political or administrative boundaries, or by stopping the migrations of nomads by law or economic stimuli like building houses).”

According to Su (1993), and based on discussions with local pastoralists, livestock has traditionally been herded at the base of the Qinghai Nanshan Mountains and near Qinghai Lake in the cold season, and herded much higher in the mountains in the warm season. Rarely, if ever, was livestock grazed in the present study area during the warm season. Although a traditional grazing pattern is still practiced in large part today, there is an increasing amount of summer grazing in the traditional winter pastures as well. This trend has been noted in many other parts of the province as well. Thus, at least in the present study, fenced pastures may represent not so much the “new” management as they do more traditional forms of grazing – that is, seasonal grazing. Counter-intuitively, it is the *unfenced* land that best represents the newer, more intensive grazing management that now is being promoted throughout the province. As such, fences are not so much “improving” the grassland as they are “protecting” it from the new trend of continuous grazing. And, as already noted, it is continuously grazed grasslands that are relatively less diverse, and have a poorer vegetation cover. In short, new forms of intensive grassland management in Qinghai may not be ecologically sustainable (Cincotta et al. 1992, Miller 1995), and more seasonal mobility and flexibility should be sought in future development initiatives. Development investments should also be directed toward promoting more opportunistic management alternatives, both traditional and modern (Galaty and Johnson 1990, Briske and Heitschmidt 1991, Sheehy 1993, 1996, Miller and Jackson 1994, Tainton et al. 1996 cited in Holzner and Kriechbaum 1999, Wester 1997).

CHAPTER SIX

Rangeland Utilization, Grassland Quality, and Biodiversity in Alpine Grasslands: A Regional Analysis

Introduction (back to top)

In recent years, China's grasslands have undergone many changes in the way they are utilized. The total human population and population structure as well as basic resource management objectives have changed in the last few decades, with some potential negative consequences for sustainability. In the Tibetan plateau region, which comprises most of China's alpine grasslands, many of these changes have followed directly from the region becoming increasingly integrated with the rest of the country – with its economy, its population, its politics, and its culture or predominant value system. Some of the ecological impacts of fencing (and the land use intensification, even sedentarization, that it represents) have been examined in the previous chapter.

In this chapter, the impacts on grassland quality and biodiversity of several other ecologically important variables, both natural and human, are examined. This chapter is a continuation of the previous one, simply based on a different dataset that has been compiled from official governmental sources. As with fencing, most of the variables examined here – annual rainfall, population density, presence of non-local influences, the relative importance of pastoralism, and seasonality of grassland use – are closely related to changing times, some to new development goals and objectives or to new approaches in resource management, and others simply to an increasing human population or to internal migration patterns within China. The purpose of this chapter is to examine further some of the implications of old and new (or emerging) patterns of land use (resource management) in Qinghai's alpine grasslands by analyzing official county-level government statistics[1[1]].

[1[1]] There is some concern in the international scientific community about the overall reliability of official statistics in China, mainly because of the ubiquitous misreporting of data during some periods of China's modern history. Many Chinese scientists and government leaders share these concerns (Smil 1995, 'How do statistics…' 1998, Wu 1998). A second problem with Chinese research often has been the political or economic motivations for "scientific" inquiry – even today, according to Zhu (1995), "the foremost goal of scientific work is to further economic development." Any finding that would suggest a limit to development, for example, would therefore be considered less desirable than the opposite conclusion. Clearly, this approach to scientific

Methods and Results (back to top)

General methods (back to top)

The present dataset was compiled from four main sources. Measures of grassland areas, grassland quality, and season of use were obtained for each county in *Qinghai Province Today* (Jing 1986), population figures and information on main occupations in *Tabulation on the 1990 Population Census of Qinghai Province* (Qinghai Census Bureau 1992), rainfall in *Qinghai's Resources* (Wei 1993), and information on the presence of mammal species in each county in the *Annals of Qinghai's Economic Wildlife* (Li 1989).

Alpine grassland counties are here defined by the exclusion of all counties in the main agricultural area of the province, Haidong district, and of the most arid counties in Haixi prefecture. All the counties in Haibei, Hainan, Huanguan, Guoluo, and Yushu prefectures, as well as Tianjun and Wulan counties in Haixi prefecture, are included in the following analyses. The area defined by these 27 counties lies almost exclusively over 3,000 m above sea level, and the habitat ranges from mesic alpine meadow to xeric alpine steppe (Hu et al. 1992).

In this chapter, grassland quality and mammalian biodiversity are taken as two dependent variables, each affected by many other natural and anthropogenic factors. However, since many of these factors (variables) are interrelated, principal components analysis is first used to transform them into statistically independent factors, then Varimax rotation is used to increase the interpretability of each factor and thus to assign each factor to one of the original variables. Multiple regression makes it

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inquiry can hinder basic research. Fortunately, these problems are now recognized in China and are being resolved (Plafker 1995, Zhou 1995, Zhu 1995, Freeman 1997, Environment Science and Technology 1998d). However, the question of whether or not currently available data should be used is still debated.

The approach taken in this chapter is to limit reliance on historical data, but nonetheless to use the available data at least to inform, and to substantiate where possible, a general discussion of the environmental impacts of several development-related factors. Historical data (time-series) were specifically avoided, and some caution should be used when examining the "biodiversity" data (Li 1989), but to the best of my knowledge rainfall data, population figures, and grassland areas were compiled following standard methods (Jing 1986, Su 1993, Qinghai Census Bureau 1992, Wei 1993). Also, even the simple measure of biodiversity used in this chapter at least leads to "expected" results, increasing overall confidence in its use as a basic indicator of population and development impacts on Tibetan wildlife. Grassland quality and biodiversity are two important aspects of sustainability: when and where either of these factors is impacted negatively by development activities, such development may not be ecologically sustainable.

possible to determine which factors most affect (or are most closely related to) grassland quality and biodiversity.

Grassland quality (GQ) (back to top)

All of China's grasslands have been classified according to general type and class (Su 1993). Of the 17 main types thus identified, five occur primarily on the Tibetan plateau. The total land area of each type, the proportion it comprises of the total natural grassland area in China, and the area and proportion of each grassland type that is "available" for livestock grazing are presented in Table 15. According to Huang (1992), 49 percent of Qinghai's grassland is classified as alpine meadow, and 38 percent as steppe. All grasslands in Qinghai also have been divided into different classes according to the "proportion of the forage weight of various classes [qualities] which compose the grassland community" (Su 1993). Usable grassland thus has been classified in Qinghai as either low, medium, or high quality grassland. This latter classification was introduced in the early 1980s as part of the Household Responsibility System in order to promote a more equitable distribution of land to individual users or lease holders (Ho 1998).

Table 15. Main grassland types present on the Tibetan plateau (adapted from Su 1993)

Grassland Type	Total Area in China (ha)	Proportion of Total Grassland	Area of Usable Grassland (ha)	Proportion of Usable Grassland
High-Cold Meadow-Steppe Type	6,870,000	1.9 %	6,010,000	87.5 %
High-Cold Steppe Type	41,620,000	11.7 %	35,440,000	85.2 %
High-Cold Desert-Steppe Type	9,570,000	2.7 %	7,750,000	81.0 %
Montane Meadow Type	16,720,000	4.7 %	14,920,000	89.2 %
Alpine Meadow Type	63,720,000	17.9 %	58,840,000	92.3 %

However, in order to relate grassland quality to average annual rainfall, rangeland population density and other variables, a unique (single) measure of grassland quality is needed instead of three separate measures of grassland area. Such a measure is obtained by weighting each class category by a different factor – high quality grassland by a factor of 3, medium quality grassland by a factor of 2, and low quality grassland by a factor of 1 – and then dividing the sum of these products by the best possible (or potential) grassland quality. Potential grassland quality is the value that would be obtained if the entire grassland area in each county were classified as high quality grassland (and hence multiplied by a factor of 3). This simple ratio is a relative measure of grassland quality, without units, and with a numeric range between 0.33 and 1.00. (Note that the lower end of this relative measure, 0.33, is contingent on the arbitrary weighting factors that were chosen). In order to increase ease of interpretation, multiplying all the values by 1.5 increases the range of relative values to one unit, and the range can then be shifted to between 0 and 1 by subtracting 0.5 units. In algebraic terms, the equation used to convert three distinct classes of grassland quality into a single relative measure of grassland quality (GQ) is

$$(((3H + 2M + 1L) / 3 (H + M + L)) * 1.5) – 0.5$$

where H is the area of high quality grassland, M is the area of medium quality grassland, and L is the area of low quality grassland. This equation provides a measure of grassland quality that can be compared between counties with different total grassland areas. Measured this way, grassland quality varies all the way from 0.05 to 1.00 in the 27 alpine grassland counties, with an average value of 0.62 (i.e., slightly better than “medium” quality).

Biodiversity (BD) (back to top)

A basic estimate of biodiversity was derived from a Chinese publication that provides a dataset of the presence/absence of 103 mammal species for each county (Li 1989). However, given the limited resources (financial and otherwise) available to the principal researchers, it is not clear whether the presence/absence data were used to determine species’ distribution ranges, or if “known” distribution ranges were instead used to "compile" the dataset. It must be understood therefore that the present measure of biodiversity may be based only on the "likely presence" of several key species and may not be suitable for any more detailed species- or county-specific examination. However, this measure can still be taken as a general indicator of basic trends in species' presences and, when many species are considered jointly, of species richness.

Of the 103 species in the original dataset (Li 1989), only species with the following characteristics are included in the present analyses: species that were reported in more than 25 percent of the 27 alpine grassland counties, species that were identified as "Tibetan fauna" by Hoffmann (1991) or as "resident" or "characteristic fauna" of the Tibetan plateau by Zhang (1991), and species that are known or presumed to inhabit steppe, grassland, or montane habitat. Twenty-one mammals were identified as characteristic of Qinghai's alpine grasslands (Table 16). The measure of biodiversity used here is the percentage of these 21 species that occur in each grassland county. Biodiversity values range from 57 to 90 percent, with an average of 80 percent. It is assumed that all 21 mammal species are potential residents of each county.

Rainfall (RF) (back to top)

Rainfall is an important variable because it is likely the single most important factor affecting grassland productivity (Sala et al. 1988), and more productive grasslands are positively associated with plant biodiversity (Tilman et al. 1996). According to Smith (2000), "temperate natural grasslands develop in regions characterized by an annual rainfall between 250 and 750 mm … and [with] seasonal and annual droughts." Annual rainfall in Qinghai is 432 mm on average, and varies between 176 and 764 mm.

Population density (PD) (back to top)

The presence of pastoralists on the grassland both impacts the grassland and its wildlife and is constrained by the availability of forage resources. The population density of pastoralists in Qinghai's rangelands was calculated by multiplying the proportion of each county's working population engaged in pastoralism by the county's total population (this provides an estimate of the total population that has a predominantly pastoral livelihood), and then dividing this figure by each county's usable rangeland area (i.e., the area "available" for livestock grazing; Su 1993). The latter is the same area that is used to calculate "season of use" and grassland quality. The average population density in the 27 counties is 2.5 people/km^2, ranging from 0.3 to 5.9 people/km^2. However, since pastoralists tend to have larger families than average (Qinghai Census Bureau 1994), the calculated measure of population density underestimates real densities on the grasslands.

Table 16. Characteristic alpine grassland mammalian fauna of Qinghai province

Order	Family	Latin name	Common Name
Carnivora	Canidae	*Canis lupis*	gray wolf*
	Canidae	*Vulpes ferrilata*	Tibetan sand fox*
	Canidae	*Vulpes vulpes*	red fox*
	Felidae	*Panthera uncia*	snow leopard
	Mustelidae	*Meles meles*	Eurasian badger*
	Mustelidae	*Mustela altaica*	mountain weasel*
	Mustelidae	*Mustela eversmanni*	steppe polecat*
	Ursidae	*Ursus arctos*	brown bear
Artiodactyla	Bovidae	*Ovis ammon*	argali
	Bovidae	*Pantholops hodgsoni*	Tibetan antelope*
	Bovidae	*Poephagus mutus*	wild yak
	Bovidae	*Procapra picticaudata*	Tibetan gazelle*
	Bovidae	*Pseudois nayaur*	blue sheep*
	Cervidae	*Cervus albirostris*	Thorold's deer*
Perissodactyla	Equidae	*Equus kiang*	Tibetan wild ass*
Rodentia	Cricetidae	*Cricetulus longicaudatus*	long-tailed hamster
	Cricetidae	*Myospalax baileyi*	Bailey's zokor*
	Sciuridae	*Marmota himalayana*	Himalayan marmot*

-

Lagomorpha	Leporidae	*Lepus oiostolus*	Tibetan woolly hare*
	Ochotonidae	*Ochotona cansus*	Gansu pika*
	Ochotonidae	*Ochotona curzoniae*	plateau pika*

Note: My doctoral supervisor (Dr. A.T. Smith) or myself have observed the species marked by an asterisk.

Non-local influences (NL) (back to top)

Because so many of the changes currently taking place in the Tibetan plateau region have been introduced from the outside – both at the policy level and in terms of the arrival of new immigrants (and the various occupations, increasing demands on resources, and even the ideas that they may bring to the pastoral regions with them) – an examination of the relative influence of the "non-local" in each county could prove insightful. A simple measure of "non-local" influences in an area is the proportion of the total population that is comprised by non-local people. Such data are available from the 1990 population census (Qinghai Census Bureau 1992). The presence of non-local people varies between 0.7 and 16.1 percent over the 27 county area, with an average of 6.3 percent of the total population. The majority of local people are Tibetan pastoralists, while most non-local people are Hui and Han Chinese.

Percent pastoralism (PP) (back to top)

The proportion of each county's population engaged in animal husbandry (pastoralism) is also examined. The relative importance of pastoralism in the 27 counties varies widely, with between 7 and 89 percent of the working population engaged in pastoralism. On average, 53 percent of people are herders or otherwise engaged in pastoral activities. In some counties, particularly those situated in the border areas of the Tibetan plateau, local people also cultivate the land, thus agriculture accounts for much of the observed variability. In county and township administrative centers, on the other hand, government posts, technicians' jobs, and a variety of business opportunities also can be found.

This statistic – the proportion of pastoralism present in each county – is calculated by dividing each county's workforce specifically engaged in animal husbandry by the total workforce. When this statistic is examined independently of rangeland population density (PD) and the presence of non-local influences (NL), it can help determine whether the practice of pastoralism itself, intrinsically, impacts grassland quality or biodiversity.

Season of use (SU) (back to top)

Finally, the total areas of summer and winter pastures are reported for all 27 counties (Jing 1986). Although these figures may not be exact, they nonetheless provide a basic regional overview of the relative importance given to each land use category in Qinghai's grasslands. According to Su (1993),

> "1. Cold season grazing rangelands … in the frigid-temperate zone [are rangelands] where the snow depth is less than 10-20 cm in winter and spring.
>
> 2. All-year grazing rangelands are those within a radius of 10 km from the fixed inhabited spots [which] can not only be used suitably for grazing in cold seasons but also in warm seasons.
>
> 3. Warm season grazing rangelands are those of alpino-arctic ranges above the forest line with mild weather and stable water supply for man and animals. They consist of all the available ranges except those for grazing in cold seasons and those for year-round grazing."

Thus as much grassland as possible is used for all-year (or year-round) grazing, and as much grassland as possible is used during the cold season. Given current policies in China, the area of uniquely summer pastures is likely to be decreasing, and many pastures are likely to be increasingly used in all seasons (with all of the negative ecological consequences noted in the previous chapter). The proportion of summer pastures in Qinghai's 27 alpine grassland counties is 48 percent on average, ranging between 27 to 71 percent of the usable grassland area.

Principal components analysis (back to top)

Because the above five variables are interrelated (correlated), principal components analysis (PCA) is used to make them statistically independent. The independence of potentially explanatory variables is a basic assumption of regression analysis. The variation explained by the five independent

PCA factors is reported in Table 17. Factor loadings are easy to interpret after Varimax rotation, and each factor can be assigned easily to a single original variable (Table 18).

Table 17. Main principal component analysis (PCA) factors

Variable	Eigenvalue	Percent of Variation	Cumulative Percent
Factor 1	2.0745	41.5	41.5
Factor 2	1.3205	26.4	67.9
Factor 3	0.7785	15.6	83.5
Factor 4	0.4334	8.7	92.1
Factor 5	0.3931	7.9	100.0

Table 18. Principal components analysis (PCA) factor matrix (after Varimax rotation)
-

Variables *(new names)*	Factor 1 *(Fact-SU)*	Factor 2 *(Fact-PD)*	Factor 3 *(Fact-NL)*	Factor 4 *(Fact-PP)*	Factor 5 *(Fact-RF)*
NL	-.00142	-.16589	.94512	-.20532	-.19256
PL	.13809	-.10632	-.20987	.93713	.21763
RF	.21568	.06897	-.20424	.22486	.92545
PD	-.08704	.97908	-.14838	-.09207	.05782
SU	.96985	-.09028	-.00184	.12552	.18834

Multiple regression analysis (back to top)

With five independent factors, each one distinctly associated with season of pasture use, rangeland population density, the presence of non-local influences, the proportion of pastoral livelihoods, or average annual rainfall, it is now possible to examine each of their separate effects on (or association with) the two independent variables of this study, grassland quality and biodiversity. The results of the two multiple regression analyses are reported in Table 19.

Table 19. Multiple regression analysis of season of use, rangeland population density, the presence of non-local people, proportion of pastoral livelihoods and average annual rainfall on grassland quality (GQ) and biodiversity (BD)

				ANOVA				
Variable	**ß**	**t**	**p**	**Source**	**df**	**MS**	**F ratio**	**p**
Grassland quality (*n* = 27, *r* = 0.7527, R^2 = 0.5665)								
Fact-RF	0.4276	2.976	0.0072	regression	5	0.1254	5.4883	0.0022
Fact-PD	0.4276	2.976	0.0072	residual	21	0.0228		
Fact-SU	0.3091	2.151	0.0432					
Fact-NL	-0.2969	-2.067	0.0513					
Fact-PP	0.1307	0.910	0.3732					

				ANOVA				
Variable	**ß**	**t**	**p**	**Source**	**df**	**MS**	**F ratio**	**p**
Biodiversity (*n* = 27, *r* = 0.7453, R^2 = 0.5555)								
Fact-PD	-0.5485	-3.770	0.0011	regression	5	0.0204	5.2485	0.0028
Fact-NL	-0.3218	-2.212	0.0382	residual	21	0.0039		
Fact-SU	-0.3161	-2.173	0.0414					
Fact-PP	0.2230	1.532	0.1403					
Fact-RF	0.0377	0.259	0.7982					

Grassland quality is associated with rainfall, population density, season of use, and non-local influences in each county. Ecologically, rainfall is expected to be positively associated with grassland productivity, and hence with grassland quality. As expected, the relationship between rainfall and grassland quality is significant (GQ by Fact-RF, p = .0072). Average annual rainfall accounts for one-third of the total variability in grassland quality (R^2 = 0.3387; Figure 34).

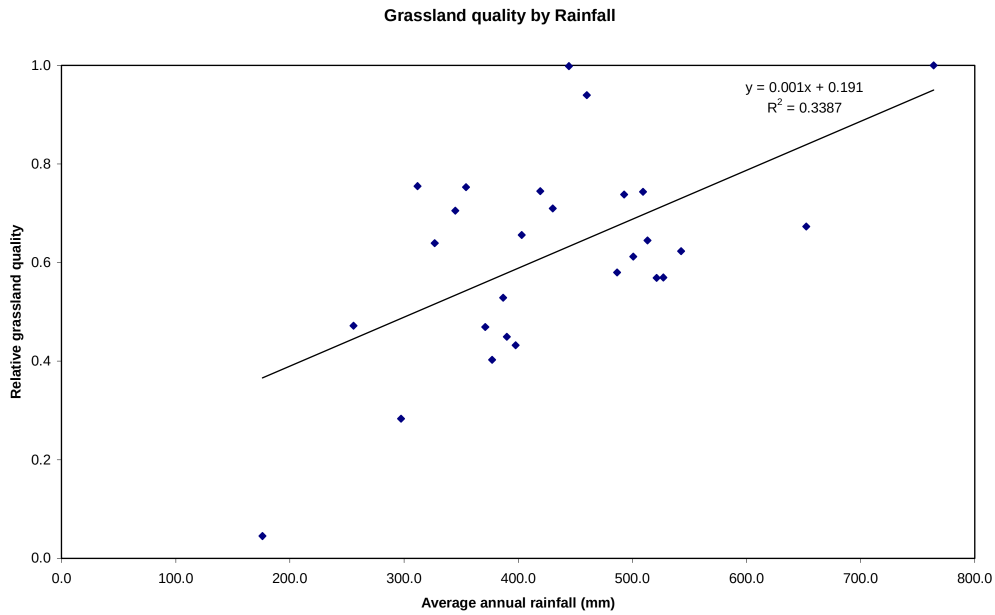

Figure 34. Relative grassland quality by average annual rainfall

Grassland quality and population density also are associated with each other (GQ by Fact-PD, p = .0072). Given the direction of the relationship, however, it appears that this relationship is mainly the result of pastoralists' long-term attempts to utilize optimally all available grassland resources (based on grassland quality as well as total grassland area). Grassland quality accounts for one-fifth of the variability in rangeland population density (R^2 = 0.2014; Figure 35).

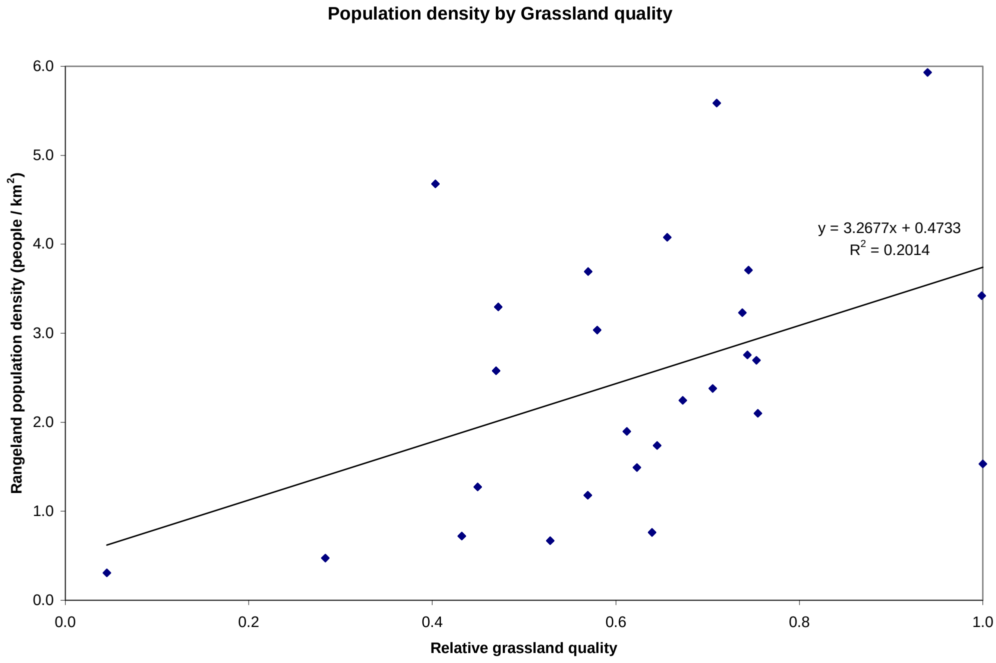

Figure 35. Rangeland population density by relative grassland quality

Even when the effect of rainfall is accounted for, as well as the association between grassland quality and population density, two other factors still have a significant impact on the quality of alpine grasslands: season of use (GQ by Fact-SU, $p = .0432$) and the presence of non-local people in each county (GQ by Fact-NL, $p = .0513$). Grassland quality increases when more grassland is used in the warm season ($R^2 = 0.1287$; Figure 36), and decreases when more non-local people reside in the area ($R^2 = 0.2128$; Figure 37). The proportion of pastoral livelihoods, however, is not significantly associated with grassland quality.

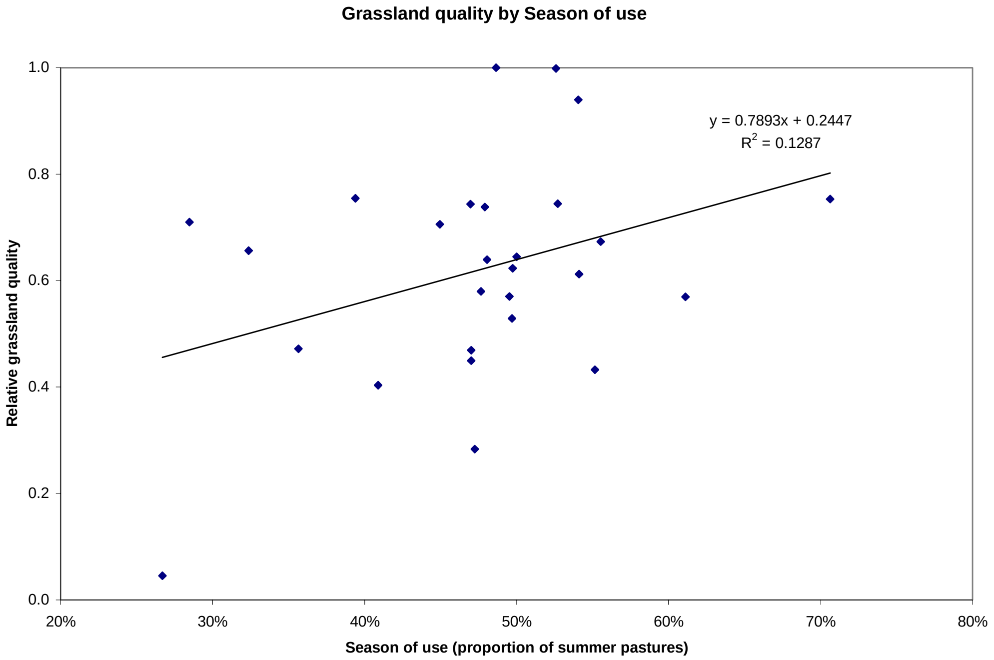

Figure 36. Relative grassland quality by season of use

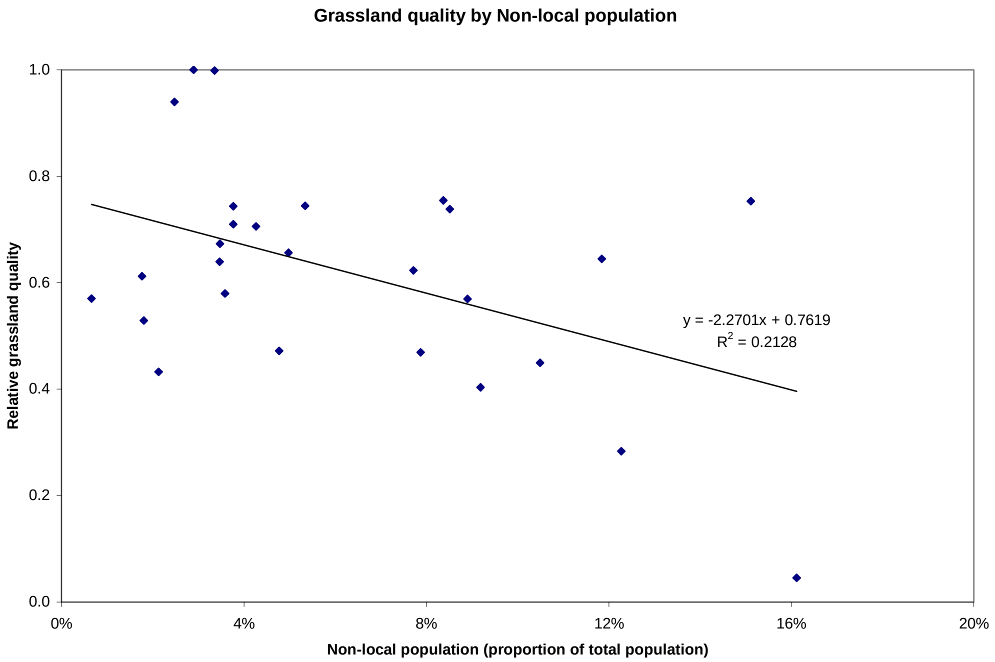

Figure 37. Relative grassland quality by proportion of non-local population

As noted in Table 19, rangeland population density and season of use also impact biodiversity (i.e., the proportion of characteristic Tibetan plateau mammals present in each county), as do non-local influences (as measured by the presence of non-local people). The proportion of characteristic mammals present in each county decreases as rangeland population density increases (BD by Fact-PD, p = .0011). However, this relationship is most likely due to human disturbance, as opposed to competition for forage, since the quality of grassland vegetation tends to be inversely related (insignificantly) with biodiversity. Rangeland population density explains over one-fifth of the variability of the measure of biodiversity used in this study (R2 = 0.2303; Figure 38).

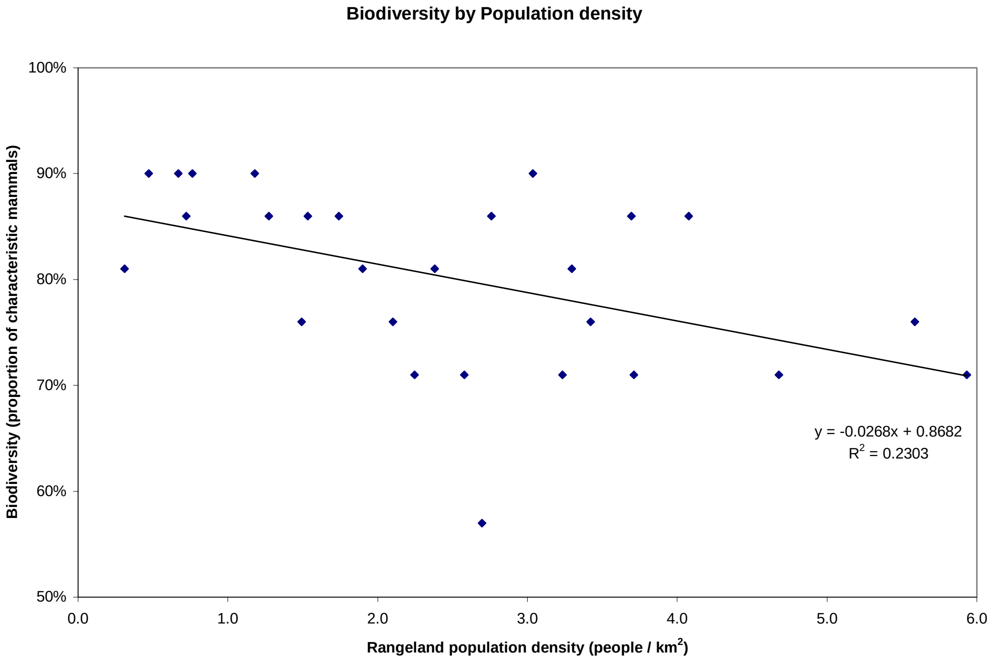

Figure 38. Biodiversity by rangeland population density

The presence of non-local influences (non-local people) likewise impacts biodiversity negatively, as does season of use. Biodiversity decreases as non-local influences increase (BD by Fact-NL, p = .0382), and biodiversity is lower where more grassland is used as summer range (BD by Fact-SU, p = .0414). The magnitude of both these relationships, however, is quite small (R2 =

0.0706 and 0.0491, respectively). Finally, biodiversity is neither impacted by rainfall nor by the relative importance of pastoral livelihoods (which is separate from population density) in Qinghai's alpine grassland counties.

The direction of the relationships between biodiversity and both population density and non-local influences is in the one expected (i.e., both of these factors impact biodiversity negatively), but the relationship between biodiversity and season of use is not as straightforward. However, since human influences (population density and non-local influences) negatively impact biodiversity, and this is likely the result of various forms of physical disturbance, then it is expected that wildlife would survive better in areas characterized by less human disturbance. Wildlife generally will not inhabit the low-lying winter pastures since these tend to be occupied by pastoralists throughout most of the year. It is expected that their preferred habitat is the more remote, mountainous, summer pastures, or uninhabited grassland. It is therefore normal that wildlife would tend to avoid areas where pastoralists are more common in their (the wildlife's) preferred habitat (i.e., the remote alpine pastures). This is the relationship that has already been noted above (BD by Fact-SU, $p = .0414$). If human physical disturbance is one of the main factors that affects biodiversity, as clearly seems to be the case, then it is also expected that wildlife will be most abundant (biodiversity will be higher) in areas where there is more rangeland left unused by pastoralists (even though such rangeland also may be sparser or of lower quality). Data are available to examine this relationship, and it is found that unused grassland (classified as "unusable" grassland by most herders and government planners) is a strong predictor of biodiversity. Both the proportion of the grassland area considered to be "unusable" by pastoralists ($R2 = 0.3183$, $p = .0027$) and the total area (absolute area) of "unusable" grassland ($R2 = 0.4352$, $p = .0002$; Figure 39) in each county are closely related to biodiversity in Qinghai's alpine grassland region. This confirms the strong influence of human physical disturbance on biodiversity, whether such disturbance is because of hunting by non-local people or the geographic proximity of herders in preferred wildlife habitat.

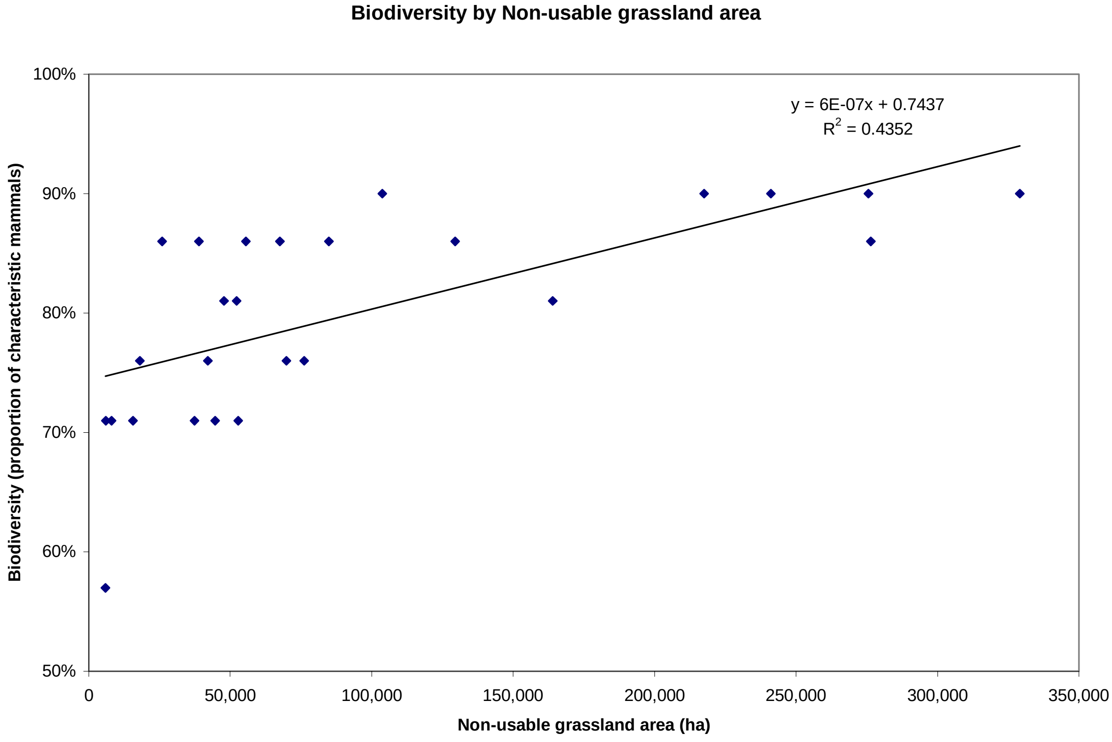

Figure 39. Biodiversity by area of "non-usable" grassland

General Discussion [(back to top)]

Rainfall [(back to top)]

Rainfall is the single most important determinant of grassland productivity in many temperate ecosystems (Sala et al. 1988). In the Tibetan plateau region, both water and temperature (short growing season) affect primary productivity because of the very high altitude (Ekvall 1974, Holzner and Kriechbaum 1999). In the present study, it was confirmed that annual rainfall significantly impacts overall grassland quality. Furthermore, the proportion of unusable rangelands (because of insufficient water supplies to support livestock; Su 1993) also is inversely related with the quality of adjacent usable grasslands in each county (Pearson's product moment r = -0.6275, p = 0.0005, unpublished analysis). Thus, average rainfall is clearly a very important determinant of grassland productivity and quality on the Tibetan plateau.

Percent pastoralism[2[2]] (back to top)

The most obvious anthropogenic factor on the Tibetan plateau grasslands is the presence of pastoralists. Pastoralism has been practiced on the plateau for between 2,200 and 3,000 years (Zhao 1992, Hare 1998). As noted in this study, the practice of pastoralism itself (as distinct from population density, different aspects or forms of resource management, or a variety of non-local influences; see below) does not affect grassland quality or biodiversity. This finding is consistent with many other researchers' assertion that, given the long history of pastoralism on the Tibetan plateau, sustainable husbandry practices have long been the norm for the region's indigenous pastoralists (Ekvall 1968, Clarke 1987, Goldstein and Beall 1990, Miller 1995, Wu N. 1997). In contrast to this view, however, many government leaders and development workers assume that traditional forms of pastoralism are irrational, a view that has led to a plethora of misguided policies, usually related to the intensification of land use and promoting more sedentary lifestyles for pastoralists (Aronson 1980, Bennett 1988, Coughenour 1991, Barnett 1993, 'Old ways…' 1994, Environment Science and Technology 1998a, 1998c). Since pastoralism does not appear to impact the alpine grassland ecosystem, broadly defined, biodiversity protection and pastoralism should no longer be considered intrinsically at odds with each other. Instead the needs of each should be addressed together in an integrated way that synergistically builds on the contributions that each area can make to the other. In other words, pastoralism (and pastoralists) should be included in the formulation of broad regional plans for environment protection, not blamed and excluded from the process (Ghai and Vivian 1992, Noss and Cooperrider 1994, Stevens 1997a) or, worse still, moved to other regions altogether (a recurring suggestion made by several government bureaus in Qinghai).

Population density (back to top)

In contrast to the simple presence or practice of pastoralism, population density is closely related to both grassland quality and biodiversity. Population density is positively associated with grassland quality, which would indicate that pastoralists tend to distribute themselves on the

[2[2]] Because principal components analysis was used to transform all the variables examined in this chapter into statistically independent PCA factors, each variable can be examined *independently* of the others.

rangeland proportionately with grassland quality which, in conjunction with total grassland area, is a good measure of an area's potential to meet livestock's nutritional requirements. The fact that increasingly more people live in areas with higher grassland quality is also indicative of the fact that this relationship is likely due to human behavioral responses to grassland conditions (see Figure 35; while a linear curve explains 20 percent of the variation in rangeland population density, an exponential curve explains even more of the observed variation, $R^2 = 0.3491$; unpublished analysis). It seems that population density does not so much impact grassland quality as the reverse: grassland quality is a limiting factor that impacts (or constrains) pastoralists' general distribution on the rangelands. This finding does not mean that various other factors usually related with population density do not affect the grasslands – but in the present analysis, such factors (e.g., the demand for livestock products, and hence livestock populations and overall grazing pressure) are more likely to be included in the following, independent variable termed non-local influences.

In contrast to grassland quality, biodiversity is greatly impacted by population density on the Tibetan grasslands. From wildlife's point of view, population density is a straightforward measure of human disturbance. This disturbance can be of two varieties, the simple presence (geographic proximity) of pastoralists, or the practice of various non-pastoral activities such as hunting (it has already been shown that pastoralism itself does not directly impact grassland quality or biodiversity). Based on the literature, it is safe to assume that both forms of disturbance affect wildlife on the Tibetan plateau (Schaller et al. 1988, Cai et al. 1990, Schaller and Liu 1996, Schaller 1998, World Wide Fund for Nature 1998, Harris et al. 1999).

Non-local influences (back to top)

Although Tibetans do occasionally hunt wild animals (Hedin 1925, Ekvall 1968, Vigoda 1989, Geoffrey 1993), it generally has been non-local people that poach the most wildlife. In the 1950s, for example, army units were ordered to meet large hunting quotas, and wildlife was decimated in most areas of the province (Qinghai People's Government 1951, 'Open up…' 1956, Cai et al. 1990, Becker 1996; also personal interviews with several pastoralists). Even today, poaching poses a huge threat to wildlife across the entire plateau (Miller and Schaller 1996, 1997, Schaller 1998, World Wide Fund for Nature 1998). It is this and other activities undertaken by outsiders that are included in the indicator of non-local influences examined in this chapter. Not only are these activities generally detrimental to wildlife populations, they also negatively impact the grassland vegetation, probably due to increasing demands for livestock products made by the non-local population. Such market demands provide an incentive to increase overall livestock production, and hence grazing pressure on the grassland. The presence of non-local people in an area equally is representative of a more general increase of external influences in the area, influences that usually include a strong impetus for change in many different areas, from economic development and the adoption of more modern production methods (and, conversely, the abandonment of traditional practices) to education and literacy, health care, and the rapid development of basic infrastructure. The merits and drawbacks of each of these areas of change are extremely varied, and any evaluation also depends on the observer's own development perspective. Each area would therefore require an extensive study in its own right. However, at least from an ecological point of view, it already is clear that non-local influences (as measured by the proportion of each county's total population comprised by non-local people) have to date tended to be more negative than positive. Fortunately, though, there are many indications of change at higher (national) government levels (Drake 1997, Yan 1997, Environment Science and Technology 1998d), and new perspectives on the environment and development will eventually trickle down to local leaders and decision-makers as well. In the meantime, similar to the development history of many other developing countries in the world (Bennett 1988, Galaty and Johnson 1990, Germeraad and Enebisch 1996, Sheehy 1996), the current direction of change introduced by external forces is to limit pastoralists' mobility and to increase overall ease of governance by promoting more sedentary ways of life on the Tibetan plateau. But as Fernández-Giménez and Erdenebaatar (1995) explain, "to maintain sustainability in the pastoral system, national land policy and its local implementations must allow for and encourage movement in response to spatial and temporal variability in resources. In other words, herders must not be excluded from extensive pasture resources."

Season of use [(back to top)]

An important characteristic of traditional nomadic pastoralism in most areas of the Tibetan plateau is the use of distinct seasonal pastures (Lattimore 1940, Ekvall 1968, Spooner 1973). Although pastoralists may spend over two-thirds of the year in the winter pastures, it is the summer pastures that are most crucial for livestock to recover from the previous winter and to prepare for the next. Summer pastures are also the most easily degraded (Lang et al. 1997). However, most development activities in Qinghai almost exclusively target the winter pastures, such as seeding plots to grow additional winter forage and building livestock shelters, and these activities are often to the exclusion of any regard for the condition of summer pastures (Cincotta et al. 1992). Furthermore, any grassland that can be used in winter will be used in winter (Su 1993), mainly because of the closer-to-home focus on livestock, rather than on grassland conditions, adopted by most pastoralists and by many government leaders alike. This focus on livestock has translated into a disproportionate concern for winter pastures because livestock are most vulnerable in winter. Most development activities have therefore aimed to improve the over-winter survival of livestock, including the classification of as much grassland as possible as favorable for winter grazing. In practice, this means that more modernized areas are likely to have a larger proportion of winter pastures or pastures grazed in both summer and winter (i.e., former winter-only pastures, equivalent to the unfenced pastures examined in the previous chapter), while less developed grassland areas are likely to have a larger proportion of summer pastures. The proportion of summer grasslands can thus be used as a measure of relative grazing seasonality because as much grassland as possible is now grazed in the winter season (in order to increase the over-winter survival of livestock), and any land that is grazed in winter, even if also grazed in the summer, is generally classified as winter grassland (Su 1993). The larger the area of summer pastures in a county, therefore, the more seasonal the character of pastoralism in that county, and to a lesser degree, the greater the overall pastoral mobility and flexibility.

In the present study, overall grassland quality was found to be significantly higher where more grassland is grazed in summer only. This result has direct implications for current development priorities and plans in the province, and suggests in particular that more attention should be given to the conservation of summer pastures as well as winter pastures. Biodiversity, on the other hand, is lower in counties where there is more summer pasturage, but this was found to be the result of the preference of wildlife for undisturbed grassland habitat, as opposed to summer pastures that are used more extensively by pastoralists. Clearly, most mammals are common only in remote, relatively inaccessible mountain areas (Harris et al. 1999), yet these areas also tend to comprise the pastures most suitable for summer grazing by livestock (i.e., pastures in the high mountains, in contrast to the lower plains or valley floors grazed during the long cold season). This suggests that, while the overall area of grassland used for summer grazing should be increased where possible (in order to reduce the amount of overgrazing by overstocking small summer pastures, and thus to improve overall grassland quality), specific measures must also be taken to ensure the protection of wildlife in these areas. Protective measures should include the establishment of some core zones in high mountain areas where wildlife cannot be disturbed.

These present findings justify seasonal use of the grassland and other aspects of spatial mobility, not only as long-term effective strategies for pastoralists, but also as judicious techniques for managing and conserving alpine grassland quality and biodiversity in one of the world's harshest environments, the Tibetan plateau.

The way forward (back to top)

The alpine grasslands of the Tibetan plateau are characterized by a semi-arid climate and variable primary productivity. Precipitation in Qinghai's grassland areas ranges from around 200 to 700 mm per year (Jing 1986; Carey 1996). In the Qinghai Lake area, between 1961 and 1975, average grassland productivity ranged from 607 kg/ha in dry years to 1,449 kg/ha in wet years (Western Resources and Environment Research Center 1994). Local pastoralists have traditionally capitalized on the variable climate by adopting a flexible production strategy, namely nomadic pastoralism (Spooner 1973, Galaty and Johnson 1990, Wu N. 1997). The key feature of pastoral livelihoods is their inherent mobility – instead of working fields of land, pastoralists work "fields" of livestock, or "fields on the hoof" (Ekvall 1968). Livestock can be moved between pasture as climate and annual productivity warrant, to capitalize on regular seasonal pastures in good years and on more distant pastures in poor years. Mobility thus allows pastoralists to "maintain within a wide geographical region a total livestock population far greater than that which could be sustained … by independent herds operated separately on small plots of land" (Thompson and Wilson 1994). Many bureaus and agencies in China, however, consider traditional practices as backward, including the use of distant seasonal pastures, and herders are encouraged to "turn to modern production methods" (Xie 1997) and to abandon all aspects of nomadism as rapidly as possible.

This analysis of sustainability (via grassland quality and biodiversity) in Qinghai's alpine grasslands has shown that in areas with relatively large winter pastures, poor grassland quality may result from the increased concentration of livestock on the proportionally smaller summer pastures. A positive feedback loop can develop if livestock enter the winter in poor condition because of insufficient grazing during summer, and pastoralists perceive a need to further invest in and enlarge their winter pastures to avoid starvation of livestock in late winter; the next year, livestock are grazed on even smaller summer ranges and overall intensity of grazing on the summer range increases, causing even more grassland degradation. Thus, livestock in higher numbers on increasingly degraded land put on less weight during summer, the only growing season for grassland resources, and concomitantly enter winter in ever poorer condition. This completes the vicious cycle. However, even though the poor condition of summer pasture is an underlying cause of livestock starvation in winter, it is still ignored by most decision-makers.

Policies in the 1960s and 1970s aimed at raising the standard of living of pastoralists in Mongolia (Mearns 1995) and Inner Mongolia (Li et al. 1993; Williams 1996) closely resemble those of Qinghai today. In both instances land use was intensified, herd mobility was reduced, and entire grassland ecosystems were degraded. According to Ho (1998), attempts to fence grasslands are especially ill-suited to the ecosystem's highly variable productivity (e.g., with periodic snow disasters, such as the snowstorms that covered Zhiduo in October 1999; Disaster Information Center 2000), and the grasslands would "benefit more from flexible arrangements than from rigid ones." Ho continues: "It should be no surprise that the experiments for dividing the rangeland into delimited plots have failed." Several development practices current in Qinghai today (e.g., building livestock shelters, increasing winter forage production) also aim to maintain local livestock populations artificially at otherwise unsustainable levels (Cincotta et al. 1992, Fernández-Giménez and Erdenebaatar 1995), and privatization in general "can be less meaningful for good resource management than other factors, such as secure tenure, equitable access to community resources, and meaningful institutional supports in the form of credit, production services, and legal protection" (Williams 1996).

Promoting land use intensification and reducing herd mobility are the result of a short-term livestock management perspective. For example, capital investments in "grassland construction" projects in one county in southern Qinghai have focused almost entirely on livestock, not on the rangeland, in an attempt to increase livestock over-winter survival. Yet, over a decade of construction has failed to achieve an increase in total livestock numbers while the grasslands continue to deteriorate (Shu 1993; Dari county government, personal communication). In many counties in Qinghai, grassland degradation has become so severe that many pastoralists have been forced to leave their family pastures to search for better land or to beg for a living (Guoluo and Yushu prefecture governments, personal communications), and many pastoralists have even been termed "ecological refugees" (Lang et al. 1997).

In contrast to a livestock management perspective, one should instead focus more attention on the grassland biome as a whole and on its long-term sustainable utilization. Adopting this perspective, the underlying resource, the grassland ecosystem, comes first, and utilization patterns should be based on local ecological conditions instead of perceived development goals by non-local forces. In practice, this means that there are limits to development on the Tibetan plateau and that grassland quality (and the integrity of the ecosystem as a whole, including the plateau's biodiversity) must be maintained. The grasslands themselves must therefore be managed as well as the livestock. Such a perspective also calls for a long-term approach to be adopted in development planning.

Although such a (partial) shift from livestock to grassland management does not ensure that all needs will be met – resources are still finite – it may be the only way for development to be sustainable and to protect the native biodiversity of Qinghai's alpine grasslands for future generations.

Furthermore, expertise and financial resources that are currently being directed at counter-productive activities could be re-directed to work in concert, not at odds, with local ecological conditions. Finding new ways to use natural resources, or to diversify the economy, is already an explicit goal in China. The present analysis, based on local government bureaus' own findings, simply highlights the ecological need to find such alternate development mechanisms. Instead of investing effort and resources primarily on winter pasture areas and attending almost exclusively to livestock, it would be best to focus more attention on the underlying rangelands. Traditional land use patterns should also be examined further to determine what aspects might be incorporated beneficially into future pastoral development plans and activities.

CHAPTER SEVEN

New Wildlife Sightings in Qinghai Province

Introduction (back to top)

Wildlife was observed on many occasions in Qinghai between May 1995 and December 1999. I undertook specific surveys in several localities, including the Datong Mountains in northern Gangcha, around Jiayi in Gonghe, in the eastern Kunlun Mountains in Dulan, around Ku Lake in Maduo, and in Luoxu Nature Reserve in Shiqu (near Yushu, but in northwest Sichuan) (Figure 40). Most wildlife sightings, however, were made on an *ad hoc* basis while conducting other work, most notably the coordination of a snow disaster relief operation and assisting with several development projects in the province (Foggin 1998b, 1999a, 1999b). Wildlife sightings were made from vehicles, on horseback, and on foot. Tibetan pastoralists also gave many verbal accounts of the distribution and the status of local wildlife populations. Observation of 18 mammal species and approximately 140 bird species are reported in this chapter. Several endemic, unique, or ecologically important mammals of the Tibetan plateau are also described in greater detail.

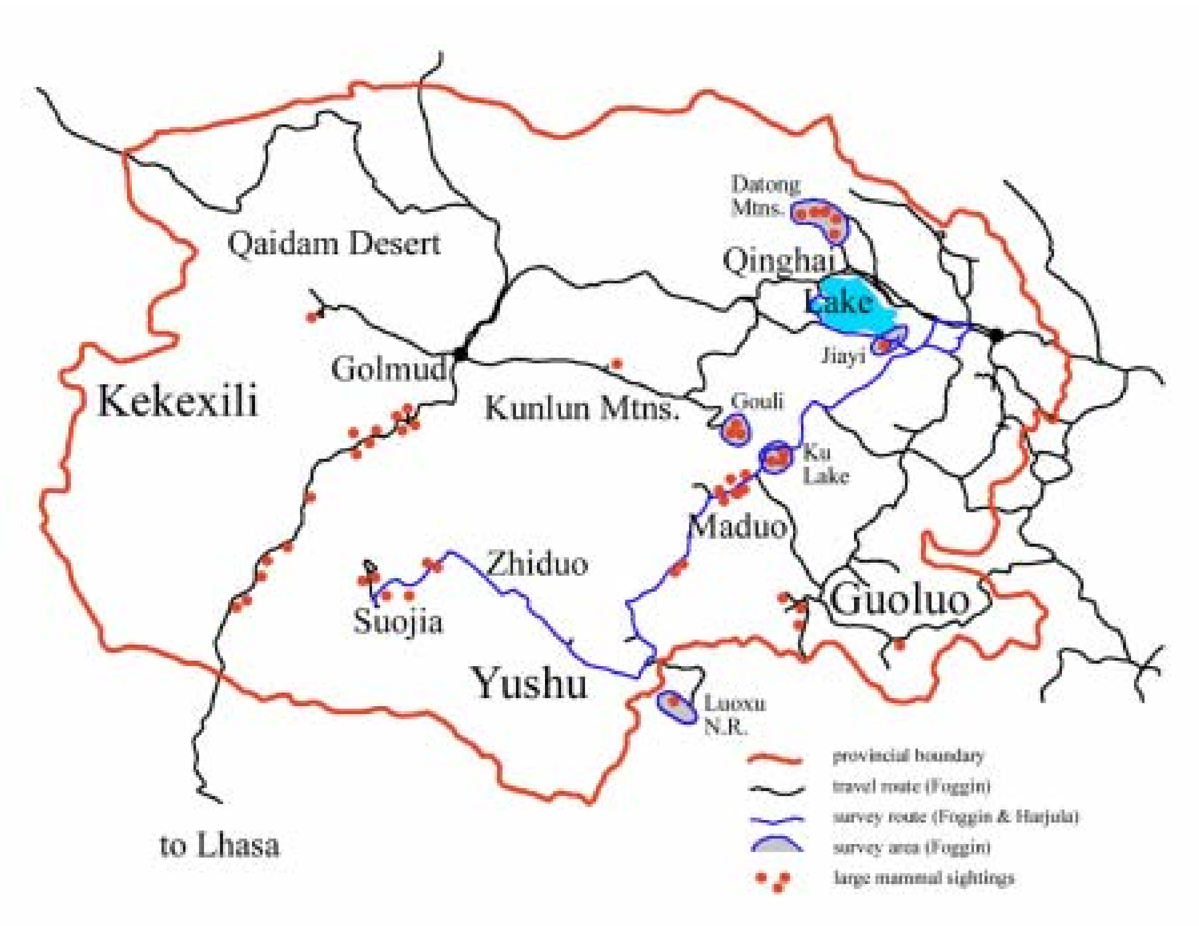

Figure 40. Main survey areas and mammal sightings in Qinghai (1995-1999)

Wildlife Observations, 1995-1999 (back to top)

Qinghai's avifauna was surveyed intensively in several locations in Qinghai (and also in Sichuan and Gansu provinces), and birds were always identified if possible whenever they were seen. Specifically, bird surveys were conducted in northern Gangcha (south of the Datong Mountains, 4 days, October 1996; north of the Datong Mountains, 12 days, May 1997), in the vicinity of Jiayi village in Gonghe (from the lake's shoreline and Daotanghe marsh up to the summits of the Qinghai Nanshan; many trips, all seasons), and in Luoxu Nature Reserve (LNR) and its surrounding area (8 days in July 1999). Many incidental observations also were made in many parts of Qinghai and in the grasslands of southern Gansu. In addition to personal observations of Qinghai's avifauna, species identified by two experienced birders (Dr. Jukka Harjula and Mr. Jesper Hornskov) and those reported by Song et al. (1998) are noted in Table 20. Dr. Harjula and I observed birdlife together on two occasions, on a 2-

day trip to Qinghai Lake in June 1998 and on a 15-day trip to Suojia, in Zhiduo, in March 1999. Mr. Hornskov also has conducted numerous bird surveys in the province and has kindly shared a manuscript that lists many of his observations (Hornskov 1999). Song et al. (1998) provide additional insight into the avifauna of the northeastern part of the Tibetan plateau (in southern Gansu) by dividing their observations into two broad categories, species that were seen in swamp meadow and species seen in alpine meadow (designated in Table 20 as “Song I” and “Song II,” respectively). The presence of each species in three geographic areas of Qinghai (i.e., in the Qinghai Lake area, Yushu prefecture, and Guoluo prefecture) and the general status of each species that I identified (around 140 species) are indicated in Table 20. One hundred and ninety bird species are thus noted as present or highly probable in Qinghai, a number that comprises a large portion (around 70 percent) of the 265 species previously reported for the province (Carey 1996).

Of particular interest are the black stork, golden eagle, Pallas’ fish eagle, lammergeyer, black-necked crane, Severtzov’s grouse, (nationally protected species, Category I), whooper swan, Accipitridae, Falconidae, eagle owl, little owl, Himalayan snowcock, Tibetan snowcock, white eared pheasant, blue eared pheasant (nationally protected species, Category II), Hume’s ground jay (the only truly endemic genus on the Tibetan plateau), Roborovski’s rosefinch, Kozlov’s bunting (nearly endemic to Qinghai); and the large variety of snowfinches, rosefinches, redstarts, larks, buntings, and corvids so typical of the Tibetan plateau.

Many mammals also were seen in Qinghai, both while conducting wildlife surveys and while involved in other (development) work. Eighteen species were thus identified between 1995 and 1999 (Table 21).

Table 20. Bird species observed in Qinghai (Part I: Bird species 1-64) (Part II) (Part III)

Spp. No.	Page No. DS	Page No. WP	Species: Common Name	Species: Latin Name	Geographic Area: QL	YS	GL	Other	Surveys (Foggin): GC	JY	LNR	other	Surveys (Others): Harj.	Horn.	Song[1]	Song[2]	Status
	I		**Podicipedidae (Grebes)**														
1	*119*	*4*	Little grebe	*Podiceps ruficollis*	x	x							x				occasional
2	*120*	*6*	Great crested grebe	*Podiceps cristatus*	x					x			x	x			occasional
	II		**Phalacrocoracidae (Cormorants)**														
3	*126*	*12*	Great cormorant	*Phalacrocorax carbo*	x				x	x		x	x		x		abundant
	III		**Ardeidae (Bitterns, Egrets, Herons)**														
4	*133*	*18*	Chinese pond heron?	*Ardeola bacchus*	x					x							occasional
5	*133*	*18*	Great egret	*Egretta alba*											x		
	IV		**Ciconiidae (Storks)**														
6	*138*	*24*	Black stork	*Ciconia nigra*	x				x								occasional
	V		**Anatidae (Swans, Geese, Ducks)**														
7	*139*	*32*	Whooper swan	*Cygnus cygnus*	x					x					x		occasional
8	*140*	*30*	Graylag goose	*Anser anser*	x					x			x		x		common
9	*141*	*30*	Bean goose	*Anser fabalis*											x		
10	*141*	*30*	Bar-headed goose	*Anser indicus*	x	x	x		x	x	x	x	x	x	x		abundant
11	*142*	*34*	Ruddy shelduck	*Tadorna ferruginea*	x	x	x		x	x	x	x	x		x		abundant
12	*142*	*34*	Common shelduck	*Tadorna tardorna*	x					x					x		occasional
13	*143*	*36*	Spot-billed duck	Anas poecilorhyncha		x							x		x		occasional
14	*143*	*36*	Mallard	*Anas platyrhynchos*	x	x				x			x		x		common

15	*143*	*34*	Common teal	*Anas crecca*		x					x		x		x		common
16	*144*	*36*	Falcated teal	*Anas falcata*	x								x				occasional
17	*144*	*38*	Gadwall	*Anas strepera*	x								x				occasional
18	*145*	*38*	Wigeon	*Anas penelope*	x								x		x		common
19	*145*	*34*	Common pintail	*Anas acuta*		x							x		x		occasional
20	*146*	*38*	Northern shoveler	*Anas clypeata*	x								x				common
21	*147*	*38*	Red-crested pochard	*Netta rufina*	x					x			x	x			abundant
22	*147*	*40*	Common pochard	*Aythya ferina*	x	x							x				common
23	*147*	*40*	Ferruginous pochard	*Aythya nyroca*	x								x		x		occasional
24	*153*	*46*	Common merganser	*Mergus merganser*	x	x	x		x	x		x	x	x	x		common
VI			**Pandionidae (Ospreys)**														
25	*154*	*66*	Osprey	*Pandion haliaeetus*	x							x			x	x	occasional
VII			**Accipitridae (Kites, Harriers, Buzzards, Eagles)**														
26	*155*	*48*	Black kite	*Milvus migrans*	x	x	x	x			x	x	x		x	x	abundant
27	*156*	*58*	Pallas' fish eagle	*Haliaeetus leucoryphus*	x	x	x			x	x	x		x	x		occasional
28	*156*	*60*	White-tailed eagle	*Haliaeetus albicilla*											x		
29	*157*	*62*	Lammergeyer (bearded vulture)	*Gypaetus barbatus*	x	x	x	x		x	x	x	x	x		x	abundant
30	*158*	*62*	Himalayan griffon	*Gyps himalayensis*	x	x	x	x		x	x	x	x		x	x	abundant
31	*158*	*62*	Cinereous vulture	*Aegypius monachus*	x			x			x	x			x	x	common
32	*165*	*52*	Upland buzzard	*Buteo hemilasius*	x	x	x	x			x	x	x	x	x	x	abundant
33	*167*	*56*	Tawny (steppe) eagle	*Aquila rapax*		x					x			x	x	x	occasional
34	*167*	*56*	Golden eagle	*Aquila chrysaetos*	x	x	x	x	x	x	x	x	x	x			common
VIII			**Falconidae (Falcons)**														
35	*170*	*70*	Eurasian kestrel	*Falco tinnunculus*	x	x	x	x				x	x				common
36	*172*	*70*	Merlin	*Falco columbarius*												x	
37	*172*	*70*	Red-footed falcon	*Falco vespertinus*												x	
38	*173*	*68*	Northern hobby?	*Falco subbuteo*		x					x						occasional
39	*173*	*66*	Saker falcon	*Falco cherrug*		x	x					x	x	x		x	common
IX			**Tetraonidae (Ptarmigans, Grouse)**														

40	*175*	*74*	Severtzov's grouse	*Bonasia sewerzowi*				x				x				x	occasional
	X		**Phasianidae (Pheasants, Partridges, Quails)**														
41	*178*	*76*	Himalayan snowcock	*Tetraogallus himalayensis*		x					x						occasional
42	*178*	*76*	Tibetan snowcock	*Tetraogallus tibetanus*	x	x				x	x			x			occasional
43	*179*	*78*	Chukar partridge	*Alectoris chukar*				x				x					occasional
44	*180*	*80*	Tibetan partridge	*Perdix hodgsoniae*		x					x						occasional
45	*191*	*92*	White eared pheasant	*Crossoptilon crossoptilon*		x					x			x			occasional
46	*192*	*92*	Blue eared pheasant	*Crossoptilon auritum*		x					x					x	occasional
47	*195*	*96*	Common pheasant	*Phasianus colchicus*				x				x				x	occasional
	XI		**Gruidae (Cranes)**														
48	*200*	*102*	Common crane	*Grus grus*											x		
49	*200*	*102*	Black-necked crane	*Grus nigricollis*	x	x	x			x	x	x		x	x		occasional
	XII		**Rallidae (Rails, Gallinules, Coots)**														
50	*208*	*112*	Common moor-hen	*Gallinula chloropus*											x		
51	*209*	*114*	Common coot	*Fulica atra*	x					x			x				common
	XIII		**Charadriidae (Lapwings, Plovers)**														
52	*214*	*122*	Little ringed plover	*Charadrius dubius*											x		
53	*216*	*122*	Kentish plover	*Charadrius alexandrinus*	x				x	x		x	x		x		common
54	*216*	*122*	Mongolian plover	*Charadrius mongolus*	x					x		x			x		occasional
	XIV		**Scolopacidae (Sandpipers, Curlews, Snipes)**														
55	*219*	*140*	Long-toed stint	*Calidris subminuta*											x		
56	*220*	*140*	Dunlin	*Calidris alpina*											x		
57	*223*	*128*	Spotted redshank	*Tringa erythropus*											x		
58	*223*	*128*	Common redshank	*Tringa totanus*	x	x				x	x		x		x		common
59	*223*	*128*	Marsh sandpiper	*Tringa stagnatilis*											x		
60	*224*	*130*	Green sandpiper	*Tringa ochropus*											x		
61	*225*	*130*	Wood sandpiper	*Tringa glareola*											x		
62	*229*	*134*	Solitary snipe	*Gallinago solitaria*		x							x				occasional

XV			**Recurvirostridae (Stilts, Avocets, Ibisbills)**														
63	*230*	*144*	Black-winged stilt	*Himantopus himantopus*	x					x					x		occasional
64	*231*	*144*	Ibisbill	*Ibidorhyncha struthersii*		x	x					x	x	x			occasional
XVI			**Laridae (Gulls, Terns)**														
65	*235*	*152*	Great black-headed gull	*Larus ichthyaetus*	x		x		x	x		x	x	x	x		common
66	*236*	*152*	Black-headed gull	*Larus ridibundus*	x							x					occasional
67	*236*	*152*	Brown-headed gull	*Larus brunnicephalus*	x		x		x	x		x	x		x		common
68	*239*	*148*	Black-tailed gull	*Larus crassirostris*											x		
69	*242*	*156*	Common tern	*Sterna hirundo*	x	x	x		x	x		x	x		x		common
XVII			**Pteroclididae (Sandgrouse)**														
70	*247*	*164*	Pallas' sandgrouse	*Syrrhaptes paradoxus*	x									x			
71	*247*	*164*	Tibetan sandgrouse	*Syrrhaptes tibetanus*		x							x	x		x	occasional
XVIII			**Columbidae (Pigeons, Doves)**														
72	*248*	*170*	Rock pigeon	*Columba livea*		x	x						x				common
73	*248*	*170*	Blue hill pigeon	*Columba rupestris*	x	x	x	x			x	x	x			x	abundant
74	*249*	*172*	Speckled wood pigeon	*Columba hodgsonii*											x		
75	*249*	*170*	Snow pigeon	*Columba leuconota*		x		x			x	x		x			occasional
76	*251*	*174*	Oriental (rufous) turtle dove	*Streptopelia orientalis*		x		x			x						occasional
XIX			**Cuculidae (Cuckoos, Coucals)**														
77	*259*	*184*	Indian cuckoo	*Cuculus micropterus*											x		
78	*260*	*184*	Common cuckoo	*Cuculus canorus*	x		x					x					occasional
XX			**Strigidae (Typical Owls)**														
79	*267*	*190*	Eagle owl	*Bubo bubo*	x	x				x	x						occasional
80	*270*	*196*	Little owl	*Athene noctua*	x	x	x					x	x			x	occasional

XXI			**Apodidae (Swifts)**														
81	*278*	*204*	Eurasian swift	*Apus apus*	x								x				occasional
82	*278*	*204*	Fork-tailed swift	*Apus pacificus*	x								x				occasional
XXII			**Upupidae (Hoopoes)**														
83	*290*	*218*	Hoopoe	*Upupa epops*	x	x	x	x		x	x	x	x		x		common
XXIII			**Picidae (Piculets, Woodpeckers)**														
84	*296*	*228*	Gray-headed woodpecker	*Picus canus*				x				x					occasional
85	*299*	*232*	Great Spotted woodpecker	*Picoides major*				x				x					occasional
XXIV			**Alaudidae (Larks)**														
86	*308*	*242*	Long-billed calandra lark	*Melanocorypha maxima*	x	x	x		x	x		x	x	x	x	x	common
87	*309*	*244*	Mongolian lark	*Melanocorypha mongolica*	x		x			x		x					common
88	*309*	*244*	Greater short-toed lark	*Calandrella cinerea*	x				x	x		x					common
89	*310*	*244*	Hume's short-toed lark	*Calandrella acutirostris*		x						x					occasional
90	*310*	*244*	Asian short-toed lark?	*Calandrella cheleensis*	x		x			x		x			x		occasional
91	*310*	*246*	Crested lark	*Galerida cristata*	x					x							occasional
92	*310*	*246*	Common skylark	*Alauda arvensis*											x		
93	*311*	*246*	Oriental skylark	*Alauda gulgula*	x	x			x	x	x	x	x		x	x	abundant
94	*311*	*246*	Horned lark	*Eremophila alpestris*	x	x	x		x	x	x	x	x		x	x	abundant
XXV			**Hirundinidae (Swallows, Martins)**														
95	*312*	*248*	Sand martin	*Riparia riparia*	x		x			x		x	x		x	x	abundant
96	*312*	*248*	Mountain crag martin	*Hirundo rupestris*	x	x		x		x	x		x	x		x	abundant
97	*314*	*248*	Barn (house) swallow	*Hirundo rustica*	x		x			x		x	x		x		common
98	*315*	*250*	Red-rumped swallow	*Hirundo daurica*		x					x						common
99	*315*	*250*	Asian house martin	*Delichon dasypus*		x					x			x	x		common

XXVI			**Motacillidae (Pipits, Wagtails)**														
100	*316*	*252*	Yellow wagtail	*Motacilla flava*											x		
101	*317*	*252*	Yellow-hooded wagtail	*Motacilla citreola*	x		x			x		x	x		x		occasional
102	*317*	*254*	White (pied) wagtail	*Motacilla alba*		x	x	x			x	x	x		x		common
103	*318*	*254*	Richard's pipit	*Anthus novaeseelandiae*											x		
104	*319*	*254*	Tawny pipit?	*Anthus campestris*	x								x				occasional
105	*320*	*256*	Rosy pipit	*Anthus roseatus*	x	x				x	x				x		common
XXVII			**Laniidae (Shrikes)**														
106	*333*	*274*	Bull-headed shrike	*Lanius bucephalus*											x		
107	*333*	*276*	Brown (red-tailed) shrike	*Lanius cristatus*		x					x						common
108	*336*	*276*	Gray-backed shrike	*Lanius tephronotus*	x	x		x		x	x	x	x		x		common
XXVIII			**Cinclidae (Dippers)**														
109	*338*	*302*	White-throated dipper	*Cinclus cinclus*		x					x				x	x	common
XXIX			**Troglodytidae (Wrens)**														
110	*338*	*302*	Northern wren	*Troglodytes troglodytes*												x	
XXX			**Prunellidae (Accentors)**														
111	*340*	*304*	Robin accentor	*Prunella rubeculoides*	x	x	x		x	x	x	x	x			x	common
112	*340*	*304*	Rufous-breasted accentor	*Prunella strophiata*												x	
113	*341*	*306*	Brown accentor	*Prunella fulvescens*		x							x		x	x	common
XXXI			**Turdidae (Thrushes, Chats, Redstarts)**														
114	*344*	*312*	White-tailed rubythroat	*Erithacus pectoralis*			x					x					occasional
115	*349*	*322*	Black redstart	*Phoenicurus ochruros*	x	x	x		x	x		x	x		x	x	common
116	*349*	*322*	Hodgson's redstart	*Phoenicurus hodgsoni*	x	x	x			x	x	x				x	common
117	*350*	*324*	Blue-fronted redstart	*Phoenicurus frontalis*		x		x					x				occasional

118	*350*	*324*	White-throated redstart	*Phoenicurus schisticeps*				x				x			x		occasional
119	*350*	*324*	Daurian redstart	*Phoenicurus auroreus*	x	x		x		x	x	x			x		common
120	*351*	*326*	White-winged redstart	*Phoenicurus erythrogaster*	x	x	x		x	x	x	x	x				abundant
121	*351*	*326*	White-tailed (blue) robin	*Cinclidium leucurum*											x		
122	*352*	*328*	Grandala	*Grandala coelicolor*		x								x			
123	*354*	*332*	Common stonechat	*Saxicola torquata*											x	x	
124	*355*	*330*	Hodgson's stonechat	*Saxicola insignis*	x					x							occasional
125	*356*	*334*	Northern wheatear	*Oenanthe oenanthe*	x								x				occasional
126	*356*	*334*	Desert wheatear	*Oenanthe deserti*	x								x				common
127	*357*	*334*	Isabelline wheatear	*Oenanthe isabellina*				x				x					common
128	*357*	*336*	River redstart	*Chaimarrornis leucocephala*		x		x			x	x	x		x	x	common
129	*362*	*346*	Red-throated thrush	*Turdus ruficollis*												x	
130	*364*	*344*	Common blackbird	*Turdus merula*		x					x						occasional
131	*364*	*344*	Chestnut thrush?	*Turdus rubrocanus*		x					x						occasional
132	*365*	*346*	Kessler's thrush	*Turdus kessleri*		x	x	x			x	x	x		x	x	common
XXXII			**Timaliidae (Babblers)**														
133	*372*	*362*	Kozlov's babax	*Babax koslowi*		x								x			
134	*376*	*368*	Pere David's laughingthrush	*Garrulax davidi*				x						x			
135	*380*	*378*	Elliot's laughingthrush	*Garrulax elliotii*		x		x			x	x			x		occasional
136	*390*	*396*	Chinese fulvetta	*Alcippe striaticollis*		x								x		x	
XXXIII			**Sylviidae (Old World Warblers)**														
137	*402*	*418*	Brown-flanked bush warbler	*Cettia fortipes*											x		
138	*409*	*432*	Tickell's leafwarbler	*Phylloscopus affinis*	x					x					x		occasional
139	*411*	*436*	Lemon-rumped warbler	*Phylloscopus proregulus*											x	x	

140	*415*	*440*	Goldcrest	*Regulus regulus*										x		
141	*416*	*446*	Severtzov's tit warbler	*Leptopoecile sophiae*		x		x			x	x				occasional
XXXIV			**Paridae (Tits)**													
142	*436*	*474*	Marsh tit	*Parus palustris*										x		
143	*438*	*474*	Rufous-vented tit	*Parus rubidiventris*										x		
144	*439*	*472*	Yellow-bellied tit	*Parus venustulus*				x			x					occasional
145	*439*	*474*	Gray crested tit	*Parus dichrous*										x		
146	*440*	*470*	Great tit	*Parus major*		x		x		x	x	x		x		occasional
XXXV			**Sittidae (Nuthatches)**													
147	*445*	*484*	(Red-winged) Wallcreeper	*Tichodroma muraria*				x			x		x			occasional
XXXVI			**Emberizidae (Buntings)**													
148	*455*	*540*	Pine bunting	*Emberiza leucocephala*				x			x					occasional
149	*455*	*550*	Kozlov's bunting?	*Emberiza kozlowi*		x				x			x			occasional
150	*455*	*546*	Eurasian rock bunting	*Emberiza cia*		x		x		x	x	x		x		abundant
151	*459*	*548*	Little bunting	*Emberiza pusilla*										x		
152	*462*	*544*	Black-faced bunting	*Emberiza spodocephala*										x	x	
XXXVII			**Fringillidae (Finches)**													
153	*468*	*514*	Mealy redpoll	*Carduelis flammea*										x	x	
154	*469*	*516*	Twite	*Acanthis flavirostris*	x	x				x		x		x	x	abundant
155	*470*	*518*	Brandt's mountain finch	*Leucosticte brandti*			x				x		x			occasional
156	*472*	*538*	Przevalski's rosefinch	*Urocynchramus pylzowi*		x							x		x	
157	*473*	*526*	Common rosefinch	*Carpodacus erythrinus*	x	x			x	x		x		x		common

158	*474*	*526*	Beautiful rosefinch	*Carpodacus pulcherrimus*												x	
159	*474*	*526*	Pink-rumped rosefinch	*Carpodacus eos*		x								x			
160	*476*	*528*	Pallas's (Siberian) rosefinch	*Carpodacus roseus*											x	x	
161	*476*	*528*	Three-banded rosefinch	*Carpodacus trifasciatus*		*x*	x	x			x						occasional
162	*477*	*526*	White-browed rosefinch	*Carpodacus thura*							x	x					occasional
163	*478*	*520*	Eastern Great rosefinch	*Carpodacus rubicilloides*		x						x					occasional
164	*478*	*520*	Great rosefinch	*Carpodacus rubicilla*		x							x	x			occasional
165	*478*	*520*	Red-breasted rosefinch?	*Carpodacus puniceus*		x						x		x			occasional
166	*479*	*528*	Roborovski's rosefinch	*Kozlowia roborowskii*			x						x	x			occasional
167	*482*	*532*	Gray-headed bullfinch	*Pyrrhula erythaca*												x	
168	*484*	*536*	Spot-winged grosbeak	*Mycerobas melanozanthos*		x	x				x	x					occasional
169	*484*	*538*	White-winged grosbeak	*Mycerobas carnipes*				x				x					occasional
XXXVIII			**Ploceidae (Weavers, Sparrows, Snowfinches)**														
170	*489*	*502*	Eurasian tree sparrow	*Passer montanus*	x	x	x	x		x	x	x	x	x	x		abundant
171	*489*	*504*	Rock sparrow	*Petronia petronia*											x	x	
172	*489*	*504*	Rock sparrow	*Petronia petronia*												x	
173	*490*	*504*	Tibet (Adam's) snowfinch	*Montifringilla adamsi*	x				x				x			x	abundant
174	*490*	*506*	White-rumped snowfinch	*Montifringilla taczanowskii*	x	x	x		x			x	x	x		x	abundant
175	*490*	*506*	Pere David's snowfinch	*Montifringilla davidiana*	x									x			
176	*491*	*506*	Rufous-necked snowfinch	*Montifringilla ruficollis*	x	x	x		x			x	x	x		x	abundant
177	*491*	*506*	Blanford's snowfinch	*Montifringilla blanfordi*	x	x	x			x		x	x	x			common

XXXIX			**Sturnidae (Starlings, Mynas)**													
178	*494*	*286*	Common starling	*Sturnus vulgaris*		x						x				occasional
XXXX			**Corvidae (Crows, Jays)**													
179	*511*	*294*	Azure-winged magpie	*Cyanopica cyana*				x			x			x		occasional
180	*512*	*294*	Eurasian magpie	*Pica pica*		x		x		x	x	x		x		common
181	*514*	*296*	Henderson's ground jay	*Podoces hendersoni*				x			x		x			common
182	*514*	*298*	Hume's ground jay	*Pseudopodoces humilis*	x	x	x		x	x	x	x		x	x	abundant
183	*515*	*298*	Red-billed chough	*Pyrrhocorax pyrrhocorax*	x	x		x	x	x	x	x			x	abundant
184	*515*	*298*	Yellow-billed chough	*Pyrrhocorax graculus*	x	x	x			x	x		x			abundant
185	*515*	*300*	Eurasian jackdaw	*Corvus monedula*										x		
186	*516*	*300*	Daurian jackdaw	*Corvus dauricus*		x		x		x		x				abundant
187	*516*	*300*	Rook	*Corvus frugilegus*				x				x		x		common
188	*518*	*300*	Large-billed crow	*Corvus macrorhynchos*		x		x		x	x	x		x		common
189	*518*	*302*	Collared crow	*Corvus torquatus*			x				x					occasional
190	*518*	*302*	Raven	*Corvus corax*		x	x	x			x	x		x	x	common

Abbreviations:

DS: Rudolphe Meyer DeSchauensee’s “Birds of China” (1984);
WP = China Wildlife Protection Organization’s “Atlas of Birds of China” (1995)

QL: Qinghai Lake Area
YS: Yushu Tibetan Autonomous Prefecture (and nearby area, including Luoxu Nature Reserve)
GL: Guoluo Tibetan Autonomous Prefecture

GC: Gangcha County
JY: Jiayi village (in Gonghe County)
LNR: Luoxu Nature Reserve (in Shiqu County, Sichuan Province)

Harj.: Bird species identified in Qinghai by Jukka Harjula (personal communication)
Horn.: Bird species identified in Qinghai by Jesper Hornskov (Hornskov 1999)
Song[1] and Song[2] : Bird species reported to occur in southern Gansu: (1) swamp meadow, and (2) alpine meadow grasslands (Song et al. 1999)

Table 21. Mammal species observed in Qinghai

Spp. No.	Species: Common Name	Species: Latin Name	General Status (and Protection Status in China)	Distribution (Wildlife Observations): Date	Location	Numbers	Other Comments
	I. Lagomorpha						
1	Plateau pika (Black-lipped pika)	*Ochotona curzoniae*	Common to abundant in large portions of the plateau	Observed in all seasons	All counties, in alpine meadow	Common to abundant	Local populations sometimes crash, very high densities in some areas, a keystone species of the plateau
2	Glover's pika	*Ochotona gloveri*	Locally common in southwest Qinghai and in adjacent areas of Sichuan and Tibet	July 1999	Chengduo and Shiqu (Sichuan)	3 individuals observed	Seen on cliff near stream and at base of dirt wall, closely related to the red-eared pika *Ochotona erythrotis*
3	Tibetan woolly hare (Gray-rumped Hare)	*Lepus oiostolus*	Occasional to common In most areas of the plateau	Observed in warm season	All counties, cosmopolitan	Occasional to common	Endemic to the Tibetan plateau
	II. Rodentia						
4	Himalayan marmot	*Marmota himalayana*	Locally common in most areas of the plateau	July 1997 (burrows seen all seasons)	In Kunlun Mtns. south of Golmud	Large active colony	Hibernate six months of the year, sign observed in several counties
5	Zokor	*Myospalax baileyi*	Uncommon in most areas, locally abundant in some places	(mounds seen in all seasons)	Around Qinghai Lake, in Guoluo	Few mounds observed	Can cause excessive local degradation of alpine meadow (black sands)
	III. Carnivora						
6	Gray wolf	*Canis lupus*	Present in low numbers in most areas of the plateau	Observed in all seasons	Gangcha, Dulan, Maduo	8 individuals observed	One observed by frozen carcass of a Tibetan gazelle *Procapra picticaudata* (five wolves observed by L. Wester)
7	Tibetan sand fox	*Vulpes ferrilata*	Present in moderate numbers in most areas of the plateau	Observed in all seasons	Gangcha, Dari, Jiuzhi, Maduo, Zhiduo, etc.	~25	The most common fox on the Tibetan plateau (The red fox *Vulpes vulpes* is heavily hunted for its fine pelt)
8	Weasel / Polecat	*Mustela* spp.	Present in low numbers in most areas of the plateau	June 1998, July 1998	Dari, Zhiduo	1 individual observed	Steppe polecat *Mustela eversmanni* is an important predator of the plateau pika *Ochotona*

							curzoniae
9	Eurasian badger	*Meles meles*	Uncommon	July 1998	Jiuzhi	1 individual observed	Observed in meadow with low shrubs, near county administrative center
10	Pallas' cat (Manul)	*Felis manul*	Uncommon (II)	June 1998	Jiuzhi	1 individual observed	Observed along roadside near a township administrative center
11	Chinese desert cat	*Felis bieti*	Uncommon (II)	April 1998	Maduo	1 individual observed	Observed in remote pastoral area, close to high mountain pass (and one old, unfriendly, armed Tibetan nomad!)
12	Snow leopard	*Uncia uncia*	Uncommon (I)	April 1997	Gouli (in Dulan)	sign (scrape) observed	Scrape and scat observed on ridge in Kunlun Mtns., abundant prey nearby (blue sheep *Pseudois nayaur*)

IV. Perissodactyla

13	Tibetan wild ass (*Kiang*)	*Equus kiang*	Uncommon or present in low numbers in most areas of the plateau, locally abundant (I)	March 1997	Maduo	~165	Several herds seen on 28 / 03 / 97 (6 to 14 animals / herd, avg. ≈ 10), eight herds seen on 31 / 03 / 97 (5 to 44 animals / herd, avg. ≈ 14)
				May 1997	Gangcha	~110	Around ten herds seen in May 1997 (2 to 25 animals per herd, avg. ≈ 11)
				July 1997	Golmud-Lhasa Highway	~35	Nine groups or individuals seen in July 1997 (1 to 9 animals / group, avg. ≈ 4) (The highway passes through the Kekexili Range of western Qinghai)
				March 1999	Suojia (Zhiduo)	~550	Four or five large herds seen in Wild Ass Valley, totaling over 500 animals (Suojia is located in western Zhiduo, on the edge of the Kekexili Range)

V. Artiodactyla

14	White-lipped deer	*Cervus albirostris*	Locally abundant, uncommon in most	July 1998	Suojia (Zhiduo)	3 individuals	Observed on the bank of the

	(Thorold's deer)		areas of the plateau (I)				Tongtian River (Yangtze River)
				October 1999	Zhiduo	~150	Many deer seen at the Deer Farm
15	Goitred gazelle	*Gazella subgutturosa*	Present in low numbers In the Qaidam Basin (II)	July 1997	Dulan, Geermu	5 individuals	Observed in remote desert and arid mountainous region
16	Tibetan gazelle (*Goa*)	*Procapra picticaudata*	Present in moderate numbers in most areas of the plateau (II)	July 1997	Golmud-Lhasa Highway	~20	Solitary animals and small herds
				Observed in all seasons	Maduo	~290	Solitary animals and herds of up to 12 individuals, mostly female
				October 1996	Gangcha	34 individuals	Four herds seen on 26 / 10 / 96 (2 to 18 animals / herd, avg. ≈ 8)
17	Blue sheep (Bharal)	*Pseudois nayaur*	Common in mountainous areas in most areas of the plateau (II)	April 1997	Dulan (in Gouli, Xiangride)	~260	Three herds were observed in Dulan (95, 32 and 131 individuals) high in the eastern Kunlun Mountains
				July 1997	Geermu	5 individuals	Small herd observed on scree cliff
				July 1998	Suojia (Zhiduo)	~15	Small herd observed on rocky cliff, less than 500 m from a winter home
				July 1999	Shiqu (Sichuan)	~45	Several herds observed in Luoxu N.R.
18	Tibetan antelope (*Chiru*)	*Pantholops hodgsoni*	Rare, declining population (I)	June 1995	Wudaoliang (Golmud-Lhasa Highway)	~1150	Four herds seen on 11 / 06 / 96 (~100 to ~550 animals / herd), female and young animals only
				July 1997	Wudaoliang (Golmud-Lhasa Highway)	22 individuals	Two herds seen 25 / 07 / 97, female and young animals only
				July 1997	Wudaoliang (Golmud-Lhasa Highway)	over 142 individuals	One herd seen on 28 / 07 / 97, partial count only (some animals hidden), female and young animals only

Notes: Protection status in China: I = Category One protected species, II = Category Two protected species (Carey 1996)

Mammal sightings include sighting a Pallas' cat and Chinese desert cat, several wolves, numerous herds of Tibetan wild ass, and several herds of Tibetan antelope. Glover's pika also was seen in the southwest of the province, and a snow leopard scrape was seen high in the Kunlun Mountains. As noted in Figure 40, most large mammals were observed in intensively surveyed areas (e.g., the Datong Mountains in northern Gangcha) or in remote areas of the province, most notably in Maduo – which is high, very remote, and has one of the lowest human population densities in the province (around 0.4 people/km^2) – and the greater Kekexili area (in Suojia township, and along the Golmud-Lhasa highway). A brief description of several ungulates (Tibetan antelope, Tibetan gazelle, Tibetan wild ass, wild yak, blue sheep, argali, and white-lipped deer), two predators (snow leopard, Tibetan brown bear), and a keystone species (plateau pika) of the Tibetan plateau are provided below.

Tibetan antelope / Chiru *(*Pantholops hodgsoni*)* (back to top)

> "With their rather chunky bodies and slender legs, chirus are reminiscent of antelopes. Adult males stand about 83 cm high at the shoulder (measured from the hoof tip) and weigh up to about 40 kg…. The male's most conspicuous antelope-like feature is the long, slender, black horns, which rise almost vertically from the head, curve slightly back in the distal half, and then terminate with smooth rapier-like tips pointing forward. … The coat of adult males is dense and woolly, with hairs 4-6 cm long on neck and body. The summer pelage is reddish fawn with light gray and brown tones grading to white on the underside. … The face and the front of the legs are dark gray. … Females are about 74 cm tall at the shoulder and average about 26 kg …. They are hornless, unlike other female caprids. Their coat is fawn-colored, almost pinkish, often with rust brown on the nape, blending into the whitish underside. A pale white area encircles the tip of the muzzle and the eyes. The top of the muzzle and front of the legs are grayish. The young are colored like the females" (Schaller 1998).

The Tibetan antelope, or chiru, has received considerable attention recently, both in the scientific community (World Wide Fund for Nature 1998, Harris et al. 1999) and in the national and international press (Deng 1998, Rennie 1998, Bay 1999, McCarthy and Florcruz 1999, 'Xining Declaration…' 2000). The most significant threat to its survival is ongoing large-scale poaching, usually by non-local people, to obtain the antelope's wool known as shatoosh (Schaller 1996, Xinhua News Agency 2000, 'Xining Declaration…' 2000). According to Harris et al. (1999), "poaching of antelope has become a serious problem throughout the Tibetan plateau in recent years, and … an entire subpopulation can disappear … within a relatively short time-frame." Fortunately, protective legislation began to be enforced more widely in 1999, and several education and anti-poaching propaganda campaigns are now ongoing in Qinghai. Miller and Schaller (1997b) note that although a few small Tibetan antelope populations are sedentary, most are migratory, and they suggest there is evidence for four main migratory populations. One of these migratory groups is found in Qinghai, and another group may cross seasonally into Qinghai from adjacent areas of northern Tibet. Miller and Schaller (1997b) followed the latter population in 1994 and found that

> "in May, the pregnant females with their female offspring of the previous year migrate north along traditional routes to give birth. In 1994 we observed migrating herds on May 30-31 about 40 km northeast of the settlement of Garco. The chiru continued northeast across hills and plains, crossing a pass at about 5,300m, to an area about 40 km south of lake Dogai Coring from where they then evidently moved northeast and then probably north to give birth somewhere near the Tibet-Qinghai border. In two days (May 30 and 31, 1994) we counted approximately 1,000 female antelope. The exact location of the birthing grounds for this population is still unknown. From May 30 to June 26, 1994, we tallied 1,825 male antelope along a 1,250 km survey route north of the settlement of Shuanghu."

And in another survey area in Qinghai, around 20,000 km^2 in size, Schaller et al. (1991) found that

> "chiru were concentrated in two localities: the Golo Valley north of Totohe, where 267 animals were counted, and a 2100 km^2 tract north of Wudaoliang where mean transect density was 1.47 chiru km^{-2}, or ~3087 animals… As chiru were rare outside the concentration areas, the total number of animals was ~3500-4000, or 0.18-0.20 km^{-2} (Schaller and Ren 1988). Also tallied within the transect strips were 413 kiang, 90 Tibetan gazelles, and 9 wild yaks (all males). … In the area of concentration of chiru near Wudaoliang, there were an estimated 222 kiang (0.1 animals km^{-2}) and 122 gazelles (0.06 animals km^{-2})."

It is in almost exactly the same location where Schaller et al. (1991) saw over 3,000 Tibetan antelope in the mid-1980s, near Wudaoliang on the Golmud-Lhasa highway (about 200 km southwest of Golmud), that I observed around 1,150 Tibetan antelope on 11 June 1995, in four distinct groups, between 16:00 and 18:00 h in the evening. The Tibetan antelope were all female (adult and young), and were apparently undisturbed by our passing vehicle (a public bus) or by the presence of domestic livestock and a herder less than 200 m away. All four sub-groups were slowly moving northward, presumably to their birthing grounds. Around two years later, two groups totaling 22 Tibetan antelope were observed on 25 July 1997, and one group comprised of at least 142 antelope was observed three days later, on 28 July 1997, also northeast of Wudaoliang. Of the latter group, 104 antelope were female and 38 were young (i.e., slightly over one-third of the females had young with them). All the animals were grazing or walking slowly in a southward direction. The herd was observed at a distance of around 5 km, aided by 8x binoculars and a 15-40x spotting scope. No male antelope were observed.

These observations should also be compared with Harris et al. (1999) who searched for but failed to find almost any Tibetan antelope in Wild Yak Valley in September 1997, less than 100 km north of Wudaoliang. This is in sharp contrast to the fact that Tibetan antelope were the most abundant ungulate in the same valley only several years earlier, with over 2,000 individuals in 1991 (Harris 1993, Harris and Miller 1995). It remains unclear, though, if the animals described in the present observation are part of the Wild Yak Valley population, or if they are part of a different, migratory group. Given different directions of travel in mid June (1995) and late July (1997), the second hypothesis is most probable. This view is also consistent with Schaller's observation that "females migrate north in May and June, calve somewhere [in the north] and return south almost immediately," as well as his assumption that the Tibetan antelope in Wild Yak Valley are (or were) a resident population (Schaller 1998).

A small but growing resident (non-migratory) population of Tibetan antelope is also reported in Suojia, to the east of the Golmud-Lhasa highway (reported by local pastoralists in July 1998 and March 1999). Unfortunately, I have not had the opportunity to observe the herd personally, and specific numbers have been difficult to obtain. Prior to the snowstorms of 1985, Tibetan antelope and other ungulates are reported to have been very abundant in the entire region. In particular, one local herder recalls seeing tens of thousands of Tibetan antelope in 1975 between the Tongtian (Yangtze) and Dangqu rivers, in western Suojia near the Golmud-Lhasa highway, supposedly one of the Tibetan antelope's elusive birthing grounds.

Tibetan wild ass / Kiang *(*Equus kiang*)* (back to top)

> "The kiang is the largest of the wild asses, a robust yet trim animal up to 142 cm high at the shoulder … and with an estimated body mass of 250-300 kg, with some stallions up to 350-400 kg … although, like in all equids, sexual dimorphism is slight. … The kiang's head is large, the muzzle blunt, and nose convex. The mane is upright and relatively short. The coat is a rich chestnut color, darker brown in winter and a sleek reddish brown in late summer after the animal has shed its woolly pelage…. The legs and undersides, including

> the ventral part of the neck, are white, as are the insides of ears and end of the muzzle. A dark dorsal stripe extends from the mane to the end of the tail, which has a tuft of stringy black hairs. The tips of the ears and a narrow band along the margin of the hooves are also black" (Schaller 1998).

Like the Tibetan antelope, Tibetan wild ass also prefer the open plains. According to Miller and Schaller (1997b), they reach their greatest abundance on the alpine steppe (such as in parts of Maduo and Suojia) but become increasingly scarce where the desert steppe begins to predominate. Of the large mammals, the kiang dominates wildlife biomass (Schaller and Gu 1994). As seen in Table 2, kiang "roam singly and in small herds for much of the summer, usually with fewer than 25 animals," but during the winter "herds congregate in areas with good grazing [and] up to 300 kiang may assemble … and remain … until they disperse the following spring" (Miller and Schaller 1997b). In March 1999, over 500 were observed in 4 or 5 herds in Wild Ass Valley (Jiongqu village) in Suojia. However, because they are believed to compete with livestock for forage, many pastoralists are not too sympathetic to their presence in such large numbers, particularly in proximity to their livestock grazing pastures.

*Tibetan gazelle (*Procapra picticaudata*)* (back to top)

> "The Tibetan gazelle has a compact body and slender legs and stands about 60-65 cm high at the shoulder. Its coat is sandy brown to grayish brown, grayer in summer than in winter. The fronts of the legs are light gray, and the inside of the legs and the belly are white. The animal lacks conspicuous facial markings and a lateral stripe. The rump patch is white, large, and heart-shaped, and its hairs are erectile, often fanning out as the gazelle flees. A band, light rust in color, borders the rump patch, which surround the short (8-9 cm) black-tipped tail…" (Schaller 1998).

Like the Tibetan antelope (*chiru*) and Tibetan wild ass (*kiang*), Tibetan gazelle also prefer the open plains. However, unlike the antelope, and to a lesser degree the wild ass, Tibetan gazelles are quite sedentary. Overall, their status has remained unchanged in most areas (Miller and Schaller 1997b, Harris et al. 1999) and they are the most commonly seen ungulate on the Tibetan plateau today. Tibetan gazelle usually are found in small to moderate numbers (and occasionally in large numbers) in some localities, but may be absent from many other areas. The presence of Tibetan gazelle appears to depend largely on local availability of their preferred forbs (Miller and Schaller

1997b). In this study, Tibetan gazelle were observed in a variety of places, almost always in small herds, but sometimes many herds were seen in a small geographic area (e.g., in Maduo).

*Tibetan wild yak (*Bos grunniens*)* (back to top)

> "The wild yak is massive with sturdy legs and a conspicuous hump that rises abruptly behind the neck and tapers down to a level back. It is black with rust-brown overtones except for gray toward the tip of the muzzle. A long fringe of hair on the lower neck, chest, sides, and thighs drapes the lower parts like a skirt. In bulls this fringe may be 70 cm long and hang almost to the ground…. The tail terminates in a large, bushy tuft which … waves back and forth when, during aggressive encounters, the animal raises its tail vertically. … A dense layer of wool grows beneath the coarse guard hairs. … The thick coat and the low number of sweat glands … are efficient adaptations for conserving heat. Even on brisk days, yaks often stand knee-deep in ice-cold streams, apparently to cool off; they survive poorly in warm climates or below 3200 m on the Tibetan plateau. … The shoulder height of wild adult bulls is about 175-203 cm and of cows 137-156 cm; the total length of bulls is 358-381 cm and that of the one cow measured is 305 cm. … Wild yak horns are gray to black. Those of bulls sweep out and forward then back and often somewhat inward, whereas those of cows curve more sharply up and farther back." (Schaller 1998)

In Wild Yak Valley, the Tibetan wild yak population appears to be essentially unchanged in recent years, with about 1,200 to 1,300 animals in both 1990-92 and 1997 (Harris et al. 1999). In most of their range, however, they have been hunted heavily and their overall population has been largely decimated. According to Miller and Schaller (1997b), "wild yaks … now exist mainly where pastoralists are either sparse or absent. … Wild yaks prefer to be on or near hills which they ascend to about 5,300m at the limit of vegetation. … Herds roam widely, making seasonal shifts for 60km or more." The eastern limit of their range is said to lie near the Golmud-Lhasa highway, which runs through the transition zone between the alpine meadow in the east and the alpine steppe in the west (Su 1993, Schaller and Liu 1996). However, a small population is reported to occur around 100 km east of the highway, north of the Tongtianhe (Yangtze River) in Suojia, but this has not yet been confirmed. In the past, Tibetan wild yak were exceptionally abundant in Suojia and elsewhere on the Tibetan plateau (see, e.g., Rockhill 1894, Hedin 1903; cited in Schaller 1998), but today they are very rare almost everywhere.

*Blue sheep (*Pseudois nayaur*)* (back to top)

> "Adult males are robust and handsome, about 80-91 cm tall at the shoulder, with a sleek grayish brown to slate blue pelage. The ventral surface of the neck, the chest, and the front

of the legs are dark gray to black. … A conspicuous black flank stripe separates the upper parts from the white belly. The rump patch, the inside and the back of the legs, and the tip of muzzle are also white…. The hair is short without beard, ruff, or other hairy appendage. The smooth horns sweep up and out and then curve back before curling up at the tip. They are massive and relatively short, the record being 84 cm…. Females resemble males except that they have gray, instead of black, markings and their short horns, 10-20 cm long, project first up and then out…. Although seemingly marked in a striking pattern, blue sheep are remarkably inconspicuous, blending so well into their environment that they are often difficult to spot" (Schaller 1998).

Overall, blue sheep are common in suitable habitat. As they are the main prey of snow leopard (Oli 1996), as well as an important source of food for wolves and other predators, blue sheep prefer rough terrain and cliffs that provide them with adequate escape routes. Herds are reported often to consist of 50 or more animals (Miller and Schaller 1997b). Several large herds of at least 95, 32 and 131 animals were observed in April 1997 in the high mountains of Gouli, in the Kunlun Mountains of southeast Dulan. This area already is recognized for its high density of snow leopard (and blue sheep), and it is here that the Xining Zoo trapped many of its animals in the past (Yang 1994). I also have observed herds of blue sheep in Geermu (in the central Kunlun Mountains), in Suojia, and in the Luoxu Nature Reserve in northwest Sichuan.

*Argali (*Ovis ammon*)* (back to top)

"Adult rams have a shoulder height of about 118 cm and they weigh an average of 105 kg…. [They have a] distinctive white-ruffed winter coat…. In their summer coat, rams are a light grayish brown, sometimes darker on the neck, with an indistinct margin between white rump patch and adjoining body hair, and there is a faint side stripe separating the upper parts from the white belly. The horns of rams are heavily ribbed and average 39.4 cm … in circumference at the base in animals 6-7 years and older…. Horn length in sheep increases steadily with age, the oldest animals usually having the longest horns as measured along the outside curve. … Female Tibetan argalis resemble males in summer pelage and have light grayish brown upper parts, darker along the back, and white bellies and rumps. They stand 104-112 cm high at the shoulder and weigh an estimated 68 kg… a third less than adult rams" (Schaller 1998).

No argali were seen in this study, but they were reported specifically in Gouli, in Suojia, and in the Luoxu Nature Reserve (in Sichuan). Argali are very rare throughout their range.

*White-lipped deer (*Cervus albirostris*)* (back to top)

"White-lipped deer are large and robust. Adult stags stand about 120-140 cm tall at the shoulder and weigh 180-230 kg, whereas females are about 115 cm tall and weigh usually less than 180 kg…. The antlers are smooth and somewhat flattened…. The pelage is coarse and stiff and the hairs are hollow as in blue sheep, providing an insulating layer of warm air. The dark hairs have a light-colored band near the tipe, giving the animal a grizzled appearance. As their name implies, the deer have a white upper lip and tip of muzzle, and they also have white inside the ears, on chin and throat, and on the inside of the legs. The belly is cream to grayish white. The body is light buff or grayish brown to dark brown, pelage color varying somewhat with sex, season, and possibly locality. … The rump patch is rusty-colored and surrounds the tail" (Schaller 1998).

Several white-lipped deer were seen in the wild in Suojia. Many were seen, however, in the semi-wild deer farm near Zhiduo town, where their white-lipped deer antlers are harvested yearly for their velvet. The white-lipped deer is endemic to the Tibetan plateau, but it is now rare throughout most of its range.

*Snow leopard (*Uncia uncia*)* (back to top)

"Snow leopards inhabit some of the most remote and highest ranges on earth. Their luxuriant smoke-gray coats with black rosettes and their long, lush tails are evocative of snow and immense solitudes. Rare and elusive, the cat has become symbolic of the wildness and wilderness of central Asia's mountains. … Raking their hindpaws, the cats make characteristic scrapes on the ground at mountain passes, the base of cliffs, the confluence of streams, by prominent boulders, and other conspicuous places" (Schaller 1998).

No snow leopard was seen in this study, but one fresh scrape was found in Gouli. Snow leopards also were reported to be very abundant in one remote mountain area of Suojia (in Muqu village). This large predator is considered as an "indicator species" because its presence depends on the ecological integrity of entire mountain ecosystems (Jackson and Hunter 1996). Overall, the snow leopard is extremely rare.

*Tibetan brown bear (*Ursos arctos*)* (back to top)

"The brown bears on the Tibetan plateau belong to the subspecies *Ursus arctos pruinosus*. … The bears on the plateau are medium-sized animals … with a shaggy coat and sometimes a conspicuous ruff. Their pelage color is distinctive though highly variable. Adults usually are dark brown to black except that the face is rust brown to tan and a white collar extends from the shoulder to the chest, becoming broader below. The ears are also black and at times so hairy that they seem tasseled. … Subadults are generally lighter colored than adults. Although the legs, face, and hump are dark, the rest of the coat may range from pale brown to such a light tan that the animals appear almost white at a distance. … The Tibetan brown bear is now rare on the steppes, where they mainly persist in or near mountainous terrain" (Schaller 1998).

Brown bear were reported in several areas of the province. They are said to be common in some parts of Dari (in Guoluo), and they also are reported to be present in Suojia. Although brown bear are now relatively rare, they were reportedly quite numerous in the past (Combe 1989).

*Plateau pika (*Ochotona curzoniae*)* (back to top)

> "The black-lipped [or plateau] pika is at times so abundant on the alpine meadows and steppes that it probably has the highest mammalian biomass in many areas and is a key link in the food chain for most predatory birds and mammals. … [It is] a typical chunky, tailless lagomorph [with] a brown to reddish tan coat with light gray undersides …. Colonies occur almost wherever the terrain is flat to gently sloping, well drained, and with a silty or sandy soil devoid of rocks. Pikas greatly favor alpine meadows [and] live in burrows, which they leave for several hours in daytime to forage" (Schaller 1998).

The plateau pika is probably the most abundant animal on the Tibetan plateau. Pika do not hibernate, and they are a keystone species of the alpine meadow (Smith and Foggin 1999). However, they are poisoned in vast areas of the plateau because they are believed to compete with livestock for forage, and a lot of native wildlife is impacted negatively by this activity. Smith and Foggin (1999) provide a detailed account of the plateau pika and its significant contributions to the biodiversity and ecological integrity of the Tibetan plateau.

Historic Wildlife Abundances *(back to top)*

It is clear from the above account that wildlife is not very abundant in most parts of the province. Only in remote areas are large mammals seen with any frequency, a situation very different from only several decades ago. Even in 1947, Migot (1957) found grasslands with "a tremendous lot of wildlife in this region, which is in effect a sort of sanctuary undisturbed by man. Herds of yaks, wild asses, and gazelles were all quite easy to get near." Late last century, Rockhill (1891) saw many hillsides that were "literally black with yak, they could be seen by the thousands." Indeed, virtually every explorer that has ever traveled in the region, at least up until the 1950s, saw huge and thriving wildlife populations (e.g., Prejevalsky 1876, Deasy 1901, Hedin 1903, Rawling 1905, Kozloff 1910, Ward 1913, Huc and Gabet 1928, Schäfer 1933, Ekvall 1968, Combe 1989, Norbu 1997).

One of the most famous adventurer-explorers of his time, the Russian Nikolay Przewalski found the wildlife of the Tibetan plateau to be exceptionally abundant. According to Rayfield (1976), the people that he met during his travels knew the Tibetan plateau as *guresu gadzyr*, the country of wild animals. Rayfield (1976) recounts Przewalski's travels last century in (present-day) Qinghai:

> "Despite [the plateau's] desolation it was well-watered in summer and kulans [Tibetan wild ass] and yaks searched for patches of grass, while wolves and foxes pursued the herbivores in search of carrion. … The country of wild beasts was a game-hunter's dream. Herds of yak and kulan, wild sheep [argali] and bharals [blue sheep], orongo gazelles [Tibetan antelope] and ada antelopes [Tibetan gazelle] roamed the plateau, unused to, and hardly afraid of, man. The orongo stags were herding the hinds: in their rut they paid little attention to the hunter." (pp. 75-76)

> "Somehow they reached the Kuku Shili [Kekexili] range where marshes gave the camels food, and also provided cover for a new race of bear. Przhevalsky watched a wolf pack follow a bear, seizing marmots as the bear scraped them from their burrows [and] there were hundreds of wild yak that had not yet migrated downstream." (p. 135)

> "The narrow strip of level ground between the lake [Koko Nor, or Qinghai Lake] and the mountains [Qinghai Nanshan] is excellent steppe-land … where those ever-recurring denizens of the steppe, the … *ogotona* [pika, *Ochotona*], larks, and sand-grouse were to be seen. Here too were new kinds of birds and mammalia, peculiar to the deserts of Tibet. The most remarkable of the birds was [the Long-billed Calandra Lark, which is] larger than a starling; inhabiting the tufted marshy grass, an exquisite songster. Two kinds of *Montifringilla* [Snowfinches] and a *Podoces humilis* [Hume's Ground Jay] were occupying the burrows of the alpine hare [plateau pika]. … Among birds of prey, vultures and lammergeiers daily visit its shores in search of food, and numerous buzzards, hawks, and eagles appear to winter here for the sake of feeding on the alpine hares [plateau pika] that are found so abundantly.

> "The last-named animal … inhabits in extraordinary numbers the pasture land at the foot of the mountains. … Hundreds and thousands may be seen on a fine day disporting themselves in the open, or basking in the sun near their holes; and although destroyed by eagles, buzzards, and hawks, wolves, foxes, and steppe-foxes [sand foxes], they multiply so quickly as to make up for all losses. Bears, wolves and badgers [also feasted on] marmots and mole-rats [zokors].

> "The most remarkable animal of the steppes of Koko-nor [Qinghai Lake] is the wild ass or *kulan*, called *djang* [kiang] by the Tangutans (*Equus kiang*), in size and external appearance closely resembling the mule…. We saw them first on the upper Tatung-gol [Datong River, in north Gangcha] where the Kan-su mountains are unwooded, and the pasturage is good. The kulan ranges over Koko-nor, Tsaidam [Qaidam], and Northern Tibet, but it is found in the greatest numbers in the first-named country [where] larger herds of several hundred [were seen]." (pp. 144-147, 163)

> "Once they were down in the rich, boggy salt-marsh – the Odon Tala, or 'Starry Sea' [near the source of the Yellow River, in present-day Maduo] – where springs bubbled up like stars through the bog, such countless herds of *kulan* [Tibetan wild ass], yak and antelope [Tibetan gazelle] appeared that Przhevalsky had to limit hunting and conserve ammunition." (p. 165)

> "For eighteen days Przhevalsky shot pheasants and went on bear *battues*. … Przhevalsky [Przewalski] stopped at a warm sulphurous spring, where he found his gerbil, *Brachiones*

przewalskii, a few bears and huge herds of kulan [Tibetan wild ass]. … The Russian New Year of 1885 (13 January) was celebrated by shooting twenty-three orongo [Tibetan antelope].” (pp. 171-173)

“The characteristic animals belonging to the order of Mammalia, which are most numerous in the Tibetan deserts, are the wild yak (*Peophagus grunniens*), the white-breasted argali (*Ovis poli?*), the kuku-yaman (*Ovis Nahoor*), the antelopes called orongo and ata (*Antilope Hodgsoni and A. picticauda*), the kulan or wild ass (*Equus Kiang*), the grey wolf (*Lupus Chanco*). Besides which are the bear (*Ursus* sp.), the manul (*Felis manul?*), the fox (*Canis vulpes*), the steppe fox (*Canis Corsac*), the hare (*Lepus tolai*), the marmot (*Arctomys* sp.) and two kinds of lagomys.” (pp. 186-187) (See Appendix IV for the current common and scientific names of mammals).

It is evident from even this single account that wildlife was, until not very long ago, extremely abundant almost everywhere on the Tibetan plateau. Today, however, one must travel far and wide to see only a few animals. It is only in remote and sparsely populated regions of Qinghai, such as the Kunlun Mountains in Dulan, the vast open plains of Maduo, and the Kekexili region (e.g., in Suojia and along the Golmud-Lhasa highway) that a greater variety and more abundant wildlife populations can still be seen.

Main Threats to Qinghai’s Wildlife *(back to top)*

The main threats to wildlife have long included land conversion for agriculture, which has negatively impacted biodiversity in many parts of the Tibetan plateau through outright destruction of valuable alpine grassland (Qinghai People’s Government 1951, ‘Open up…’ 1956, Western Resources and Environment Research Center 1994, Becker 1996). Plowed land can take many years, even decades, to recover (Cincotta et al. 1991). In 1999, however, China finally corrected its national policy, and no more land on the high alpine grasslands will be converted for agricultural purposes. Considerable farmland will even be restored to its former state, including around 30 percent of the cultivated land in Qinghai (‘China to cut grain…’ 2000, ‘China to reduce … 2000, ‘NPC deputies…’ 2000, ‘Top advisors…’ 2000).

“Rodent control” also has been undertaken in many areas of Qinghai and across the entire Tibetan plateau. This activity, however, continues to receive official sanction despite the critical damage that results from the widespread poisoning of the plateau pika (*Ochtona curzoniae*; not a rodent, but a lagomorph), a keystone species of the Tibetan plateau grasslands. The plateau pika is a keystone species because it makes burrows that are the primary homes to a wide variety of small birds and lizards, creates microhabitat disturbance that results in an increase in plant species richness, serves as the principal prey for nearly all of the plateau's predator species, and contributes positively to ecosystem-level dynamics (Smith and Foggin 1999). Although pikas are not being killed (poisoned) illegally, their demise nonetheless contradicts national policies that require that due consideration be given to local ecological conditions, and thus to promote sustainability. As a keystone species, removal of the plateau pika has multiple, negative, cascading effects on many other animals, on plant species richness, and on basic ecosystem functions (Smith and Foggin 1999).

Illegal hunting (poaching) continues to pose one of the most serious threats to the mammals of the plateau (Miller and Schaller 1997, Schaller 1998). Although national and international law forbids hunting of most rare and endangered species, many animals are still targeted each year by Chinese poachers and foreign trophy-hunters. Hunted species include Tibetan antelope, Tibetan wild yak, snow leopard, blue sheep, argali, Tibetan gazelle, musk deer, brown bear, and possibly even Koslow's pika (Schaller et al. 1988, Harris 1991, Hoffmann 1991, Zhang 1991, Aukatsang 1994, Jackson and Hunter 1996, Schaller and Liu 1996, Schaller 1998, World Wide Fund for Nature 1998, Bay 1999, Harris et al. 1999). Local pastoralists also kill snow leopard and wolves to protect their livestock (Miller and Jackson 1994, Miller and Schaller 1997), and red foxes are heavily hunted for their fur (personal observation).

Illegal gold mining has increased in the past decade, particularly with a gold rush to the remote Kekexili area in southwest Qinghai (Aukatsang 1994). Local cash-strapped governments have also considered gold mining as a potential source of revenue (Shi 1997). However, in both cases, it is usually non-local people who are hired to find gold (personal observations), and poaching, whether for meat or for sale, is very closely tied with mining activities in the province (Bay 1999, McCarthy and Florcruz 1999).

"Building the grassland," a basic maxim for pastoral development in China, also affects wildlife populations. Modernization in Qinghai is still predominantly oriented toward infrastructure development rather than toward the creation, organization, and dissemination of information (e.g., extension services, training, education). Current grassland construction activities include large-scale grassland fencing schemes, “rodent control,” and the Four-in-one Scheme for poverty alleviation (building houses for pastoralists, building livestock shelters, fencing the grassland, and planting winter forage crops). Almost all of these activities promote an overall intensification of resource use, with concomitant reductions in the overall flexibility, mobility, and seasonal character of traditional Tibetan pastoral practices. Grasslands have not fared well under such conditions in Mongolia (Sheehy 1993, 1996) and Inner Mongolia (Hu et al. 1992, Li et al. 1993, Williams 1996), nor even in Qinghai’s grasslands (Qinghai Census Bureau 1994, Western Resources and Environment Research Center 1994, Lang et al. 1997, Chen et al. 1998). The ecological integrity of alpine grasslands is therefore at stake, and biodiversity is rapidly being diminished.

Increasing human and livestock populations have likewise affected wildlife in Qinghai. Livestock may compete for forage with wildlife, including Tibetan gazelle and Tibetan wild ass, and overstocking contributes to serious land degradation (Qinghai Census Bureau 1994, Lang et al. 1997, Chen et al. 1998). The simple presence of people and livestock also can create serious physical disturbance for wildlife, and wild animals are now present in large numbers only in the most remote, mountainous areas of the province (Schaller 1998, Harris et al. 1999, personal observations).

Finally, according to Miehe (1992, 1994) and others (e.g., Western Resources and Environment Research Center 1994, Miller 1995), climate change is particularly important to explain some of the observed changes in grassland species compositions. In particular, a general dessication (drying) trend has been noted which may be the main factor causing the transformation of alpine sedge (Cyperaceae) meadow vegetation into alpine steppe vegetation in some parts of the Tibetan plateau (Cincotta et al. 1991, Miller and Schaller 1997). Dessication also is an important factor contributing to land degradation through the formation of severely degraded land known as “black sands” (Edmonds 1994, Mao et al. 1997, Lang et al. 1997, Chen et al. 1998). Wildlife species dependent on specific grassland types or on sufficient forage availability thus may be affected by local and regional climatic changes.

Summary *(back to top)*

We now know where wildlife tends to be most common in Qinghai, and also how sparse it is compared to even the fairly recent past. We also are aware of many of the threats to wildlife in Qinghai today. We have thus met the first half of Miller's (1996) definition of conservation biology, that is, "to investigate human impacts on biodiversity." We also have pointed toward several possible directions of change that would better protect overall biodiversity (e.g., to promote more flexible and mobile forms of rangeland management). However, simple theoretical statements and recommendations by outsiders rarely provide clear, straightforward guidance for local decision-makers who must face real-world complexity, many competing demands, tortuous power plays, and sometimes even political intrigue! We therefore have yet to meet the second half of Miller's (1996) basic definition of conservation biology, that is, we have yet to develop *practical approaches* to preserving biodiversity and ecological integrity. In other words, How can good concepts and theories be transformed into concrete and feasible, real-world solutions?

The final chapter of this dissertation is therefore a case study that examines in practice how conservation is currently being promoted in one very specific context in the source area of the Yangtze River. The case study focuses in particular on the work of a local grassroots organization and the local government, who jointly have focused their work on integrating environment and development in the alpine grasslands of the Tibetan plateau. A report on a field trip made to Suojia (the case study area) in July 1998 is provided in Appendix V, including a general description of the area and an overview of the local history (environmental and cultural history) as well as some glimpses into the early stages in the development of the local non-governmental organization.

CHAPTER EIGHT

Regional Conservation Planning in the Source Area of the Yangtze River (Suojia Township): A Case Study

Introduction (back to top)

Situated in the center of the Tibetan plateau, Suojia Township provides an ideal geographic setting to examine the intersection of conservation and development in China. At the local level, the township and county governments as well as the first grassroots organization in the province, the *Qingzang Gaoyuan Huanchangjiangyuan Shengtai Jingji Cujinghui* (that is, the Upper Yangtze Integrated Conservation and Development Organization, or the Upper Yangtze Organization for short), have made economic development and environmental protection their dual priority goals. At the higher provincial and national levels, economic growth and natural resource protection also both are considered to be extremely important. Indeed, 70 percent of China's fixed asset investments and foreign loans this year (2000) has been designated for use in the poorer "western hinterlands" (Jin 2000), and all levels of government in China now pay considerable attention to the ecological conditions of the source areas of the Yellow, Yangtze, and Mekong rivers, especially since the devastating floods of 1998 (He 1997, Liu 1998, Hen 1999). Furthermore, an enormous region in southern Qinghai recently was designated by central (national) authorities as a multiple-use nature reserve to protect regional grassland ecology ('China plans…' 2000, 'Qinghai to build…' 2000). Clearly, the integration of environmental protection (biodiversity protection) and socio-economic development is an important priority for all the stakeholders in the region.

This chapter presents a unique case study of biodiversity conservation on the Tibetan plateau by examining the current activities and plans of the local government, as well as the formation, current activities, and future plans of the Upper Yangtze Organization. The work of the government and the local organization largely are integrated in Suojia through the influence of one person – namely, Drashi Dorje Hashil (or Zhaduo, for short) – who is both the Party Secretary of Suojia and the principal founder and Director of the Upper Yangtze Organization. Of course, Zhaduo is assisted greatly in this innovative and strategic work by a number of colleagues.

In a first instance, the broad context for conservation is reviewed in this chapter. Second, the recent emergence of civil society in China (i.e., non-governmental organizations, or NGOs, and other formal and informal interest groups) is described briefly. Third, a concrete example of community-based, "bottom-up" biodiversity conservation on the Tibetan plateau is described by providing detailed information about Suojia and the Upper Yangtze Organization, as well as by documenting my own involvement in the development of local activities and plans. Some of the roles and responsibilities of different stakeholders in the present effort to achieve regional sustainability and to protect the native biodiversity of this special part of the Tibetan plateau also are discussed in the case study. Ecologically sound recommendations for future conservation efforts in this region of Qinghai thus are beginning to emerge.

Biodiversity Protection (back to top)

Biodiversity conservation (and development) in China (back to top)

The maintenance of biodiversity now is regarded worldwide as an essential ingredient for long-term ecological sustainability. The official strategy for biodiversity conservation in China is explained in *Chapter 15: Conservation of Biodiversity* of the national *White Paper on China's Population, Environment, and Development in the 21st Century* (Administrative Centre for China's Agenda 21, 1994; URL: *http://www.acca21.edu.cn/chnwp15.html*, viewed 12 April 2000):

> "The policy for biodiversity conservation in China is 'laying equal stress on both the development and utilization and the conservation and protection of natural resources' and 'he who develops, conserves; he who utilizes, compensates; he who destroys, restores.'"

However, as Bradbury et al. (1996) explain, although the importance of the environment now is recognized in theory in China, in practice, "economic development [still] is the nation's principal objective and [often is deemed unable to] accommodate environmental objections." Fortunately, though, the situation in the source area of China's great rivers appears to be an exception, and may even indicate a fresh start for resource protection in China with the environment now considered of primary or equal importance, instead of only secondary, to development (‘China plans…’ 2000, ‘Qinghai to build…’ 2000).

Clearly, whether recognized or not, there *are* limits to growth (World Conservation Union et al. 1991, World Resources Institute et al. 1992, Smil 1993), and ecological sustainability implies “low external input” (Westing 1996, Lawrence 1997). The shift in China toward a more ecological approach to development therefore is an encouraging change. In the Tibetan plateau region, the conservation of biodiversity is important not only because it enhances regional sustainability, but the adoption or the maintenance of ecologically sustainable livelihoods also allows for the “elimination of subsidies [which] is a matter of pride to the Tibetans and [a matter] of economics to the Han” (Environment Science and Technology 1998d). Biodiversity protection is a win-win solution that benefits local to regional, national, and even international stakeholders (‘Forging partnerships…’ 1997, Miller and Craig 1997, Stevens 1997b, Zeppel 1998).

Key strategies for successful conservation (back to top)

Many of the key challenges to effective conservation, however, are not biological and scientific, but rather social and economic (Schaller 1998). Drawing on the experience of IUCN - The World Conservation Union, the International Institute for Environment and Development (IIED), and the World Resources Institute (WRI), Carew-Reid (1993) has summarized some key lessons learned over the past few years for successful conservation:

> “[Conservation] strategies are not one-off events. They should rather be action-based, building on priority areas where government and people are already committed. …
>
> Strategies should be seen as a continuous, cyclical process and integrated into conventional development cycles. They are not just something to be ‘added on’. …
>
> Successful strategies are not possible unless the capacity to carry them through is built up at the earliest stage. …
>
> Centralized planning and decentralized implementation don’t mix. …
>
> Participation needs to increase as a strategy develops. … In poor local communities strategies may first need to identify and meet immediate needs, so that benefits can be felt.
>
> Strategies need to be processes of action and reflection. This means that monitoring and evaluation are vital. The appraisal of strategies needs to stress the way things are done as well as the outcome. …

> Donors need to operate at a level appropriate to local conditions, and to build on local initiatives. … Donors should forget about 'model' strategies and support tailor-made solutions. Low-level, continuous external backing over a long period is almost always much better than short, high level, one-off inputs."

All of the above components of a broad comprehensive conservation strategy already have been included, to varying degrees, in the conservation efforts currently in progress in Suojia township (see below). Nonetheless, finding appropriate ways to encourage local community participation in conservation, and to avoid the danger of being satisfied with passive or manipulative participation (sensu Mowforth and Munt 1998), remains a real challenge. Indeed, it is the joint issues of local participation and a genuine sense of ownership in conservation (integrated with sustainable development) that perhaps are the most significant factors that will lead to – or conversely, that may hinder – successful biodiversity protection on the Tibetan plateau.

Putting (local) people first (back to top)

Many researchers, environmentalists, planners, and community development workers have found that "putting people first" is an extremely important, even essential, part of successful, long-term conservation:

> "The bottom line is that effective, long-term conservation of biodiversity can be greatly assisted by 'putting people first.' This means listening to their concerns, encouraging their ability to organize themselves, and then addressing their needs… Actions taken at the community level are becoming the keystone of global efforts to conserve biodiversity" (Wilson 1996).

> "A key to the success of conservation projects outside of protected areas is that they address the needs and aspirations of resource users." (Carpenter 1998)

> "The principle of beginning where the people are is crucial… Their value system must be quickly learned and respected so that you can dialogue with them (Freire 1970) … Hang in and try to move with the grain of the community as it raises and drops and raises its issues at its pace, and as new people become involved and leadership develops and broadens." (Lee 1997)

Although it tends to be "against the normal survival instincts of governments to want to share power and responsibility" or to "use their power to give away some of their power" (Bayon 1996), it now is clear that "sustainability planning *must* be community-led and consensus-based because the *central issue is will*, not expertise; only a community-based process can overcome the political, bureaucratic and psychological barriers to change" (Doering 1994; emphasis added). At the same time, though, adopting or encouraging a bottom-up (grassroots) approach to change does not means that local, regional, or national leaders are no longer involved in the process, as some leaders may fear. Rather, the opposite is true, since “bottom-up, citizen-led processes must be combined with top-down government support if plans are going to be implemented and activities sustained because it is still only governments that have the regulatory and taxing powers to secure the transition to sustainability” (Doering 1994).

As McNeely (1990) explains, it also is imperative that we begin to “recognize that our existing governmental institutions and procedures [often] are not evolving nearly as quickly as our environmental problems emerge, so that new institutions may be required to design and implement [more appropriate] integrated development plans and programmes.” The development of civil society, or the growth of the non-governmental sector, is one area that has contributed significantly to successful conservation efforts worldwide. Thus both top-down and bottom-up approaches to change are helpful to adequately plan and implement integrated conservation and development projects, and both should be encouraged.

Power plays in project planning **(back to top)**

While it is recognized that both top-down and bottom-up approaches may be necessary to ensure that an area’s resources are used sustainably and that its native biodiversity protected, there still are several pitfalls uniquely associated with the notion of local community participation. As Mowforth and Munt (1998) explain, “the principle of local participation … is easier to promote on paper from a distance than it is to put into practice at the local level.” One of the main challenges is that there are many different ways that the idea of participation can be understood. Pretty’s (1995) “typology of participation” is particularly helpful to determine the type or degree of local participation present in (or desired for) any given conservation or development project. According to Mowforth and Munt (1998),

> “The types of participation [identified in Pretty’s typology] range from manipulative participation, in which virtually all the power and control over the development or proposal lie with people or groups outside the local community [and thus participation is simply a pretence], to self-mobilisation, in which the power and control over all aspects of

> the development rest squarely with the local community. The latter type does not rule out the involvement of external bodies or assistants or consultants, but they are present only as enablers rather than as directors and controllers of the development."

Based on his experience in several African nations, Huntington (1988) found that a "socialist model [of development] tends to view local participation [only] as a means of mobilizing and channeling the energies of the masses to serve centrally defined developmental needs of the nation," a viewpoint still shared by many decision-makers in China today. In contrast, the vaguer Western notions of participation range from an idealism of local people assuming "their own responsibility for economic development" to a "consultation process" to simple "contributions of free menial labor to reduce the costs of constructing public buildings" (Huntington 1988; also see Pretty 1995).

The most important question, then, is: Development and conservation, *by whom* and *for whom*? Indeed, the most important issue is power, since "development [i.e., change] everywhere and at all times involves some people gaining and others losing" (Attwood et al. 1988). Power struggles can easily occur at all levels, at the international level as well as at the local or regional levels.

As Jasanoff (1993) explains, even "science" involves power, since "when it comes to studying the causes of complex environmental problems, there is almost always more than one way to skin the scientific cat. And these choices are not themselves scientific. They're deeply social, cultural, and ethical." Working in the Indian Himalayan region, Datta and Virgo (1998) also found that "actual priorities perceived by villagers through participatory (PRA-based) planning frequently differ from 'targets' and priorities defined by outside planners." Therefore, the main limiting factor in the ability of most conservation projects to involve local communities is that most projects are driven by external values and goals (Carpenter 1998), particularly "First World" values and goals (Mowforth and Munt 1998).

For example, even though the IUCN – The World Conservation Union's guidelines call for consultation and addressing local people's needs, as Stevens (1997b) explains,

> "indigenous peoples' settlement and land use are to be supported *only* when they are in accordance with the larger objectives of the protected area and, in the case of wilderness areas, perhaps only when they continue to be an expression of a 'traditional' way of life…"

Likewise, Mowforth and Munt (1998) draw attention to the fact that

> "conservation measures designed to maintain ecological biodiversity undertaken by organizations such as Conservation International have frequently been 'contradicted' by the priorities and aspirations of local communities attempting to secure their livelihoods. … [Yet] the global concerns and consciousness of First World citizens are played out at a local scale; their 'will' is imposed upon communities thousands of miles away."

In light of this, Gray (1991, in Stevens 1997b) concludes with the ominous prediction that

> "as long as environmentalists [continue] to seek monolithic solutions to problems of conservation and paternalistically project their ideas about protection onto [local] peoples without trying to understand their perspectives, the world will end up with neither conserved areas nor [local] peoples."

Clearly, then, there is a definite "geography of power" (Massey 1995) in the arena of biodiversity conservation. Part of the solution for reconciling different worldviews lies in a simple, humble acceptance "that First World agencies, organizations and institutions do not have all the right solutions," and that we, conservation biologists of the First World, must try to avoid the serious pitfalls by which "Third World local communities [often] have emerged as *commodities* utilised by [international] NGOs … to secure grants and aid, and on [whose] behalf widespread fundraising [is] undertaken" (Mowforth and Munt 1998, emphasis added). Instead of seeking "their" participation in "our" projects, we rather should seek the formation of genuine, long-lasting, and equal partnerships for global conservation. In this way, local participation will be accepted both as a method of change and as a goal in its own right (that is, for the empowerment of local communities). This broader understanding of "participation" is significant because there is both intrinsic and practical value in local participation in development and conservation projects.

> "It is at this level [i.e., community level] that ordinary people can best articulate a holistic concept of their needs [and] at this level, people are directly aware of community problems and unused resources – that is, they are able to match development plans with existing and potential resources. Self-interest intersects with self-reliance and self-management to produce possibilities for development" (Kaufman and Alfonso 1997).

Civil Society in China (back to top)

The emergence of environmental NGOs in China (back to top)

In China, local participation in decision-making is most evident in village-level elections and, more recently, in the development of civil society. In areas where government authorities do accept increasing levels of local autonomy, however, it is primarily for the sake of expediency, mostly to revive collapsed economies (Kelliher 1997) or to address other specific local needs. Nevertheless, whatever the motives, now there is increasing opportunity in China for grassroots voices – the voices of individuals and communities – to be expressed and heard.

In Muldavin's (1997) study of policy reform and environmental degradation in Heilongjiang province in northeast China, it is even suggested that locally based collective action may be essential to achieve sustainability:

> "We are now able to identify multiple Chinas – multiple development models and paths occurring simultaneously (Muldavin 1992). … Alternate pathways are emerging, for example, a shift to markets within a predominantly collective economy allowing peasants to employ long-term decision-making strategies in production alongside short-term market ones. … A wide range of options are already in place to deal with the problems facing rural China – all of them better than a complete turn to a market economy composed of millions of small producers. … [Most notably, the present] situation provides space for dialogue between different state institutions and independent social movements – *the development of civil society*. … Taking into account the immense heterogeneity of China, *locally-based collective action* and long-term production strategies must be promoted if the difficult problems of sustainability are to be resolved." (emphases added)

Back at the level of the village, there has been a significant move in the last two decades toward greater local autonomy, or at least toward self-government or self-management. Kelliher (1997) explains:

> "In 1982, China's newly revised Constitution briefly mentioned [for the first time] a grass-roots organ called the 'villagers' committee' (*cunmin weiyuanhui*), which would be elected by village residents to manage public affairs. At first this change seemed meaningless. … But, in early 1984, the Ministry of Civil Affairs – backed by Peng Zhen, the powerful chairmain of the Standing Committee of the National People's congress – began work on a law that would make the innocuous passage in the Constitution a reality. Peng, despite his reputation as a conservative, was in earnest about granting self-government to villages. … Eighteen of China's thirty provincial-level units succeeded in holding elections in at least some of their villages in 1990. … Ministry of Civil Affairs officials stand out among the proponents of village self-government, with central officials appearing somewhat more enthusiastic than their provincial counterparts. Conspicuous among the foes of self-government are rural office-holders at the county level and below, especially within the townships."

Ironically, popularly elected village governments may simply be one of the few (if not the only) means to "make villagers obey policies they abhor" such as compulsory production quotas, taxes, and birth control (Kelliher 1997). With a quick "sleight of hand," village-level democracy in

China has detached self-determination from the more acceptable, pragmatic notion of self-government, and thus village elections are primarily a “means for getting villagers to do what the state wants” (Kelliher 1997) through the increased sense of obligation that comes from even a “passive participation” and “participation by consultation” in the decision-making process (Pretty 1995). Nonetheless, although some proponents for greater local autonomy feel that village elections do not give sufficient voice to the masses, and that state laws on other forms of association also are too restrictive (Human Rights in China 1998), the degree of grassroots participation officially encouraged by the government does give rise to considerable hope for a positive trend in community involvement in development and conservation endeavors (see, e.g., the Administrative Centre for China’s Agenda 21, 1994; *Chapter 20: Public Participation in Sustainable Development*, URL: http://www.acca21.edu.cn/chnwp20a.html, viewed 18 May 2000).

The second primary area of community involvement in decision-making in China is the formation of voluntary “social organizations.” Knup’s (1997) overview is especially insightful:

> “Perhaps the key question which preoccupies many Chinese leaders is how to keep the economy growing while addressing new social challenges and preventing unrest. … One important outgrowth of China’s reforms is a recognized need to address social concerns but a limited state capacity to do so. This situation has compelled the Chinese government to seek alternative ways to address these problems, thereby *creating space for the emergence of social organizations or NGOs*. As long as these organizations address problems deemed valid by the state [such as environmental protection], and in a manner deemed appropriate by the state, some public space will continue to exist and perhaps even grow. However, the situation is fluid: NGOs in China must tread warily in a vague and uncertain political climate which keeps a careful eye on potential threats to social stability….” (emphasis added)

Environmental organizations in particular have proliferated in China over the past few years (Knup 1997, Viederman 1998), and it is estimated that over 200,000 social organizations are registered nationwide (Knup 1997). Several kinds of organizations have developed, from unregistered neighborhood groups to individual-organized NGOs, to government-organized organizations or “state-led civil society” (Brook and Frolic 1997, Knup 1997, Viederman 1998, Crane 2000). All these organizations, however, remain only semi-independent of the state because they are obliged to work within the broad purview of government goals. A second limitation on civil society is that only one organization can work legally within any given field at a given administrative level (Knup 1997, Human Rights in China 1998). The most important contribution of civil society lies therefore, not in contesting government goals, but rather in its ability to focus specific attention on finding new or more effective ways to achieve specific government goals, as well as to provide a forum for individuals and communities to be heard on the relevant issues. The Upper Yangtze Organization, for example, focuses only on integrating environmental protection (conservation) and sustainable development in the alpine grasslands in the source area of the Yangtze River. The organization leaders also have chosen to pursue their (and the government's) goals in close cooperation with the local pastoral population in ways similar to Pretty's (1995) classification of "interactive participation" and community "self-mobilization."

Special characteristics of the Tibetan plateau (back to top)

Some unique characteristics of the Tibetan plateau environment, both the natural and the cultural or social environment, impact the way that government and non-governmental institutions should work in places like Suojia (i.e., in remote, high altitude, pastoral regions of the Tibetan plateau) to ensure long-term successful development and biodiversity conservation. To date, most development efforts have focused on technological interventions that aim to "improve" the productive capacity of the grasslands (see, e.g., Huang 1992, Lang et al. 1997, Liu and Wang 1998, Han 1999). Cultural and environmental factors of the "sustainability equation," on the other hand, largely have been ignored (Wu Ning 1997, Miller 1998, Su 1998, Smith and Foggin 1999). Similar development patterns and omissions have been detrimental to many grassland ecosystems, and the peoples they support, around the world (Ellis and Swift 1988, Köhler-Rollefson 1997, 'China plans…' 2000). Many aspects of the environmental and cultural contexts of the Tibetan plateau have been discussed in detail in the earlier background chapters of this dissertation.

Regarding local traditions, or the way of life, of Tibetan nomads, Wu Ning (1997) specifically notes the important linkage between nomadism, biodiversity, and sustainability:

> "In a nomadic society biodiversity provides a fundamental base to nomadism and to the overall economic systems. It is the source of resiliency and regeneration, necessary for the

> sustainability of nomadic systems. It is the ultimate basis for local self-sufficiency, and a global asset, bringing benefits to people in terms of material welfare in more ways than we realize."

In a similar vein, Ellis and Swift (1988) also suggest that some local traditions, such as seasonal movements between pastures, must not be ignored: "A cautious approach to pastoral development is to ask if intervention strategies can be formulated which will build upon the best aspects of traditional systems, rather than imposing wholesale alterations upon them." And in the specific context of the Tibetan plateau, Miller (1998) notes that

> "herders have often been left out of the development process with neither their knowledge nor their needs and desires considered in the rush by many governments and development agencies to introduce more 'modern' methods of livestock production. The key to sustainable pastoral development in the Himalayas lies in incorporating and building upon the indigenous knowledge and skills herders already possess when designing new interventions. …
>
> "Factors that should be considered in developing strategies for biodiversity conservation and sustainable development in the rangelands of the Himalayas [include] to:
>
> - adopt a holistic, systems approach that takes into consideration social as well as ecological and livestock production aspects;
>
> - pursue multiple-use management approaches on the rangelands; … and
>
> - encourage donor agencies to take more innovative approaches to pastoral development and range resource management."

To achieve greater sustainability, "most of all, environment and economics must be integrated in all of our major institutions of decision-making" (MacNeill et al. 1991). Furthermore, "a 'bottom-up' approach [also] might succeed … where the 'top-down' approach [alone] has failed, but successful models are few" (Attwood et al. 1988).

In principle, almost all government leaders, from the township level right up to the national level, agree with the above recommendations to consider ecological and cultural realities as well as the shorter-term economic concerns that pertain to the "development" of high altitude grasslands. In practice, however, there still is a lot of progress that needs to be made, at several levels, to adequately integrate all of these considerations. The local government and Upper Yangtze Organization now both are at the local forefront of promoting a holistic, integrated, bottom-up approach to conservation and development in the source area of the Yangtze River. It is to their work that we now specifically turn our attention.

Suojia and the Upper Yangtze Organization: A Case Study

(back to top)

In choosing a specific geographic area to present as a case study of current efforts to conserve biodiversity in Qinghai's alpine grasslands, several conditions were sought. First, the area must have some wildlife to conserve, since the proactive approach to wildlife conservation pursued in this dissertation requires that wildlife populations be present at least in small numbers. Unfortunately, many areas of the Tibetan plateau already have lost almost all their native animals, and some grassland areas are changing rapidly due to climatic conditions, overgrazing, and other factors (Cai et al. 1990, Reardon-Anderson and Ellis 1990, Hu et al. 1992, Miehe 1994, 1996, Lang et al. 1997, Environment Science and Technology 1998b, Schaller 1998, Smith and Foggin 1999, Harris et al. 1999, Holzner and Kriechbaum 1999). In this work, wildlife (biodiversity) protection is considered a priority over species reintroductions (e.g., reintroduction of the Przewalski Horse in Mongolia; Ryder 1993, Van Dierendonck and Wallis de Vries 1996, Rees 1997) and ecosystem restoration efforts (Baldwin et al. 1993, Noss and Cooperrider 1994), hence finding an area with current wildlife populations was necessary.

Second, because the focus of this work is the integration of environment and development, the study area also should be situated where there is a resident human population. To date, most wildlife conservation studies have focused largely on uninhabited areas of the Tibetan plateau, such as Yeniugou, or Wild Yak Valley, in western Qinghai (Harris and Miller 1995, Harris et al. 1999), and the Chang Tang Nature Reserve in northern Tibet (Miller and Schaller 1996, 1997a, Schaller 1998). However, it is conservation efforts undertaken in inhabited areas that most likely will lead to successful strategies to protect biodiversity, that is, outside protected areas where human needs and aspirations must be incorporated in land use planning along with the needs of wildlife populations (Gunn 1994, Noss and Cooperrider 1994, Jeffries 1997, Carpenter 1998, Harris et al. 1999). This dissertation aims in particular to find ways in which conservation can build on development, and vice versa, in order to reduce the risk that wildlife populations will be decimated any further.

Third, it is essential to select a study area that is governed by innovative, forward-looking government and community leaders who understand the value of biodiversity, and who are ready to discuss alternative conservation and development strategies. Without the confidence and support of such leaders, it would be impossible to anchor any of the concepts and ideas discussed in this work in reality, that is, to ground-truth any of the present findings and recommendations by testing them in the real socio-cultural, economic, and political (policy) contexts that affect the alpine grasslands.

The above three conditions for an effective case study are met in Suojia, a vast township in western Zhiduo. In this township, both modernization and rapid loss of biodiversity are imminent, yet the local government and the local grassroots Upper Yangtze Organization are open to new approaches for biodiversity conservation and other progressive changes in primary education, literacy work, community health, and sustainable income generation. The following case study thus is a simple, straightforward account of the conservation work already begun in Suojia, a unique "experiment" in conservation (sensu Eberhardt and Thomas 1991, Hargrove and Pickering 1992) that the local government, the Upper Yangtze Organization and I have been developing together, both formally and informally, since December 1997. Although it will be impossible to replicate in their entirety the specific conditions that underlie this work, at least the guiding principles can be replicated elsewhere in the future. These principles include, most importantly, the promotion of community participation and self-mobilization, the establishment of genuine partnerships at the local to international levels, and a commitment to work in ways that enable a sense of ownership in the work by all stakeholders. In sum, the empowerment of local communities so that they can design and implement their own conservation and development initiatives is a key objective of our integrated work (Ghai and Vivian 1992, Western and Wright 1994, Kaufman and Alfonso 1997, Margoluis and Salafsky 1998).

Where is Suojia? [(back to top)]

Many local herders consider Suojia to be the “belly of the plateau” because it is located near the center of the Tibetan plateau (see Figure 9). Situated in the vicinity of the source area of three great rivers – the Yellow, Yangtze, and Mekong rivers – government leaders also recognize that Suojia is a vital area for regional conservation of the Tibetan plateau, and an important part of China’s and even the world’s natural and cultural heritage. A large portion of Suojia is uninhabited, most notably the Kekexili District west of the Golmud-Lhasa Highway (see Chapter 7, Figure 40), which falls under provincial and national administration as a national-level nature reserve. The populated area of Suojia, on the other hand, is divided into four main administrative units (that is, four *dadui* or “villages,” each of which also is divided into four smaller *xiaodui* or “work teams”) (cf. Yaqu, Muqu, Jiongqu, and Dangqu; Figure 41). The latter section – that is, the populated area of Suojia, east of the Golmud-Lhasa Highway – is the geographic focus of the present study. However, even this populated area is so remote that herders and leaders alike have told me repeatedly that no other outsider, neither Chinese nor foreigner, had ever visited the areas that we traveled to in July 1998. (See Appendix V for more detailed information on the local environment, population, and history of Suojia).

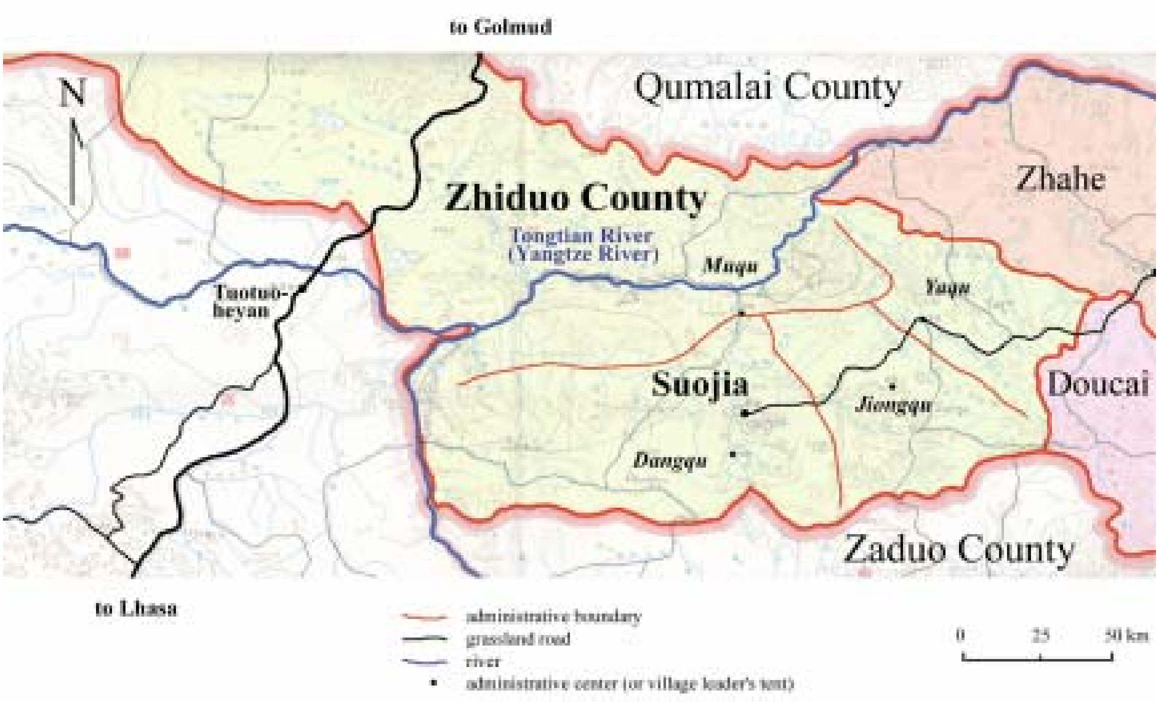

Figure 41. Map of Suojia township, Zhiduo county, with approximate village (*dadui*) boundaries in red

The sole published accounts that I have found which refer to the Suojia area were written or recounted by two Tibetans travelers, one of whom described the local environment and nomadic life based on his travels to the area in the early 20th century (Combe 1989), and the other of whom wrote about the area based on his recollections and notes from a trip through the area in the early 1950s (Norbu 1997) (see Appendix VI). Much more recently, Aukatsang (1994) found that Zhiduo town was still

> “the end of the ‘road’ on the maps. … Beyond Zhiduo lies the unknown: frozen marshes, the kingdom of the wild yaks, the snow leopard and the Tibetan wolves. A few nomads are the only ones to venture in this high desert (+16,000 feet); they do not talk about it. … Foreigners are prevented from going [any further] by the army.” (Also see Appendix VI).

Even today, logistically as well as politically, Suojia is difficult to reach. However, the single road to the township’s administrative center is being renovated, most significantly by the construction of a bridge over the Yaqu River, and plans already have been made to extend this road beyond the administrative center all the way to Tuotuoheyan on the Golmud-Lhasa highway. But until this road is completed, travel in Suojia remains nearly impossible in summer when rivers are swollen and roads turn into mud quagmires. Overall, it is much easier to travel in winter when the frozen steppe and rivers are traversed easily, the only constraints in this season being the extreme cold and unpredictable, periodic snowstorms.

Who are the stakeholders in Suojia? *(back to top)*

Stakeholders are defined as "all those who affect and/or are affected by the policies, decisions and actions of the system; they can be individuals, … communities, social groups or institutions of any size, aggregation or level in the society" ('Forging partnerships…' 1997). In Suojia, the principal stakeholders are the local pastoralists, the people affected most directly by any development policy, project, or activity undertaken in the area. For many centuries, and up until the early 1960s, the ancestors of these herders belonged to several small, semi-nomadic hunting tribes that depended almost exclusively on the rich biological heritage that once was found everywhere on the Tibetan plateau. With the establishment of Suojia Commune (later known as Suojia Township) in 1972, however, animal husbandry was introduced into the area, a lifestyle change that later was found to be coincident with ecological changes in the alpine grassland ecosystem, including marked declines in wildlife populations and grassland productivity. It can therefore be argued that nature also is a stakeholder in development ('Forging partnerships…' 1997). At the very least, it is clear that environmental change does affect the livelihood and the well-being of local pastoralists, and hence that environmental impacts, including potential loss of biodiversity, also must be assessed prior to the introduction of new developments in Suojia, particularly changes in animal husbandry and other aspects of natural resource management (Figures 42 and 43).

Figure 42. Tibetan wild ass in alpine grassland on the bank of the Yangtze River

Figure 43. Tibetan tent at the foot of a local mountain, near the vegetation line (circa 4,700 m)

The people and government of Zhiduo county and Yushu prefecture also affect, or are affected by, local changes. The population of Suojia comprises around one-quarter of the county's population, thus it significantly affects county affairs. At the prefecture level, the government has applauded the integrated environmental protection and socio-economic development work currently being undertaken in Suojia, and it even has commended the Upper Yangtze Organization as the prefecture's own home-sprung model of community participation to better implement the nation's comprehensive strategy to safeguard the environment (personal communication, Upper Yangtze Organization, 17 October 1999). In June 1999, the Upper Yangtze Organization also introduced its integrated conservation and development work to the Qinghai Environmental Protection Bureau. In response, the provincial bureau quickly incorporated the local initiative as part of its regional conservation plans. In conjunction with a British organization (Fauna and Flora International), the Environmental Protection Bureau now continues to build on the work originally designed by the

Upper Yangtze Organization and the Suojia government (with extensive consultation and advice from myself), citing in particular a “strong commitment to the project from Community through to Township and County Administration” as a critical part of their proposed solution to conserve biodiversity in the upper reaches of the Yangtze River (Fauna and Flora International 2000). Clearly, many people, bureaus, and organizations have found the beginnings of our work very promising, whether or not they have known its origins. The drawback of the immense interest shown to date in the integrated conservation and development work in Suojia, however, is that the Upper Yangtze Organization’s central role has not always been acknowledged appropriately. Ironically, their name sometimes has been used to indicate “grassroots involvements” in other stakeholders’ projects even when they, the local stakeholders, have not even known of their involvement as “collaborators” in the others’ projects! The danger here is obvious: local stakeholders can easily be dis-empowered even while all the right words are spoken at higher levels.

At the national level, the Chinese government and several non-government organizations also recognize the great biological importance of the Suojia area. For example, Friends of Nature has undertaken a campaign to protect the Tibetan antelope, formerly abundant in the Kekexili District, and the Biodiversity Working Group (a sub-group of the China Council for International Cooperation in Environment and Development, chaired by China’s Vice Premier Wen Jiabao) has chosen to promote wildlife conservation in Suojia in partnership with the Upper Yangtze Organization and local government authorities (China Council for International Cooperation on Environment and Development 1999a).

A final category of stakeholders is the “international community.” As an individual, I have been involved directly with conservation and development planning in Suojia since December 1997, and, in a more general way, in the province as a whole since July 1996. Although not a herder or other member of the local community, I nonetheless have become an “active participant” (*sensu* Spradley 1980) in Suojia and in Zhiduo, both as an expert consultant and an international liaison for the Upper Yangtze Organization. As a consultant, the Upper Yangtze Organization has told me (retrospectively) that our long discussions played a key role in several specific ways in Suojia. Most notably, our discussions contributed to

- • the establishment of four township-level wildlife protection areas;
- • a greater integration of environment and development (a better recognition of the notion of ecological sustainability);
- • the adoption of more participatory approaches in conservation and development; and
- • an increased valuation of local indigenous (traditional) knowledge.

In my capacity as a resource-person, I also have had the opportunity to serve as a liaison for the Upper Yangtze Organization (and the local government) with various individual, corporate, and government donors. In this way, the Suojia Environment Bureau has been established and partially equipped, snow disaster relief supplies were provided during the harsh winter of 1999-2000, a village-level primary school will be opened soon, and a small clinic may be built in the near future. Encouragement and guidance also have been provided for writing an environmental education book as well as a book on the local history and culture of Tibetan pastoralists and a literacy primer. An environmental awareness video has been prepared for local high school ecology classes as well. To better coordinate all of these activities, I recently have established an organization that focuses on conservation and development work in the Tibetan plateau region, namely Plateau Perspectives. To the best of my knowledge, there is only one other international organization currently working in Suojia, Children in Crisis, though several other international organizations also have plans to work in Suojia or elsewhere in Yushu prefecture in the future (including, e.g., Fauna and Flora International, Médecins Sans Frontiers, Oxfam).

Among the many stakeholders, however, not all share equally in the consequences of our joint actions. It is therefore especially important that Tibetan pastoralists, grassroots organizations, and the local government be given primary consideration, and that the influence of external players remain only secondary to that of more local stakeholders. In the light of this, partnerships should be formed so that communication will occur at all levels, and so that more grassroots initiatives will be "discovered" rather than "designed" by non-local stakeholders (*sensu* Seymour 1994). Therefore, my own role as an international player purposefully has been to encourage and aid local stakeholders in their endeavors as much as it has been to suggest new directions for conservation. Thus, I have taken the role of an advisor rather than project manager or leader, yet I have been consulted frequently on many topics – ranging from basic grassland ecology and the establishment of protected areas, to community health, adult education, and even to international experience in the organization of civil society – and my opinions and recommendations generally have been valued and accepted.

Considering the massive local, provincial, national, and international interest in the source area of the Yangtze, it is hoped that the positive lessons learned so far in Suojia will not be ignored, and that ownership and direction will remain with the local communities, not over-ridden by zealous national or international conservationists who may inadvertently manipulate communities for their own purposes or treat them as commodities for fund-raising or for prestige (Pretty 1995, Mowforth and Munt 1998).

What is at stake in Suojia? (back to top)

With sustainability and biodiversity tightly interwoven together, it is the unique native biodiversity and the local pastoral way of life that are most at stake if a comprehensive, integrated approach to conservation and development is not adopted immediately in Qinghai's alpine grasslands. Such an approach already is planned in some parts of the province, most notably in Zhiduo, both through the local government and through the first grassroots organization established in Yushu prefecture. Incidentally, even the definition and role of civil society in China's minority areas also may be at stake if only short-term perceptions of the organization's successes and failures are considered. This situation puts enormous pressure on the Upper Yangtze Organization to do its work well the first time, yet there also is a very strong pressure to demonstrate positive results quickly. Four main things are at stake in Suojia: biodiversity, development (sustainability), a way of life, and civil society.

How does the organization seek to maintain all of these elements? According to an official document of the Upper Yangtze Organization (1999), they are “a promotion [advocacy] and research group that is focused on the ecology and economy of the Tibetan plateau region.” As has been noted elsewhere in China, Mongolia, and worldwide (see Chapters 2 and 3), grassland quality and quantity are dependent on appropriate patterns of grassland utilization, most importantly with regard to the intensity, seasonality, and flexibility of livestock grazing patterns (also see Chapters 4 through 6). Therefore, the Upper Yangtze Organization aims to promote biodiversity conservation in conjunction with socio-economic development of the local pastoral population, including the introduction of more sustainable forms of animal husbandry. Its mission statement clearly spells out its commitment to such a comprehensive and integrated approach in the Tibetan plateau region (Upper Yangtze Organization 1999):

> “Our aim is to respect [the] development requirements and rights [of local stakeholders] while considering the local conditions, the value of the environment, and especially the significance of development for the local place, for our country, and for all humanity. Our work focuses on the relationship between the environment and development. Specifically, we seek to break away from some old ideas [about development]; to motivate people to walk on the road of sustainable development; to work with people and groups interested in ecological civilization [sustainable livelihoods] and human progress [development, modernization]; and to protect the resources of the source areas [of the Yangtze, Yellow, and Mekong rivers]. We want to find development ways that are good for our local economy as well as for global ecology.”

The Upper Yangtze Organization also spells out its specific priorities:

> “(1) to create a model demonstration project of ecologically sound and sustainable development on the Tibetan plateau in the source area of the Yangtze River;
>
> (2) to provide education to increase awareness of local ecology and economy, and to motivate local resource users to take greater responsibility for their actions and to participate in decision-making;
>
> (3) to motivate people in many different ways to protect the special biological resources [biodiversity] and the culture heritage of the Tibetan plateau region;
>
> (4) to encourage individuals and organizations inside and outside our country to choose Qinghai and the Tibetan plateau region to conduct special research on the local ecology, wildlife, and biodiversity, and to provide the basic site for such research; and
>
> (5) to collaborate with ecology [sustainable development] consultants and to analyze all our activities to ensure that we make scientifically sound decisions.”

The organization thus aims to demonstrate in practice its ideas and recommendations; it recognizes the importance of environmental education; it aims to protect the local biodiversity as well as to preserve the local cultural heritage; it desires to learn from and to contribute to global discourse on development and conservation; and it has chosen to adopt a scientific approach in its different endeavors. And, by its very nature, the organization is continuously (even if unintentionally) testing the waters of civil society in China.

What is the timeframe for change in Suojia? (back to top)

To assess change, it is necessary first to document what conditions were like in the past. The director of the Upper Yangtze Organization and I interviewed several older members of the Suojia community in July 1998. One 78-year-old woman recalls her childhood:

> "When I was around 2 or 3 years old, my father came here [to Muqu] with me to hunt wildlife because our family was so poor. We weren't nomads but hunters. I don't remember exactly where we lived, but we joined a group of 20 people and we lived and hunted together. We didn't have yak hair tents because we didn't keep any yak or sheep as livestock. Instead, we lived in leather houses made from wild yak skins. The people in these mountains, those that we joined, they're from the Yora tribe. They're not Buddhist like the others in the east. I remember my father shooting wild yak right from the door of our house. Wild yak were everywhere, we never had to go far to shoot them, and there were many other wild animals, too. We used wild yak skulls to hold down the corners of our house since we didn't have any wooden stakes. No one had metal knives and there were very few sewing needles, maybe only one in the group. Some stones were used as knives."

Later, a 72-year-old man also reminisces:

> "Before Liberation [in the late 1950s] wildlife was very abundant, but a lot was killed in those early years. However a lot of wildlife came back with government protection, or at least until they were reduced greatly by the 1985 snowstorm. Snows never used to be as heavy as in recent years, yet at the same time the land is drying up. The wildlife has never rebounded since 1985. During that winter, Tibetan antelope were literally at my tent door trying to come in. I had to scare them away so that I could come out of my tent. In the past, there were annual Tibetan antelope migrations. In March each year, females would disappear to their birthing grounds. … The hills right around Suojia and all the plains in this area also used to be black, covered everywhere with wild yak, but that's no more. However there is one place that hasn't changed too much, an area near Spirit Mountain where black-necked crane, snow leopard and other animals still live. That place at least hasn't changed for as long as I can remember."

Likewise, my colleague and friend, Zhaduo, recalls Suojia's environment in the 1960s when he was a young herder. In his words, the land was covered "by grass so tall that you couldn't see the dips and hollows or the water holes of the land, a land with such abundant plant life, especially in the hills, that a lot of dead plant matter remained and accumulated each year." It is in the light of this historic context that today's situation must be evaluated. The alpine grasslands now are less productive than before, and wildlife populations are much smaller than in the past. Several of the changes that have occurred in Suojia over the last few decades are reviewed in Foggin (1998a) (see Appendix V).

Moving now to the present and future, what is a probable timeframe for change in Suojia? It is important to recognize here that not only does the Upper Yangtze Organization seek to model its ideas for others, but modeling also has been an important factor within its own development. For example, the transfer of a general appreciation for indigenous knowledge undoubtedly has been much more significant than any of the detailed information that I personally gathered about Suojia on my field trips there, simply because the practice that I modeled – in this case, choosing to learn from old people, that is, valuing local (informal) knowledge and traditional land use practices – has been replicated, thus making a longer-lasting impact on the environment and on the people of Suojia (through the ongoing work of the Upper Yangtze Organization) than I ever could have done alone. In contrast to only two years ago, the organization's leaders now plan to conduct as many taped interviews as possible in order to record the valuable experiential knowledge of old pastoralists before their understanding of the local ecology is lost forever (also see Fernández-Giménez 1993, Fernández-Giménez and Erdenebaatar 1995). The Upper Yangtze Organization thus seeks to better understand the local culture, history, and environmental change in the Upper Yangtze region of the Tibetan plateau. The organization leaders also have modeled themselves in part on Suonan Dajie, the charismatic first leader of Zhiduo's Western Development Committee (Shi 1997, Bay 1999, McCarthy and Florcruz 1999; see Appendix VII). In fact, it was Suonan Dajie's vision for Suojia and the Kekexili that first inspired Zhaduo – the current government leader of Suojia as well as the visionary behind the Upper Yangtze Organization – to set up a grassroots organization to mobilize the local herders to protect and develop their land, its wildlife, and the other natural resources of the Tibetan plateau (see Appendixes VIII and IX).

Although the leaders of the Upper Yangtze Organization recognize that change is an ongoing, long-term process, they still have marked deadlines for different projects and sub-projects. However, given the complexity inherent in participatory development, they still expect measurable changes in local attitudes and behavioral patterns to take at least 5 to 10 years. In the meantime, they have assisted with the establishment of a local environment bureau and four protected areas in 1999, and the establishment of a model demonstration area in Muqu village in 2000 (see below). After several years, when their community-based work will be more fully established in Suojia, they will then initiate similar conservation work elsewhere on the Tibetan plateau as well.

Why is the Upper Yangtze Organization so important? (back to top)

The organization was established first and foremost because its founders had observed firsthand the recent deterioration of the environment in the source area of the Yangtze, because they consider biodiversity to be an important local natural resource, and because they consider the cost of inaction to be too high in both ecological and human terms. Therefore, in conjunction with the local government, the founders of the Upper Yangtze Organization set out to find new ways to utilize Suojia's resources sustainably and to protect the native biodiversity.

Furthermore, China is now at a crossroads. Local people and communities are encouraged, at least in theory, to participate in the implementation of the government's goals and priorities. The Upper Yangtze Organization is simply one attempt to reach some of these goals through more community-centered, participatory methods. The organization aims both to suggest new ways forward (to the local community and to the government) and to increase a sense of local ownership, and hence responsibility, for the long-term success of development and conservation projects.

As Harris et al. (1998) note, conservation efforts cannot be successful unless leadership responsibilities for ecologically sustainable development are given to local communities and regions. Harris et al. (1998) claim in particular that their project, located in the vicinity of the Cao Hai Nature Reserve in Guizhou province in southwest China, represents the first sustained attempt of the "integration of conservation with economic development through local participation" in the country

(Harris et al. 1998). However, the Cao Hai project was initiated as much by nature reserve staff, the provincial environmental protection bureau, and two international non-governmental organizations, as it was by local villagers. In contrast, the case study presented here represents a truly "discovered" project (sensu Seymour 1994), one that initially was designed locally by township government leaders and the founders of the Upper Yangtze Organization. It is only at a later stage that external, non-local stakeholders, both Chinese and foreign, became increasingly involved, mostly by invitation, in the integrated conservation and development work in Suojia.[3][1]

Similar to the Cao Hai Nature Reserve project, the two key strategies followed in Suojia are (1) to link conservation with community development, and (2) to place local people in more central decision-making roles. Such a community focus now is "increasingly recognized as critical to successful conservation programs (Western and Wright 1994)" (Harris et al. 1998). The development of the Upper Yangtze Organization also is an important initiative in its own right because it is a key example of a current, ground-breaking attempt to increase sustainability and to protect the environment through greater local participation, even "self-mobilization" (Pretty 1995), in the geographical and ecological contexts of the source area of the Yangtze River.

How will biodiversity be conserved in Suojia? (back to top)

The Upper Yangtze Organization's long-term plan includes four main thrusts: community empowerment, integrated development work, sustainable income generation, and regional planning.

Local Ownership and Empowerment (back to top)

Local ownership and empowerment already have been discussed at length. It will suffice here to give two examples from Suojia. Less than two years ago, the pastoral community in Yaqu – one of Suojia's four villages, or former production brigades (see Figure 41) – made clear its feeling that education was not a high priority for them or their children. However, after several visits and discussions with the township leader, the villagers started to catch a vision for their community's future. Then, in less than a year, they began to make plans for a tent school, and by August 1999 the community had pooled its resources and set aside sufficient land for the school, provided several canvas tents and yak-hair tents, provided food and bedding for the children, and hired a cook. The township government only had to hire two teachers and to provide the desks and chairs. Now, around thirty children attend first grade, and forty more already are waiting to attend school as soon as possible. The most important feature of this project is the fact that, with only a little external encouragement, it is the local community that initiated it, and now the local pastoralists consider it to be 100 percent "their" school and take great pride in this fact (Figures 44 and 45). There clearly is a real and growing sense of hope in Yaqu, and plans already are afoot to expand education in the area and to begin literacy work and health training in the future. My role in this project has simply been that of unofficial advisor to the Suojia government and the Upper Yangtze Organization, particularly encouraging them that the school project should only be initiated once the herders themselves felt that education was important – at which stage they (the herders) took over almost in full, with excellent results. In this case, it is Children in Crisis that provided the additional financial resources that were necessary to buy warm tents that could be used in all four seasons (but also see Appendix X).

Figure 44. School children and teachers in front of tent school in Yaqu village

Figure 45. Author meeting with village leaders in Yaqu village (photographer: Ms. Raija Pyykkönen)

Among the pastoralists in Muqu – another of Suojia's four villages – local participation followed a slightly different course. Initially, the leaders' hopes rose much higher than in Yaqu, but then when some specific decisions needed to be made, differences were more difficult to resolve. Specifically, different views surrounding the establishment of a tent-school had to be overcome, including finding a way to share the costs of lost grazing land, and choosing a location for the school that was considered equitable (in terms of distance away from home) by everyone. After many long discussions among village and households leaders over a period of several months, with the assistance of the Upper Yangtze Organization both as catalyst and mediator (prompted by Plateau Perspectives), the location of the school finally was agreed upon in April 2000. Only then, after the Muqu community made this first concrete step toward the project, did the Suojia government and the Upper Yangtze Organization jointly request some additional financial assistance from Plateau Perspectives. (The contribution that we made supplemented a smaller grant provided earlier by the Global Greengrants Fund for the establishment of a small research station and education center for wildlife conservation in the same geographic area. The teacher for the school will receive some training in grassland ecology and natural resource management in order to better teach the children and to increase their environmental awareness. This tent school also is the first step in a larger plan to develop a model demonstration project for sustainable development in the entire region).

Through both of these projects, in Yaqu and Muqu villages, the Upper Yangtze Organization has even increased its resolve to promote community-based decision-making. It has chosen to follow this route on the assumption that long-lasting changes in health, education, literacy, and the environment all require that local responsibility be taken alongside policy-level government decisions. For example, if tents had been purchased by external stakeholders and simply given to the local herders before they had decided for themselves that education was important, then all sense of local responsibility would be gone, the school would not be valued, and parents likely would not send their children to school.

The township government, the Upper Yangtze Organization, the county government, and even the Qinghai Environmental Protection Organization all feel varying degrees of ownership in this ongoing integrated development work as well, as also do several national and international stakeholders – even though, among the latter, very few have yet made any direct contributions. National and international stakeholders include, for example, the Biodiversity Working Group, Children in Crisis, Fauna and Flora International, the Global Greengrants Fund, the International Fund for Animal Welfare, and Plateau Perspectives. However, regarding environmental work at least, it is only Plateau Perspectives, with some assistance from the national Biodiversity Working Group, that already has begun to work in Suojia in significant, concrete, tangible ways (i.e., only Plateau Perspectives truly has collaborated with local partners, as opposed to solely the provision or promise of funds; see Appendix X).

Clearly, we must continue to seek that partnerships between local governments, grassroots to national and international organizations, and local communities are genuine for development and conservation endeavors to succeed. Particular caution must be taken so that “local participation” does not become “manipulative” (Pretty 1995), or that communities be treated as “commodities” (Mowforth and Munt 1998). In the end, it is the empowerment of local institutions and communities, by working with them as equal partners, that will best ensure long-term, continuous change even long after all external stakeholders have left the area. Intrinsic to such partnerships is capacity building for biodiversity conservation and many aspects of sustainable development.

The Integration of Basic Education, Literacy, Health, and the Environment (back to top)

The second main thrust of the Upper Yangtze Organization's work is to integrate as much as possible many of the local needs and aspirations in their work, as well as to draw attention to the somewhat more abstract, regional issues of environmental protection. To do this, the organization has chosen to integrate several areas of concern, specifically, to include health and environmental components in their basic education and adult literacy training materials. One leader already is writing a literacy primer, another is writing a book on the local environment, and a third is writing a book on the local culture and history of Suojia. A health education booklet also is being prepared for a Children in Crisis project, under Plateau Perspectives supervision, for a basic education and health training project that has been planned at the county level.

Overall, this integrated approach is important because conservation and development are mutually dependent, and also simply because this is the approach that the local communities (as represented by the Upper Yangtze Organization) have chosen to address the various complex issues surrounding their future. Why have these four specific areas of work – that is, education, literacy, health, and the environment – been chosen, and why should they be implemented simultaneously? First, for pastoralists "to be involved as actors, and not only objects [of] development, at least the basic educational standards must be raised considerably" (Närman 1990). Second, as Coombs and Ahmed (1995, in Eisemon et al. 1998) point out, illiteracy results in inequity and loss of productivity, yet attempts to increase literacy rates are effective only "as part of a wider strategy to eradicate poverty, exclusion and injustice" (Lourié 1990). Third, a population's health status can be affected by a combination of socio-environmental and lifestyle factors, by the availability of health care services, and by prevailing cultural attitudes about health and health care provision (Swift et al. 1990, Jamieson 1991, Foggin et al. 1995, 2000, Campi 1996). It also is recognized that health status and other social factors can be improved through adult education and literacy programs (Grosse and Auffrey 1989, LeVine et al. 1991, in Puchner 1998; Hoxeng 1995, in Eisemon 1998). And fourth, as has been discussed throughout this dissertation, the environment (biodiversity) must be protected to ensure sustainable development, that is, the long-term viability of Qinghai's pastoral alpine grassland ecosystems (see, e.g., Jacobs and Munro 1987, MacNeill 1991, Stevens 1997a, Margoluis and Salafsky 1998). Thus, an integrated approach to conservation and development will provide the greatest chance of success both for biodiversity conservation and for improving the quality of life of the local people and local communities in the source area of the Yangtze River in southwestern Qinghai, China.

In Suojia, such an integrated approach will be implemented first in Muqu, where a tent school already has been planned and funded (see above), and teaching will begin in Fall 2000. This also is where a large area of land (approximately 130 km^2) has been given by the township government to the Upper Yangtze Organization to develop as a demonstration area for sustainable animal husbandry and other relevant trials and feasibility studies, including limited ecotourism (see Figure 46). Thus literacy, environmental awareness, and health training also will be provided at the school when the students are not in class. The school likely will become a community center as well – as long as it remains a locally owned initiative – and will be the geographic focus (and the showcase) for the Upper Yangtze Organization's demonstration work. At this stage, however, yet another critical challenge remains, that is, to find sustainable ways of funding all of the above activities.

Ecotourism and Community Income Generation (back to top)

Tourism has been suggested many times as a possible way to generate community income in Suojia. Worldwide, travel to protected areas and to pristine wilderness – that is, ecotourism – is one of the most rapidly growing sectors in the industry, and adventure tourism comprises almost ten percent of the global tourism market (Boo 1990, Whelan 1991, Mowforth and Munt 1998). Appropriate tourism can contribute to sustainable development and even benefit biodiversity conservation (Barkin 1996, Rai and Sundriyal 1997, Roe et al. 1997). Specifically, according to Brandon (1996),

> "the key benefits for conservation can be clustered in five areas: a source of financing for biodiversity conservation, especially in legally protected areas; economic justification for protected areas; economic alternatives for local people to reduce over-exploitation on protected areas and wildlands and wildlife resources; constituency-building which promotes biodiversity conservation; and an impetus for private biodiversity conservation efforts."

Even in China, tourism in general (and to a lesser degree nature tourism) is being promoted as a valuable means to enhance regional economic development (Wei 1993, Dorje 1997, 'Qinghai Province…' 1998). However, some researchers feel that tourism in China still must refocus on low-impact, small group tours, strategically capitalizing on China's rich natural and cultural resources (Liu and Dowling 1991), rather than on mass tourism. Fortunately, environmental and cultural tourism now are being integrated with environmental protection in China, thus conforming to recent trends in international tourism as well as with Chinese policies on the environment (China National Tourism Administration 1998).

Regarding tourism in Suojia, the notion of small-group cultural tourism, ecotourism, and adventure tourism have been discussed at length for over two years as a possible source of income to fund local community development and conservation activities. The primary limitation to implementing these plans has only been the lack of a development- and conservation-minded business partner. However, with the recent announcement of a national reserve to protect the source area of the Yangtze River, with ecotourism to be developed as a main source of funding, it now is increasingly likely that such partners will be found in China and internationally. The proposed reserve, which will cover nearly one-third of the provincial area, will be divided into three main zones: a core zone closed to all human activities, a buffer zone where limited animal husbandry and relevant scientific research activities will be undertaken, and several experimental demonstration zones near populated areas where tourism development will be promoted ('New reserve…' 2000, 'Qinghai to build…' 2000).

However, a new question now arises: How will these zones be delineated? And indeed, have higher provincial or national authorities already delineated them? While I do not know the answer regarding the massive reserve proposed by the national government, it at least is clear that provincial authorities have chosen to work in concert with the local township and county governments and the

Upper Yangtze Organization in Suojia (Fauna and Flora International 2000). Therefore, the regional plans already developed locally in Suojia will, directly and indirectly, be the starting point for the Qinghai Environmental Protection Bureau's work in the area, and hence also for Fauna and Flora International and for any other organization that will choose to partner with the provincial bureau in the future. At the same time, though, the immediate future could also prove to be a very critical juncture in the history of Suojia, since the local communities that have begun to hope and to participate in designing their own future could all-too-easily be overrun or at least overlooked as a large group of new, external stakeholders, each with its own set of goals and priorities, moves into the area (Huntington 1988, Narayan 1996, Bernard and Young 1997). Even the process of mapping – the very basis of regional conservation and development planning – can either enhance or detract from a community's sense of ownership and commitment to the work. In fact, according to Hopkins (1992), maps and map-making can reveal "as much about the … agendas behind the map as about any geographic reality." Likewise, Stone (1998) states that "the map – or control of the map – sometimes *makes* the territory…. 'More indigenous territory has been claimed by maps than by [any other means]'." Therefore, it is deemed exceptionally important at this time to document here at least some of the current, locally designed plans for Suojia, most of them developed jointly by the local governments and the Upper Yangtze Organization, and for which I also have had the privilege of being a main advisor. These regional land use plans may or may not be translated into reality in the future, but they nonetheless represent the immense effort made to date by the local people and the local leadership to tackle their own future, in all of its complexity, head-on. Fortunately, it appears that the provincial government will adopt most of these plans, though the degree of community and township involvement may be dependent more on the conscientious work of the international stakeholders than on the local people themselves.

Finally, before moving on to the specifics of the regional plan in Suojia, McNeely (1990) wisely reminds us that, first and foremost, it always will be extremely important to

> "recognize that preparing a conservation strategy is a process, and that the process should be infinitely more important and attractive than the mere production of a document.

Linkages and partnerships that are forged during the process may last far beyond the date of publication, and indeed such abiding relations should *planned as part of the process*."

It is just such a process that I have undertaken since I moved to Qinghai in July 1996, nearly four years ago, and it is these linkages and partnerships that are the foundation for the "final product" presented below.

Protected Areas and Multiple-use Land Management (Regional Planning) (back to top)

The most striking element of the regional land use plan in Suojia is the presence of four township-level nature reserves (protected areas) and a large demonstration area (Figure 46). It also is worth noting the many similarities between the "conceptual layout of an ideal biosphere reserve" (based on Hough 1988, in Noss and Cooperrider 1994; Figure 47) and the regional land use plans already developed for Suojia (see Figures 46 and 48).

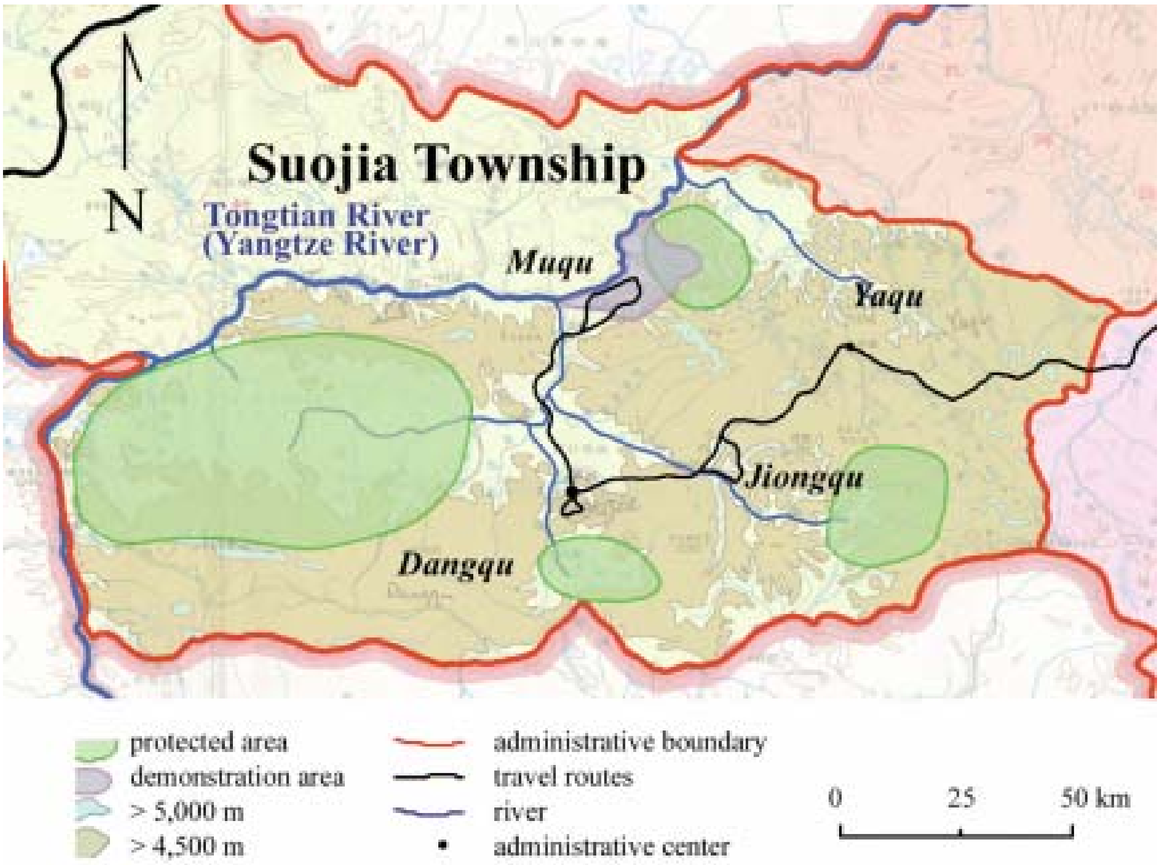

Figure 46. Map of Suojia township, with four protected areas and demonstration area highlighted

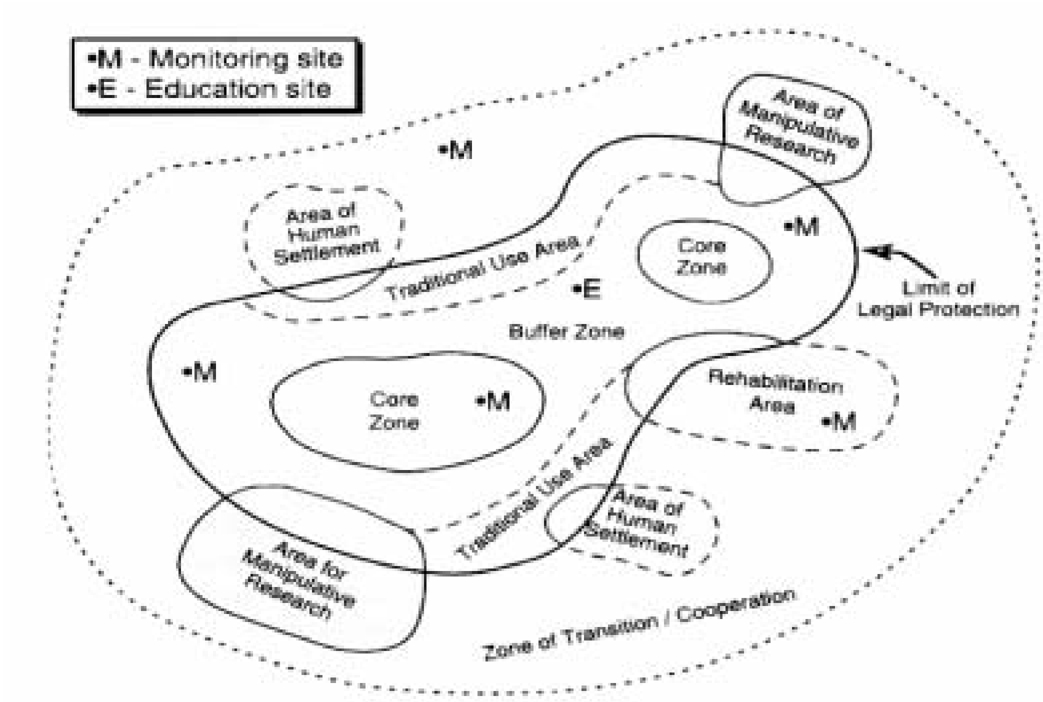

Figure 47. Ideal biosphere reserve (based on Hough 1988, in Noss and Cooperrider 1994)

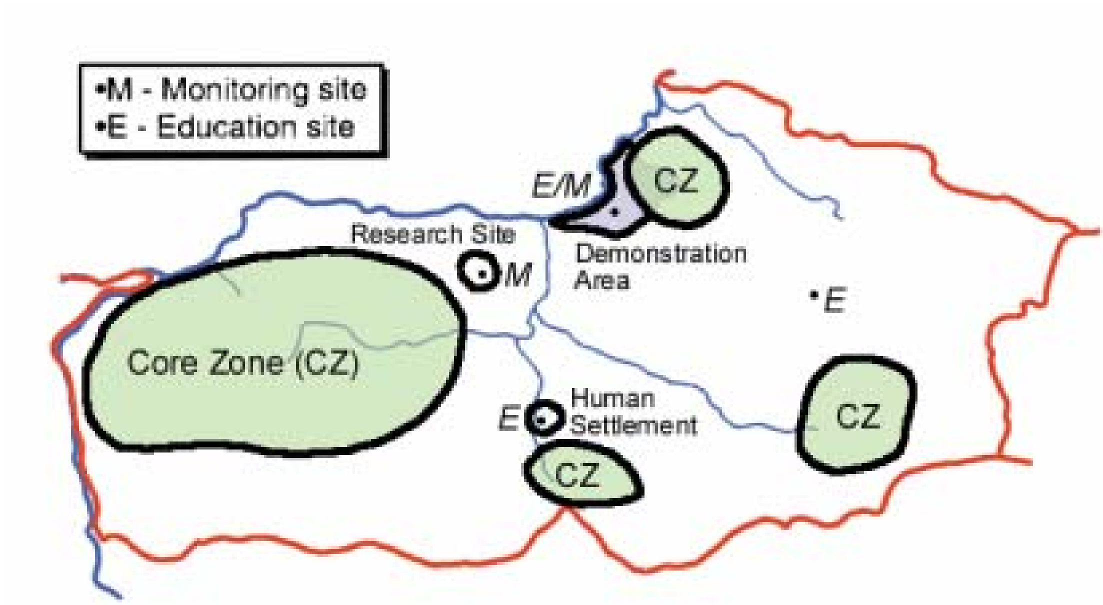

Figure 48. Simple map of Suojia township, with core zones and other management areas highlighted

The only human settlement in Suojia is the administrative center with a population of less than 150 people, many of which are government employees. Government offices, a veterinarian station, a small health clinic, a warehouse, a few small shops, and a primary school (with three grades) are located in the town, but there is little else. Environmental education can be taught in the Suojia primary school, and also in the tent schools in Yaqu and Muqu (indicated as ‘E’ in Figure 48). Other than these few public centers, though, there are only individual tents and winter homes that dot the sparsely populated high-altitude grasslands and steppes of Suojia (Figures 49 and 50).

Figure 49. Suojia landscape, with small town (administrative center) beside the Muqu River

Figure 50. Suojia's administrative center

The heart of the regional land use plan in Suojia is the establishment of the four protected areas (indicated as 'Core Zones' in Figure 48). Each of these areas was selected to protect a key umbrella species – the black-necked crane (*Grus nigricollis*), Tibetan antelope (*Pantholops hodgsoni*), Tibetan wild ass (*Equus kiang*), and snow leopard (*Uncia uncia*) – but at the same time it also is recognized that it is whole ecosystems that must be protected. Nearest (to the south of) the administrative center in Suojia is the black-necked crane reserve. Here, the rich wetlands at the base of Spirit Mountain are said to be the home for many cranes every spring and summer, and the local herders already forbid hunting (and will dissuade outsiders from hunting) for fear of the local mountain gods. To the west, a large area has been designated to protect a local, resident population of Tibetan antelope. Although pastoralists rarely use this land (the steppe vegetation is too sparse, so pastoralists only graze their livestock in the adjacent hills and mountains), some truck drivers travel across the frozen plains in winter, usually en route to Lhasa, thus disturbing and sometimes poaching the local wildlife. To the east of the main settlement in Suojia, another core zone has been established to protect the Tibetan wild ass (Figure 51). This area also has a very small human population, this time because of the very high altitude of the land (around 4,500 m) and consequent poor living conditions. Finally, to the north near the bank of the Yangtze River, a rugged mountain area has been designated as a nature reserve to protect the snow leopard and other mountain species (Figure 52). This reserve is adjacent to the demonstration area designed by the Upper Yangtze Organization (see below), and thus also of special interest for the development of a multiple-use land management plans with limited ecotourism (Figures 53 and 54).

Figure 51. Tibetan wild ass near the protected area in Jiongqu (see Figure 46)

Figure 52. Arid grassland in the demonstration area, with rugged snow leopard reserve in background

Figure 53. Cultural (religious) site of unknown origin in the demonstration area in Muqu village

Figure 54. Author and packhorses during a wildlife survey, July 1999 (photographer: Mr. David Rutledge)

The large area of land that the township government allocated to the Upper Yangtze Organization in 1998 to develop as a demonstration zone for sustainable animal husbandry (see Appendix VIII) encompasses three main valleys. The eastern valley either adjoins or is a part of the local nature reserve (the exact delineation of the four reserves still is unclear), and it has a very rugged, mountainous topography. It is possible that occasional small groups of ecotourists could enter the lower portion of this remote valley. The central valley of the demonstration area, on the other hand, will serve to test and demonstrate different animal husbandry and land management practices, including the seasonal rotation of livestock, improved veterinary practices, different marketing strategies, and the specific protection of springs and riparian areas. The training and research center (for adult literacy, health care training, nature reserve management, wildlife biology) and primary school (tent school) also will be located in this valley. Finally, some sections of the western valley in the demonstration area have undergone the most serious desertification in the region, and special attention therefore will be paid to undertaking appropriate vegetation restoration studies. Because a large part of this valley is relatively flat land on the south bank of the Yangtze River, it also has been suggested that some irrigation ditches could be built in order to grow extra winter fodder for local pastoralists' livestock. However, the economic and ecological feasibility of the latter suggestion have not yet been investigated.

A research site also has been designated, at least conceptually, between the demonstration area and the large Tibetan antelope nature reserve to the west, mainly for vegetation studies. Both the demonstration area and this smaller research site will provide natural bases for monitoring wildlife populations and grassland conditions (indicated as 'M' in Figure 48). Even more important, though, are the 16 field workers that live throughout the township. These workers are the current team leaders in Suojia, four each in Muqu, Dangqu, Jiongqu, and Yaqu villages. Through the effort of these workers (of the Suojia Environment Bureau), it is anticipated that local herders will increasingly consider wildlife protection to be for their own benefit as well, mainly through the environmental awareness that these team leaders, still herders themselves, will bring to their neighbors and constituents. Three "no hunting" zones also have been established, but I do not yet know where they are located in Suojia. And, finally, the remaining area in Suojia can be defined largely as an extensive buffer zone because sustainability is considered to be such a high priority throughout the entire township.

Together, the above zones (see Figures 46 and 48) form a comprehensive, locally designed, and insightful regional land use plan for Suojia Township. However, like Noss and Cooperrider (1994) express in their book *Saving Nature's Legacy: Protecting and Restoring Biodiversity*, "the only science worth doing is one firmly grounded in an ethic and an emotional commitment." Hopefully such a commitment is apparent in this dissertation, and also in the work of the Tibetan herders of Suojia, the Upper Yangtze Organization, and the local government leaders. Like Noss and Cooperrider (1994), we also are "by no means certain our proposals will work, but we think they have half a chance if implemented quickly and energetically." And already a lot of progress has been made, from encouraging and promoting the genuine participation of local communities, to strengthening the work of the Upper Yangtze Organization, to providing assistance in education and health care as well as biodiversity conservation (through Plateau Perspectives), to gaining the support of the China Council for International Cooperation in Environment and Development in the form of the "Upper

Yangtze Integrated Conservation and Development Demonstration Project" of the Biodiversity Working Group. In practice, the present work also has led very specifically to the establishment of an environment bureau and the creation of four protected areas in Suojia, as well as the regional plan presented above, which is the probable foundation for much of the future conservation and development work in Suojia.

As stated at the beginning of this dissertation, conservation biology aims both "to investigate human impacts on biodiversity" – which has been done through the study of relevant key themes (Chapter 2) and regions in China (Chapter 3), as well as through a general analysis of the Qinghai Lake Area (Chapter 4), an in-depth vegetation study (Chapter 5), a regional study of grassland use and biodiversity in Qinghai's alpine grasslands (Chapter 6), and an overview of wildlife observations in Qinghai and discussion of the main threats to biodiversity (Chapter 7) – and also "to develop practical approaches to preserving biodiversity and ecological integrity" (Miller 1996). The second half of this practical definition of conservation biology was addressed in detail in the present "case study" from Suojia in the heart of the Tibetan plateau rangelands.

Summary of Conservation and Development Work in Suojia (back to top)

The Upper Yangtze Organization is a local grassroots organization that recently was established in the source area of the Yangtze River in southwest Qinghai, China. The organization has been approved by the county and prefecture governments but is comprised mainly of local Tibetan herders. The main goal of the organization is to help improve the living conditions of the local nomads and simultaneously to protect the unique native wildlife of the Tibetan plateau present in the source area of the Yangtze River.

Virtually all the local people raise yak and sheep, though only one to two generations ago local Tibetans belonged primarily to hunting tribes. Currently, living conditions are difficult at best and the risk of loss of livestock (and hence of primary livelihood) is invariably high. Winter snows are unpredictable and can have devastating effects, such as last winter (1999-2000). It is felt by the Upper Yangtze Organization's leaders that only a full and real sense of ownership of new ideas by local herders will allow for long-term changes to occur. This, however, will not happen by simply telling herders what to do. The most important work, it is felt, is to establish a demonstration area where new ideas can be tried and tested, and eventually modeled and demonstrated, so that local herders can examine new practices for themselves and make up their own minds. The township government already has lent around 130 km^2 of land on the bank of the Yangtze River to the Upper Yangtze Organization to serve as such a demonstration area. Funds also have been obtained to cover basic operating costs and to help establish a tent-school in the demonstration area. The school will be expanded later to serve as a larger community center. At present, however, discussions still are ongoing between the Upper Yangtze Organization and local community leaders, since community initiatives are still new phenomena in China, especially in minority areas.

Overall, the feeling that has begun to surface in conjunction with these beginnings of grassroots, participatory development is a real sense of hope, both for improved living conditions and also simply for the possibility of having a more active role in the overall process itself. Clearly, there is both nervousness and excitement in pursuing this new avenue – grassroots development – in a country that to date has mainly operated through “blueprint” and top-down approaches toward development and change.

The Upper Yangtze Organization recognizes that development is dependent on the local natural resources. The organization also recognizes that the alpine grasslands have a very low primary productivity, are extremely fragile, and already are undergoing rapid degradation and even desertification. These facts are clearly recognized by Chinese scientists and higher government leaders as well. Significantly, the grasslands in the source area of the Yangtze River support many unique and internationally endangered wildlife species, including the snow leopard, Tibetan antelope, and black-necked crane. In order to promote environmental protection and biodiversity conservation, the Upper Yangtze Organization has successfully encouraged the establishment of a township environment bureau as well as four nature reserves, and negotiations currently are underway with provincial, national, and international organizations and government bureaus to create a “master plan” for these conservation activities in concert with the development needs and aspirations of the local pastoral population.

The two main challenges currently facing the Upper Yangtze Organization are to gain increasing support from some intermediate levels of government, and to find the expertise and financial resources necessary to begin to implement as soon as possible some of their ideas. Finally, it also is likely that specific grassroots solutions never will be suitable for implementation over large geographic areas since the most important factor determining success might simply be trust and confidence in the facilitators themselves, in this case the Upper Yangtze Organization and other local leaders. However, even the simple presence and official approval of an organization like the Upper Yangtze Organization is ground for considerable optimism and hope that local communities in the alpine grassland areas of the Tibetan plateau may become more and more involved in the search for local solutions to local and regional conservation and development needs, and thus also in directing the future. Both the local Tibetan pastoral communities and the native biodiversity of the Tibetan plateau stand to gain from these recent trends.

Ultimately, all of us are stakeholders in the global environment and in the fundamental quest for sustainability. Forging long-lasting partnerships at all levels therefore should be one of the foundations for future efforts in biodiversity conservation and development, whether in Qinghai's alpine grasslands or elsewhere in the world. The present study simply illustrates some of the early successes in one region of the Tibetan plateau that have stemmed from such partnerships and from the participation of local communities in integrated conservation and development work. And, through this study, it is seen how new hope and a growing enthusiasm for conservation also increase the likelihood of the successful protection of biodiversity.

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APPENDICES

APPENDIX

APPENDIX I: MAIN GEOGRAPHIC NAMES IN TEXT

Short Name	Full Name	Chinese (*pinyin*)
Country		
China	People's Republic of China	*zhonghua renmin gonghe guo*
Provinces (Autonomous Regions) of the People's Republic of China		
Gansu	Gansu Province	*gansu sheng*
Guangxi	Guangxi Zhuang Auton. Region	*guangxi zhuangzu zizhiqu*
Inner Mongolia	Inner Mongolia Auton. Region	*nei menggu zizhiqu*
Ningxia	Ningxia Hui Autonomous Region	*ningxia huizu zizhiqu*
Qinghai	Qinghai Province	*qinghai sheng*
Sichuan	Sichuan Province	*sichuan sheng*
Tibet	Tibet Autonomous Region	*xizang zizhiqu*
Xinjiang	Xinjiang Uygur Auton. Region	*xinjiang weiwuer zizhiqu*
Yunnan	Yunnan Province	*yunnan sheng*
Prefectures (Autonomous Prefectures, Districts) of Qinghai Province		
Guoluo	Guoluo Tibetan Autonomous Prefecture	*guoluo zangzu zizhizhou*
Haibei	Haibei Tibetan Autonomous Prefecture	*haibei zangzu zizhizhou*
Haidong	Haidong District	*haidong diqu*
Hainan	Hainan Tibetan Autonomous Prefecture	*hainan zangzu zizhizhou*
Haixi	Haixi Mongolian and Tibetan Aut. Pref.	*haixi mengguzu zangzu zizhizhou*
Huangnan	Huangnan Tibetan Autonomous Prefecture	*huangnan zangzu zizhizhou*
Yushu	Yushu Tibetan Autonomous Prefecture	*yushu zangzu zizhizhou*

APPENDIX II: CHINA'S ADMINISTRATIVE LEVELS

Administrative Level	Chinese (*pinyin*)	Examples
province	*sheng*	Qinghai, Gansu, Sichuan
autonomous region	*zizhiqu*	Tibet, Inner Mongolia
municipality or provincial city	*shi*	Beijing, Xining, Golmud
prefecture	*zhou*	Nagqu, Shannan (both in Tibet)
autonomous prefecture	*zizhizhou*	Haibei, Guoluo, Yushu
district	*diqu*	Haidong
county	*xian*	Gangcha, Dari, Zhiduo
autonomous county	*zizhixian*	Menyuan, Xunhua, Henan
county town	*zhen*	Gyegu (Yushu), Dawu (Maqen)
township	*xiang*	Suojia, Zhahe, Daotanghe
people's commune	*gongshi*	[term no longer used]
production brigade	*dadui*[4[1]]	Yaqu, Jiongqu, Dangqu, Muqu
association or committee	*muweihui*[1]	[idem.]
village	*cun*[5[2]]	[term not used in pastoral areas]
production team	*xiaodui*[1]	Yaqu's 2nd team, or association
cooperative	*hezuoshi*[1]	[idem.]
natural village	*ziran cun*[2]	[term not used in pastoral areas]

APPENDIX III: QINGHAI'S PREFECTURES AND COUNTIES

Name	Divisions	Names of Counties and Towns	Area
Xining City	4 sectors 1 county	Eastern, Central, Western, and Northern sectors; Datong Hui & Tu Autonomous County.	3,350 km^2
Haibei	4 counties	Gangcha, Haiyan, and Qilian, counties; Menyuan Hui Autonomous County. Capital: Haiyan/Xihai.	34, 706 km^2
Haidong	8 counties	Huangyuan, Huangzhong, Ledu, and Pingan counties; Huzhu Tu, Minhe Hui & Tu, Hualong Hui, and Xunhua Salar autonomous counties. Capital: Pingan.	17,010 km^2
Huangnan	4 counties	Jianzha, Tongren, and Zeku counties; Henan Mongolian Autonomous County. Capital: Tongren/Rebgong.	17,901 km^2
Hainan	5 counties	Gonghe, Guide, Guinan, Tongde, and Xinghai counties. Capital: Gonghe/Chapcha.	41,634 km^2
Guoluo	6 counties	Banma, Dari, Gande, Jiuzhi, Maduo, and Maqen counties. Capital: Maqen/Dawu.	78,444 km^2
Yushu	6 counties	Chengduo, Nangqian, Qumalai, Yushu, Zaduo, and Zhiduo counties. Capital: Yushu/Gyegu.	197,791 km^2
Haixi	6 counties	Delingha and Ge'ermu (Golmud) cities; Dulan, Tianjun, and Wulan counties; and Mangnai area. Capital: Delingha.	325,787 km^2

APPENDIX IV: COMMON AND SCIENTIFIC NAMES OF MAMMALS AND BIRDS IN TEXT

Common Name | Latin Name | Order (Family)

Mammals Species (also see Chapter 7, Table 21)

Common Name	Latin Name	Order (Family)
Argali	*Ovis ammon*	Artiodactyla (Bovidae)
Blue sheep	*Pseudois nayaur*	Artiodactyla (Bovidae)
Chinese desert cat	*Felis bieti*	Carnivora
Eurasian badger	*Meles meles*	Carnivora
Giant panda	*Ailuropoda melanoleuca*	Carnivora
Glover's pika	*Ochotona gloveri*	Lagormorpha
Goitred gazelle	*Gazella subgutturosa*	Artiodactyla (Bovidae)
Golden monkey	*Rhinopithecus roxellanae*	Primata
Gray wolf	*Canis lupus*	Carnivora
Himalayan marmot	*Marmota himalayana*	Rodentia
Lynx	*Felix (Lynx) lynx*	Carnivora
Musk deer	*Moschus* spp.	Artiodactyla (Moschidae)
Pallas' cat	*Felis manul*	Carnivora
Plateau pika	*Ochotona curzoniae*	Lagomorpha
Przewalski's gazelle	*Procapra przewalskii*	Artiodactyla (Bovidae)
Red fox	*Vulpes vulpes*	Carnivora
Red-eared pika	*Ochotona erythrotis*	Lagomorpha
Snow leopard	*Uncia uncia*	Carnivora
Steppe polecat	*Mustela eversmanni*	Carnivora
Tibetan antelope (chiru)	*Pantholops hodgsoni*	Artiodactyla (Bovidae)
Tibetan brown bear	*Ursus arctos pruinosus*	Carnivora
Tibetan gazelle	*Procapra picticaudata*	Artiodactyla (Bovidae)
Tibetan sand fox	*Vulpes ferrilata*	Carnivora
Tibetan wild ass (kiang)	*Equus kiang*	Perissodactyla
Tibetan wild yak	*Bos grunniens*	Artiodactyla (Bovidae)
Tibetan woolly hare	*Lepus oiostolus*	Lagomorpha
White-lipped deer	*Cervus albirostris*	Artiodactyla (Cervidae)
Zokor	*Myospalax fontanieri*	Rodentia

Common Name	Latin Name	Family
Birds Species (also see Chapter 7, Table 20)		
Accentors	*Prunella* spp.	Prunellidae
Bar-headed goose	*Anser indicus*	Anatidae
Black kite	*Milvus migrans*	Accipitridae
Black-necked crane	*Grus nigricollis*	Gruidae
Brown-headed gull	*Larus brunnicephalus*	Laridae
Buntings	*Emberiza* spp.	Emberizidae
Chinese hazel grouse	*Tetrastes sewerzowi*	Tetraonidae
Chinese monal pheasant	*Lophophorus ihuysi*	Phasianidae
Cinereous vulture	*Aegypius monachus*	Accipitridae
Golden eagle	*Aquila chrysaetos*	Accipitridae
Great black-headed gull	*Larus ichthyaetus*	Laridae
Great cormorant	*Phalacrocorax carbo*	Phalacrocoracidae
Himalayan griffon	*Gyps himalayensis*	Accipitridae
Hume’s ground jay	*Pseudopodoces humilis*	Corvidae
Lammergeyer	*Gypaetus barbatus*	Accipitridae
Larks	*Calandrella* and *Eremophila* spp	Alaudidae
Long-billed calandra lark	*Melanocorypha maxima*	Alaudidae
Pheasant grouse	*Tetraophasius obscurus*	Tetraonidae
Redstarts	*Phoenicurus* and *Rhyacornis* spp.	Turdidae
Rosefinches	*Carpodacus* spp.	Fringillidae
Shrikes	*Lanius* spp.	Laniidae
Snowfinches	*Montifringilla* spp.	Ploceidae
Tibetan sandgrouse	*Syrrhaptes tibetanus*	Pteroclididae
Tibetan snowcock	*Tetraogallus tibetanus*	Phasianidae
Upland buzzard	*Buteo hemilasius*	Accipitridae
Wagtails	*Motacilla* spp.	Motacillidae

APPENDIX V: PLATEAU PERSPECTIVES TRIP REPORT, SUOJIA TOWNSHIP, ZHIDUO COUNTY, JULY 1998

Recent Accounts from the Source Area of the Yangtze River (Foggin 1998a)

Background

The source area of the Yangtze River in southwest Qinghai is one of the last refuges for Tibetan wildlife. Wu (1994), Schaller (1997, 1998) and others have already described portions of the Kekexili district and adjacent areas of Tibet, but still very little is known about the local history, culture, and environment. The populated area of Suojia Township is situated east of the Golmud-Lhasa Highway in the transition zone between the vast, uninhabited Kekexili desert-steppe region to the west, and the alpine meadows to the east of the highway. The impetus for the trip described in this report was the establishment, in May 1998, of a local grassroots organization dedicated to finding ways to better integrate environmental and development concerns in this unique transitional ecological zone of the Tibetan plateau. Tibetan pastoralists still co-exist with relatively abundant wildlife in Suojia, but it is recognized that this situation will not last forever unless protective measures are taken to guard against imminent short-term external interests. I was therefore invited by Zhaduo, the government leader of Suojia township and director of the local grassroots Upper Yangtze Organization, to visit the Suojia region in July 1998 – as a friend, as conservation biologist, and as community development worker.[6[1]]

This report provides a personal narrative of my trip to Suojia Township (July 3-23, 1998). I attempt in this way to capture and provide a small glimpse into life in this remote part of Qinghai, both past and present, and to convey to some degree at least a sense of the realities and the many challenges that are faced by local Tibetan pastoralists today as they attempt to "develop" their area as well as to preserve their unique environment and cultural heritage. This report thus provides some insight into how conservation and development may be integrated in Qinghai's alpine grasslands, and even throughout the entire Tibetan plateau. Overall, a more integrated approach and community-based initiatives are critical components in the global endeavor to protect biodiversity.

Circa 1910[7[2]]

Shiamba[8[3]] sits in silence, waiting patiently in the wind. His wife and daughter have stayed behind while he, the chief's son, has accompanied his father. He now listens to his father speak with the leaders of several neighboring tribes. Most tribes have fought for years, but his father is a good man and he knows how to negotiate. His tribe, the Yala tribe,[9[4]] is also the poorest tribe and therefore poses no threat. As in previous years, the chief and his tribe are finally granted permission to travel unharmed through the other tribes' territories to their summer hunting grounds. With this

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6[1] I have returned to Suojia twice since that time (in March and October 1999), and Dr. M. Torrance, a Plateau Perspectives colleague, also has worked closely with the UYO leaders since October 1999.

7[2] This section is a reconstruction of tribal life in the Suojia area in the early 1900s, based on interviews with two old people and many discussions with several of the leaders of the Upper Yangtze Organization. Also see Namkhai Norbu's (1997) general account of the Tibetan nomad regions based on observations made in 1951, Dorje Zödba's account (in Combe 1989) of Tibetan nomad life in the Zhiduo area based on his travels undertaken in the early 1900s, and a more modern account by Aukatsang (1994); Appendix VI.

8[3] Shiamba is a fictional character. His story is a composite of several oral histories gathered in July 1998.

9[4] The Yala were a small, poor tribe of hunters who lived in the vicinity of present-day Suojia township.

approval, Shiamba and his father can now return to their winter home to assemble their clan and prepare for their imminent journey.

After three long days of walking, Shiamba and his family are exhausted. The spring winds are strong, nights are still cold, and everybody is tired of eating dried yak meat. All of the other families are also tired. However, when their clan halts in the late afternoon and wild yak are spotted in the distance, excitement once again begins to mount. Tomorrow they will arrive at their new hunting ground, an alpine valley surrounded by high peaks, a fragrant valley with many springs and a clear mountain stream that flows into the Dri River.[10[5]] *That night, despite the cold and a pack of wolves that howls in the distance, almost everybody sleeps soundly. Only Shiamba has a dream. He sees several different spirits, but one "mountain god" stands out above the rest. Riding a wild yak, the local deity looks directly at Shiamba, points toward the magnificent alpine valley that they plan to reach the next day, then turns and leaps with his wild yak over the white stone mountain. When he wakes, Shiamba decides that he will build an altar this summer, at the mouth of the valley where the mountain stream joins the great Dri River. It will be a reminder of his vision, of the mountain and the yak, and most importantly of the "mountain god" and his much needed protection. Shiamba names the mountain Yekjengo, or Wild Yak White Stone Mountain.* [11[6]]

That summer the Yala have plenty to eat. Wild yak, wild ass, gazelle, blue sheep, marmot and many other mammals are exceptionally abundant, and the ubiquitous pika provides a particularly special treat when stuffed with drolma[12[7]] *and roasted over an open fire. Shiamba's daughter continues to grow healthy and strong. Now that she has survived her third year, both parents are confident that she, too, will one day bear children of her own. But such thoughts of the future remain as occasional daydreams, for the needs of the present remain great. A lot of hunting must still be done before the winter. Tools must be made. Tents still need repair. Indeed, life is never easy, and the next winter can always be one's last.*

Summer 1998[13[8]]

In a two-room house in Suojia town, a 72-year old Tibetan man recalls his past. He remembers the snowstorm of 1985, the most severe in living memory. He reminisces about the changes that have taken place in the landscape, of deteriorating grasslands and diminishing wildlife populations. He also recalls the arrival of the first pure pastoralists in the early 1970s, and even earlier times when the local tribes practiced only hunting. Similar to the life of Shiamba (see above), this old man's own grandparents were hunters who lived solely on the direct provisions of the land, not on livestock. Indeed, this is how most people lived in the Drito region until quite recently. Furthermore, seeing Zhaduo's growing interest in the local (indigenous) knowledge available right in his own home area was also very rewarding for me. Too often, local colleagues and friends assumed (wrongly) that as a scientist I had instant, ready answers. But now, he, too, is learning to ask questions – and we now both expect the "answers" to our conservation and development dilemmas to come from a variety of sources, including all the stakeholders, and that "solutions" also will be refined continuously through practical, iterative real-life experience.[14[9]]

In early July 1998, I had left Xining, the provincial capital, with my friend and colleague, Zhaduo, on a three-week, 3,000 km long journey. Because of my training as biologist and connections to several international conservation and development organizations, Zhaduo wanted me to learn first-

[10[5]] Dri is the local name of the Yangtze River. Drito (= Upper Dri River) has been transliterated in Chinese as Zhiduo, the name of the present-day county.

[11[6]] This story was recounted while staying in a nomad tent near the base of the rugged Yekjengo Mountains.

[12[7]] *Drolma* is a sweet root. Now it is sometimes mixed with *tsampa*, or roasted barley flour, for a treat.

[13[8]] The following narrative is an account of my 20-day trip to Suojia in July 1998.

[14[9]] See Miller (1978), Guyette (1996), Jatulan and Davis (1997), Wu N. (1997), Stevens (1997), Department for International Development Cooperation (1998).

hand about the economic and environmental conditions of his home area, Suojia Township.15[10] For many months Zhaduo and I had discussed how to integrate environmental protection and development in the alpine grasslands of the Tibetan plateau, particularly within the current social, economic, and cultural contexts of Qinghai. He felt that a trip to the high altitude rangelands where he spent much of his childhood would be particularly helpful at this time for us to pursue our discussions. He hoped that one day, in the next few years, we would be able to build a model demonstration area that would promote basic education, literacy, community health and environmental protection in an integrated fashion among the local pastoralists, and that eventually we would replicate this approach to even larger areas of the Tibetan plateau.16[11] So it is that we set off, first on the 830 km road to Yushu, and then on the 200 km road to Zhiduo.

After arriving in Zhiduo, our first job is to find several of Zhaduo's close friends – Trashi, the school headmaster; Yazhou, the banker; Wenzha, the township leader of Suojia; and a few other friends and colleagues. During the two days we spent in Zhiduo looking for (and then repairing) our onward transportation, an old Beijing Jeep, I am inundated with new information, some of it useful, some of it apparently trivial, but all of it definitely very interesting. Trashi explains that there are so many tribes in the source areas of the Mekong, Yangtze and Yellow rivers (in Zaduo, Zhiduo and Qumalai counties, respectively) because travel in the region has always been difficult, and people from different valleys were almost totally isolated from each other. This isolation led to local variations in dialect and eventually to local territoriality and tribal affiliations. Another factor that contributed to the process of isolation was a concomitant lack of formal education. In fact, before Liberation, monasteries numbered only three in the whole county.17[12]

Yazhou also gives some insight into more modern activities in Zhiduo, such as the development of small enterprises and modern banking structures. But he equally takes the time to explain an important fact from local history, particularly that the name Yushu was wrongly applied to the prefecture capital. Before Liberation, the region of present-day Zhiduo was known as Yushu, the name of the local tribe that inhabited the valley. However, when the Chinese arrived, they first came through present-day Zhiduo and learned about the Yushu tribe, but they wrongly assumed that all the tribes were unified. Therefore, when they later established their base in (present-day) Yushu, they named it after a tribe that lived 200 km to the northwest (instead of giving their new base a more local name such as Gilong or Hashil18[13]). Several people have expressed to me their regret that some of their unique history is being lost.19[14]

More than anyone else, however, it is Zhaduo and Wenzha, the closest of this tight-knit group of friends, who provide the most detailed information on this trip. Although Wenzha grew up in one of Zhiduo's eastern townships, he has been Suojia's government leader for nearly three years. It is clear that he knows the land and its people well. And Zhaduo himself grew up in Suojia, and he also spent two years in the early 1990s working closely with Suonan Dorje, the founding director of Zhiduo's Western Development Committee. Suonan Dorje became has become an "environmental

15[10] Suojia Township (*xiang*) comprises around three-quarters of Zhiduo County's total land area, mostly in the Kekexili region. The populated area area is divided into 4 'villages' (*dadui*) and 16 'teams' (*xiaodui*).

16[11] Since this trip in July 1998, an environment bureau with 16 field staff has been established, four nature reserves have been created, a tent-school has opened in Yaqu village, and plans for a 'demonstration area' in Muqu village are now being finalized (including a tent-school that will open in the summer of 2000).

17[12] The Chinese Army, known as the People's Liberation Army (PLA), reached Yushu in the late 1950s. Monasteries traditionally were the only source of formal education.

18[13] Gilong and Hashil are two large Tibetan tribes that inhabit present-day Yushu.

19[14] One of the projects of the Upper Yangtze Organization (see below) is to document such local history from a local, Tibetan perspective.

martyr" in China after poachers murdered him in 1993.[20[15]] A memorial monument now stands near the county town.

Our second assignment in Zhiduo is to hold a board meeting for the Upper Yangtze Integrated Conservation and Development Organization.[21[16]] The meeting is held in Chinese rather than Tibetan for my benefit, and I am welcomed to take notes and even to participate. Four of the six board members are present: Zhaduo (chairman), Yazhou (secretary), Trashi, and Wenzha. The two other members, Lobsang Nyima and Shiamba Chumpel, are herding their sheep and yak some 200 km to the west, in Muqu Village[22[17]] of Suojia Township. We will meet them in less than one week's time. The most exciting aspect of this fledgling non-governmental organization is its unique local character (all of its leaders are Tibetan), and its desire to work with local herders as opposed to simply telling them what should be done to improve the economic and ecological situation in the source area of the Yangtze River. Most important, however, is the respect that each leading member of the UYO has within the local community, both in the county center (Zhiduo town) and among the pastoralists (throughout Suojia Township and its four villages), ensuring that the local people will more readily accept their words. In terms of their planned approach for future initiatives, it is also a major achievement of the first board meeting that everybody present expressed a clear preference for, or at least a recognition of the value of, participatory learning and multiplicative approaches to development.

Taking to the road again, we travel only 15 km to our first stop, Gonsar Monastery. We not only tour the monastery and examine the building of a new, 27 m high statue of the Buddha,[23[18]] but also have an audience with Rinpoche Gonsar Chujie, who proves to be favorable to our overall objective to integrate conservation and development in the upper reaches of the Yangtze River. After showing the Rinpoche respect by presenting him with white ceremonial silk scarves, several monks serve milk tea and dried yak meat for us to eat as we talk. A dozen or more small Lhasa dogs lie near the Rinpoche's feet or follow him around as he paces the floor. And deep, low chanting is heard in a dark back room of the hall. The Rinpoche says that he presently teaches around 100 monks in his monastery, but plans to have over 200 students by the time of the official opening and dedication ceremony for the Buddha statue.[24[19]] Local Tibetans and pilgrims from around the Tibetan plateau describe the entire monastic complex as an eagle with outspread wings, nestled at the foot of the rocky Red Head Mountain, the traditional home of the wife of mythical King Gesar.[25[20]]

From the monastery, the drive through Doucai and Zhahe townships proceeds slowly as the road is still in quite bad repair, and the early summer rains have done nothing to improve its overall condition. While we negotiated the 260 km road from Zhiduo to Suojia in only 3 days, it is not uncommon for this trip to take 7 or 8 days, or even several weeks.[26[21]] As long as our motor keeps working, though, we don't expect that kind of trouble. Indeed, I can't afford such delays since my advisor is coming all the way from Arizona to visit me, now arriving in Xining in less than 10 days'

[20[15]] See Shi (1997). A movie was also made in 1995 about Suonan Dorje's fight to protect the Kekexili region in western Zhiduo. (Also see Appendix VII).

[21[16]] The full name is *Changjiangyuantou Shengtai Jingji Cujinghui*, which literally translates to "Yangtze River Headwaters Ecology Economy Organization."

[22[17]] The four villages (*dadui*) of Suojia are: Muqu, Yaqu, Dangqu, and Jiongqu villages.

[23[18]] This Buddha statue is said to be the tallest in the world, even taller than the 23 m high statue in the Tashilhumpo Monastery in Shigatse, Tibet.

[24[19]] The official opening ceremony of the new Buddha statue is scheduled for August 2000.

[25[20]] King Gesar is a very important figure in Tibetan history. He is said to have defeated many evil spirits and unified numerous local tribes. Many places in Zhiduo are known in relation to Gesar (Norbu 1997).

[26[21]] In October 1999, we never even reached Suojia because of a heavy snowstorm! We were stranded for six days, but fortunately found warmth and food with the 'Second leader' of Yaqu village. And Wenzha was even less fortunate in December 1997 when he had to dig his jeep out of snowdrifts almost the whole way, taking nearly four weeks to make the journey!

time! So we definitely feel fortunate when we arrive in Suojia nearly on time, a few minutes after sunrise on the morning of 11 July 1998, even though we did get stuck in a quagmire in the middle of the night and had to walk the last 15 km.

From Suojia onwards, our travels become more challenging day by day. In the late afternoon, after a truck returns with our recently extracted jeep in tow, we drive even closer to the Dri (Yangtze) River. Soon we hope to reach our final destination, a large 150 km^2 of land donated by the government to the Upper Yangtze Organization (UYO) for them to develop as a demonstration site for ecologically sound and sustainable development in the grasslands of Suojia Township. A few kilometers from Suojia, we spot several Tibetan gazelle and Tibetan wild ass. Here, unlike the hills and mountains we encountered earlier, we are on the very edge of the Chang Tang, the great Northern Plains that extend for hundreds of kilometers to the west. We have entered the heartland of the Tibetan plateau where Tibetan antelope, wild yak and all the other native fauna of the plateau still live. From the plains, at 4,400 m above sea level, mountains rise hundreds of meters above us in all directions. Almost nowhere else on Earth is so rugged and of such stark beauty, nor so remote, as where we now stand. Even more amazing, local pastoralists have here learned how to rely on and to live successfully from the land's resources, despite some of the harshest environmental conditions in the world. Part of the UYO's mandate, in fact, is to document these practices as well as the local tribal histories, at the same time as protecting the local natural resources.

An hour later, we attempt to ford the Muqu River but promptly get stuck in the middle for nearly an hour. After a lot of digging, pushing, and pulling, we finally succeed to reach the other side and drive rapidly, in high gear, the rest of the way across the sand and gravel riverbed. However, soon after this heavy strain on the vehicle, much to our dismay we hear a new "twang" in the motor. With little daylight left, though, we have no choice but to continue the last 10 km to the home of Lobsang Nyima, the 'Second leader' of Muqu village. In the morning, we find our jeep is quite dead and will not move any further. The remainder of our trip is therefore spent first on horseback, then hitching rides back to Suojia, Zhiduo and Yushu, and finally taking a local bus from Yushu to Xining.

During the first evening in Lobsang Nyima's tent, and until 6 o'clock the next evening (when our host's son finally returns with four horses, and we ride off toward Shiamba Chumpel's tent 20 km away), Wenzha and all the others fill me in on the recent history and present status of Suojia Township. As we sit eating fresh boiled mutton, drinking milk tea, and licking yogurt from our bowls, we discuss, for example, how where we are now sitting used to be part of the old Tangbo Road, the former thoroughfare between Tibet and China. And as in all our talks, my hosts discuss among themselves in Tibetan while I ask (and answer) many questions in Chinese, which is our only common trade language. Many centuries ago, even when the Fifth Dalai Lama, Gamsong Gyamtso, traveled the great Tangbo Road, hunters already lived on these plains and in the surrounding hills. Although a few people did graze some livestock in the more productive pastures, everybody's primary livelihood was to hunt the abundant wildlife. This traditional livelihood lasted well into the 20th century, even up until 1958 or shortly thereafter, when the People's Liberation Army (PLA) arrived and ordered most people to move east to the new county town, Zhiduo. Over the following two decades, much of Suojia's wildlife was killed by the army for food and sometimes just for sport. Suojia Commune was formally established in 1966 with its administrative center located in Yaqu village, which now is sometimes called "Old Suojia." Most of the present population, however, arrived here only after the township administrative center was moved to its present location in 1972. Thus, from 1958 to 1972, very few if any people lived in the area where we are now talking. Thus animal husbandry is very new to this part of the Tibetan plateau, with only around a quarter century of history.[27[22]]

The official total population of Suojia Township is 4,377 people in 856 households. However 142 families are known to have moved elsewhere since the 1985 snowstorms. Some people left to find new jobs, but most left because they were made destitute by the catastrophic snowstorm and became beggars. Many of these families now live on the outskirts of the county town. The actual population in

[27[22]] Schaller (1998) notes a similar history for many pastoralists in the southern part of the Chang Tang.

Suojia is therefore significantly lower than official figures indicate. Livestock, on the other hand, now amount to 81,450 head, mostly sheep and yak, but this is generally considered an underestimate of actual numbers. In the small town itself,[28][23] there are a few buildings for government administration, several private homes, and a small health center, a veterinarian station, a primary school, and a government store. The town population is guessed at between 120 and 150 people. The two health workers treat up to 20 patients per day in winter, and they helped deliver 31 babies in 1997. They use a combination of both western and Tibetan medicines, but have very little training and minimal medical facilities. The veterinarians likewise are limited in the work they can accomplish, mostly because vaccines (and all other medicines) are no longer provided free of charge, yet local pastoralists lack the financial means to purchase medicines, and they also feel that it is still the government's responsibility to meet most of their needs. Thus the two township veterinarians who once rode regularly from tent to tent providing vaccines and other forms of assistance for the herds now sit in town with very little to do, and many out-of-date vials sitting on the shelves. Without new community income, they remain helpless to change the situation. At this juncture Zhaduo suggests eco-tourism as a possible source of income, and Wenzha readily concurs with him. Both of them are even very eager to pioneer this kind of venture. I cautiously agree that the idea has merit, that we should weigh its potential costs and benefits, but also that economic, ecological, cultural, and social aspects should all be considered carefully. Everybody agrees, but only time will tell what is truly possible. Back to Suojia town, the primary school has 4 teachers and 25 students, only a negligible proportion of the township's 760 school-age children (i.e., between 7 - 12 years old). The government store is almost permanently closed since no one has any need to purchase supplies – each person provides for himself, making or importing what is needed to live in this remote outpost on the Tibetan plateau. The most recent innovation of Suojia is the greenhouse that was built recently by the local government. The greenhouse is located in the ruins of the township fort, a mud-brick fortification with two high guard towers from which the early Chinese immigrants planned to defend themselves in the case Tibetan attacks. Once again the fort is used for protection, but this time for cabbage, onions, carrots and other vegetables, none of which can grow above 4,000 m without the extra warmth provided by the greenhouse! Finally, regarding ethnic relations in Suojia, there appears to be no animosity between Tibetan and Han (Chinese), perhaps because there are only three Chinese in the township, all of whom have adapted quite well to the local conditions.

Back to Lobsang Nyima's tent… When his son returns with four horses, we all saddle up and ride off as the sun begins to set on the horizon. Assuring Zhaduo, Wenzha and Lobsang Nyima that I have some experience riding horses, they decide to head off at a trot across the wide plain before us. We later turn up a small valley and work our way to a 4,700 m mountain pass. Again we see Tibetan gazelle, Himalayan marmot, and many pika burrows. Riding along, Zhaduo and I talk and dream of the future, and we even take turns singing for each other and for the wind. What a wonderful way to spend a late summer's evening! Quickly, though, the sun begins to disappear, we cross the windy pass, and begin our steep descent into the darkening valley. Here, we are nearing the foot of those mountains pointed out to me several days earlier, from the distant other side, a rugged range where no outsider and very few locals have ever set foot – a mountain range somewhat feared by the pastoralists, even a bit by Zhaduo himself, but also a mountain range reported to have exceptionally abundant wildlife.[29][24] Three-quarters of an hour later, and three hours after leaving the previous tents, we arrive at Shiamba Chumpel's[30][25] home, welcomed with open arms by our new hosts and by several madly barking dogs.

Tired, I would rather go to sleep immediately, but others' customs prevail. We sit and drink tea, we talk, we eat tsampa, but still several times I start to fade into a world of my own, tired both physically and also by the added mental effort of speaking an unfamiliar tongue in a very unfamiliar

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[28][23] Suojia is both the name of the entire administrative unit known as the township (*xiang*), and also of the small town (pop. between 120-150 people) built as an administrative center for the vast township.

[29][24] These are the mountains known as *Yekjengo*, or Wild Yak White Stone Mountains.

[30][25] Shiamba Chumpel is the 'First leader' of Muqu village.

environment. Past midnight I am offered the only bed, and Shiamba Chumpel, his wife, his mother, his four children, and his three other guests all make themselves relatively comfortable on the earthen floor. I sleep well for most of the night, but start gasping in the early morning hours as only very stale air remains, all the fresh air having been consumed by 11 people (and several cats) and by the dung fire that is slowly burning in the hearth. Once in the night, the eldest son steps outside the tent and yells at the top of his voice, attempting to scare away the wolves that are frightening their livestock and exciting the guard dogs.

Zhaduo wakes me before dawn and urges me out of bed. He reminds me that I had agreed last night to get up early, and though I don't remember such a plan (a memory further repressed by the warmth of the bed), I roll over and dress for a cool summer morning. Once outside, though, I quickly decide that it's already winter and I return inside to get my hat, scarf, and gloves. "This is the middle of the Tibetan plateau," I tell myself, "and it's a privilege to be here, right?" But to no avail… "It's just too cold, it's below freezing in the middle of summer!"

The reason we are up so early is to look at the livestock before they are herded away at sunrise to graze the higher pastures for the day. In fact, we are looking for a one particular yak, supposedly a hybrid, but not a normal hybrid either… It is supposedly a hybrid yak sired by an undocumented bovine species that lives in the Yekjengo Mountains, and present in several other mountain ranges of Suojia as well. Most pastoralists seem to know of its existence since it occasionally mates with domestic yak and produces hybrids with little hair and different teeth than regular yak. One of the added challenges of finding either the "real" animal or one of its hybrid offspring, though, is the *taboo* nature of talking about its presence in one's herd, at the risk of it dying and hence of the pastoralists' losing this very unique "blessing." But as I'm Zhaduo's friend, and as he is a close friend of Shiamba Chumpel, we are allowed to examine the special yak. Unfortunately, this one doesn't have any of the extra teeth that I had been told about… So, disappointed, we return to the warmth of the tent. The animal clearly was special, but more like an albino than a cross with a new, undocumented species. However, stories about local sightings of a "lake-yak" and of the more famous "snow-lion," also reported by local herders, do little to increase my confidence in the existence of any of these animals… One government cadre in Zhahe (east of Suojia) also has reported seeing an old white-haired man with a long beard riding a musk deer. At least these stories add to the uniqueness of this trip, and indeed to the special character of the entire region!

Over a breakfast of *tsampa* and fresh yogurt, Shiamba Chumpel's mother tells me her story. I quote here from my field notes (taken on 13 July 1998), only slightly modified here for the sake of clarity:

> "I was born in Doucai. I'm now 78 years old. When I was around 2 or 3 years old, my father came here with me to hunt wildlife because our family was so poor. We weren't nomads but hunters. I don't remember exactly where we lived, but we joined a group of 20 people and we lived and hunted together. We didn't have yak hair tents because we didn't keep any yak or sheep as livestock. Instead, we lived in leather houses made from wild yak skins. The people in these mountains, those that we joined, they're from the Yora tribe. They're not Buddhist like the others in the east. I remember my father shooting wild yak right from the door of our house. Wild yak were everywhere, we never had to go far to shoot them, and there were many other wild animals, too. We used wild yak skulls to hold down the corners of our house since we didn't have any wooden stakes. No one had metal knives and there were very few sewing needles, maybe only one in the group. Some stones were used as knives. People in the group almost never cried, so if someone did cry it was because his or her mother had died, or because a needle broke. Since my father was from the east he knew how to make things and he was the group's technician. After Liberation my father and I moved back east, to Gonsar Monastery, in the middle or late 1950s. When we left everybody was crying, but not because we would never see each other again. They cried because they still couldn't make knives by themselves – my father had made all our knives for over three decades. Many years later I moved back to this same place, this time

with my own family. That was when Suojia was established, around 1973. We now live in the fourth brigade (xiaodui), in Muqu village (dadui), the last one that was established. Nobody wanted to move here because it's much too cold, but we didn't have any choice. Now this is my home again."

Now, a quarter century after Shiamba Chumpel's mother returned to Muqu in the early 1970s, and three-quarters of a century after her first arrival here, she still lives close to the land. Every day, it is her job to collect water, while her daughter-in-law and her granddaughters milk the yak and do many other herding chores. Her grandsons herd the yak, and her son oversees all of the heavier chores around the tent. Even now, wild yak horns are still used as milk pails, Tibetan antelope horns are sometimes used to soften leather, and Tibetan gazelle horns are regularly used to pull yak hair, instead of cutting the hair, so that it can be used to make rope. However, despite the similarities of yesterday and today, livelihoods and, perhaps more fundamentally, the local ecology are clearly changing. The stream that used to run right next to Shiamba Chumpel's tent dried up around eight or nine years ago, and the spring finally dried up three years ago. The grandmother now has to walk up a steep hillside to another, smaller spring to collect water for the family. Similar changes have occurred around Lobsang Nyima's home as well: a spring and large water hole where his livestock used to drink water have dried up very recently, and one local valley which reportedly used to support up to 2,000 head of livestock now can support only 500 head because of the increasing abundance of poisonous weeds. Clearly, through changing hydrological regimes, possibly compounded by heavy grazing pressures, the whole land is changing,[31[26]] a land that was once covered, as Zhaduo explains, "by grass so tall that you couldn't see the dips and hollows or the water holes of the land, a land with such abundant plant life, especially in the hills, that a lot of dead plant matter remained and accumulated each year." Today, however, changes in the local plant species composition and local vegetation structure, and also the increasing desertification near the Dri River, are everyday topics of conversation, a genuine worry for virtually all the pastoralists of Drito (Suojia).

Shiamba Chumpel joins us as we ride northward to the Yangtze River in mid-morning, increasing our ranks to five. He points high above to a Blue sheep, he indicates where he saw a snow leopard up close last winter, less than 10 m away, he tells us when the stream bed we are riding along last held water, he shows us and talks about different plant species. About the large mammals found in these mountains, he says that "the snow leopard are too abundant, they kill around 20 sheep or yak each year. There are maybe 11 or 12 in the next valley alone, and there are many mountain valleys in the area." We also watch pika on the hillside. When I ask for more detail on whether or not pika eat roots (as many pastoralists report), Zhaduo elaborates that in fact "pika eat only the freshest part of the plant, above the ground but as near as possible to the earth." Shiamba Chumpel further enumerates the abundant wildlife in the mountains and valleys near his home: there are many Tibetan sand foxes, some musk deer, a few wild yak that migrate here each year from a larger population that lives across the Yangtze, numerous blue sheep, several gray wolf families, a black bear family, and also several species wild cat.

When we reach the Yangtze several hours later, we spot three white-lipped deer and a Tibetan wild ass. After lunch, we examine an old man-made structure, a circle of rocks with a pile of rocks in the middle. It's an old site of some spiritual significance, but no one knows the exact origin, neither who built this site nor when it may have been built. As we ride along the river westward, we encounter a herd of five Tibetan wild ass that, curious, first examine us for a while before moving to a safer distance. Later, as our group of five spreads out in the valley, now heading southward, I find myself alone when the same Tibetan wild ass now approach me to within 200 m – and what a delight it is to gallop alongside these magnificent and inquisitive animals for about a minute before they decide to turn away and thunder off further to the west.

[31[26]] Miller and Schaller (1997) note that "recent research indicates a general climatic trend of desiccation and warming in Central Asia [and that some] other researchers have noted changes in vegetation in Tibet due to desiccation, especially the transformation of alpine, Cyperaceae mat vegetation to alpine steppe."

In the evening light Shiamba Chumpel finally bids us farewell as he rides back to his family while we continue south for another two hours, back to Lobsang Nyima's home. Zhaduo, Wenzha and I talk about the future of the pastoral livelihood and the wildlife of Suojia, and of how we might be able to improve the living conditions of people here, as well as of how to preserve the natural heritage of this wonderful place. It is Wenzha, the current township leader, who first suggests that we might establish three protected areas[32][27] within the framework of a larger regional land use plan: one area for snow leopard in the mountains behind Shiamba Chumpel's home, one for a growing resident population of Tibetan antelope in the plains west of Suojia town, and another one for black-necked crane in a wetland south of Suojia town next to a local sacred mountain. I gladly accept the challenge of working with them in these exciting and worthwhile endeavors.

At Lobsang Nyima's home we find our jeep still effectively dead, so we spend one last night in a tent. In the morning, we eat fresh mutton for breakfast (instead the routine *tsampa* and yogurt) because a wolf killed a sheep in the night, but only carried away the sheep's head. It probably was one of the wolves from the family with 6 cubs that lives nearby. In mid-morning, a neighbor finally shows up in his truck and attempts to fix our Beijing Jeep. He and his three friends work for several hours but don't have the necessary spare parts. So at noon we finally tie the jeep behind the truck and are towed toward Suojia. With only a seven-hour ordeal to cross the Muqu river, we reach Suojia town at around 11 o'clock in the evening. Although I'm tired and want to find a bed, instead I must wait for a meal to be prepared. This time, however, although I had eaten almost everything offered to me to date, the three sheep heads, with eyes glaring at me, just prove to be a bit too much… I admit that I'm still but a visitor in this place and ask for some good and plain boiled mutton!

Even here in Suojia town the jeep can't be fixed. We discuss riding to the Golmud-Lhasa Highway, but this is deemed too far and too difficult. A shorter route is possible in winter, but now the Yangtze is much too high. So all we can do is wait for two more days and join a group of township people, around 100 people, who are going to attend the annual horse race festival in Yushu. This is their first year to attend the festivities, and so they practice their dances each day to the rhythm of large drums, they sing traditional songs, and they invariably play basketball in the afternoon. The only downside in all this is that my advisor will now arrive in Xining in less than three days' time, and I'm still over 1,200 km away!

During these two days of waiting I walk in the hills, sit by the river, and on one very special occasion, listen at length as Zhaduo interviews a knowledgeable old man who's story is so fascinating and insightful that our resolve to learn as much as possible from the older generation is greatly strengthened. The old 72-year-old man reminisces:

> "Before Liberation the wildlife was very abundant, but a lot was killed in those early years. However a lot of wildlife came back with government protection, or at least until they were reduced greatly by the 1985 snowstorm. Snows never used to be as heavy as in recent years, yet at the same time the land is drying up. The wildlife has never rebounded since 1985. During that winter, Tibetan antelope were literally at my tent door trying to come in. I had to scare them away so that I could come out of my tent. In the past, there were annual Tibetan antelope migrations. In March each year, females would disappear to their birthing grounds. I don't know where their birthing takes place, but I've heard of a lake where antelope milk flows so abundantly that a lot falls to the ground and is lapped up by migratory birds who's droppings the antelope like to eat – it's a good connection, a symbiotic relationship. The hills right around Suojia and all the plains in this area also used to be black, covered everywhere with wild yak, but that's no more. However there is one place that hasn't changed too much, an area near Spirit Mountain where black-necked

[32][27] These three protected areas were formally established at the township-level in Spring 1999. A fourth area targeting Tibetan wild ass was also created. Simultaneously, the Suojia Environment Bureau was founded with 16 "team" (*xiaodui*) leaders working as core field staff.

crane, snow leopard and other animals still live. That place at least hasn't changed for as long as I can remember."

The 72-year-old man also speaks on many other topics, for at least two hours. Zhaduo and I both agree that we must act soon to record their knowledge because so much valuable insight risks disappearing forever.

Zhaduo and the others later elaborate on the local wildlife. In 1990, the nearby plains only had around 20 Tibetan antelope, but now there are at least 100 animals in the local, resident population. Slowly they are returning after the devastating effect of snowstorm in 1985. Wenzha also attributes their increase to the poaching further to the northwest, in the Kekexili, and he feels that local Tibetan antelope here are probably "refugees" from the Kekexili district. One local herder also recalls seeing 100,000s of Tibetan antelope at their birthing grounds in 1975, somewhere between the Yangtze and Dangqu rivers. The black-necked cranes reported near Suojia town are said to breed around a small lake behind the local holy mountain. They are also said to be too numerous to count, and that the grass (reeds) in the wetlands around the lake is one meter high. One of the reasons this wetland area has remained unchanged over the last several decades is the spiritual significance of the adjacent mountain. On one hike I counted between 45 and 50 blue sheep on the local sacred mountain, and they were not even 300 m from a herd of domestic yak. Wolves, foxes, bears, and even snow leopard are still reported to be relatively abundant here as well because of the respect the local pastoralists hold for the mountain. They also are very protective of it and instantly turn away any would-be hunters, a far cry from their own hunting origins of not even half a century ago. Some herders who have killed animals on the mountain have fallen ill in recent years, and it is believed that only appropriate offerings made to the "mountain gods" can lead to their full recovery. Local rules that promote environmental protection have thus evolved in this and in many other areas of the Tibetan plateau.[33[28]]

Other elements of the human landscape in Suojia are also changing. Fences are being raised rapidly throughout the province, and fencing is moving westward each year in Suojia. Winter homes and livestock shelters, harmless in themselves but indicative of changing land use patterns, are also being built. However, attempts to introduce an intensive ranching system in this fragile environment are wrought with challenges and even serious risks.[34[29]] The local government's development goals, as well as those of the local Upper Yangtze Organization, are clearly worthwhile, but a lot of hard work lies ahead to integrate them with the ecological realities of the Tibetan plateau. Resource protection and conservation simply cannot be ignored. Though a daunting challenge, it is a privilege for me to be asked to participate with the people of Suojia and Zhiduo to help find long-term solutions to integrate conservation and development in this very special ecosystem of the world. Perhaps a model will even emerge that can be replicated elsewhere on the Tibetan plateau to improve living conditions and promote conservation more widely, for the long-term benefit of future generations of local pastoralists as well as the benefit of the entire nation.

[33[28]] Also see the section "On traditional environmental law" in Appendix I.

[34[29]] Also see Attwood et al. (1988), Galaty and Johnson (1990), Longworth and Williamson (1993), and Humphrey and Sneath (1996).

APPENDIX VI: HISTORIC ACCOUNTS OF NOMAD LIFE IN SOUTHWEST QINGHAI, CHINA

Journey Among the Tibetan Nomads: An Account of a Remote Civilization (Norbu 1997)

The following excerpts are based on the observations of Namkhai Norbu in Guoluo and Yushu prefectures in 1951.

On Tibetan Wildlife

"Most of the territories that I traveled through [in the summer of 1951] were sparsely populated, but some were devoid of any human presence; there, wild animals lived free and undisturbed, between high, majestic mountains covered with perennial ice and snow. In some regions many ice-peaked rocky mountains arose and at their feet in the valleys lived herds of deer[35[1]] and flocks of wild sheep known as nawa (ovis nahura).[36[2]]

"The nomads almost always choose for their settling places grassy plains with abundant water where the highland green is studded with innumerable mountain flowers. Herds of Kyang (*equus hemionus*),[37[3]] wild asses many thousand strong, along with hundreds of wild yaks called drong (*bos grunniens*),[38[4]] graze on those plateaux along with deer, antelopes called gowa,[39[5]] dre which is a type of marten similar to and slightly larger than the weasel,[40[6]] wild sheep called nyen (*ovis hodgsoni*)[41[7]] and many other species.

"In the green valleys, where the song of thousands of cranes resounds, stand the *rukor*, the encampments of yak-hair tents which shelter from 11 to 30 families settled together to better protect themselves and to more easily defend their camp in case of attack…

"A fact we found striking was that thousands of the birds called *atakayu* lived with the *avra*.[42[8]] These small birds, grey in color with black beak and dark grey claws, and slightly larger than a canary,[43[9]] live in the same dens as the *avra* and lay their eggs there." (pp. xiii-xiv)

35[1] White-lipped deer (*Cervus albirostris*)

36[2] Blue sheep (*Pseudois nayaur*)

37[3] Tibetan wild ass (*Equus kiang*)

38[4] Tibetan wild yak (*Bos grunniens*)

39[5] Tibetan gazelle (*Procapra picticaudata*)

40[6] Steppe polecat (*Mustela eversmanni*)

41[7] Tibetan argali (*Ovis ammon hodgsoni*)

42[8] Plateau pika (*Ochotona curzoniae*)

43[9] Probably the white-rumped snowfinch (*Montifringilla taczanowskii*)

On Tribal Chiefs

"The region of Dzachuka[44][10] is exclusively inhabited by nomads of 18 great tribes…. In every tribe there is an important family within which the title of chief has long been hereditary, but in reality no chief has the authority to govern all the nomads, nor even some of them. The families who vaunt this title do not even have the right to exact tribute. Here we are dealing with honorary inherited titles, which had been conferred over time, for a variety of reasons, in two kingdoms in eastern Tibet, Derghe and Lingtsang. Most of the tribes now in Dzachuka were under the jurisdiction of the former while the 'three tribes of the north' (Changpa Khagsum) were under Lingtsang.

"One of the main tasks of the 'chiefs' is to receive the representatives of the two above-mentioned kingdoms when on their periodical official visits to the area as well as the high-ranking lamas who might be traveling in their land. Another of their duties is to organize defences against sudden attacks by enemies and bandits and to lead those under their authority in efforts to pursue and capture them. Where disputes arise between groups … the chief has the authority to represent his group." (p. 1)

On Pastoral Migrations

"In the summer, since the grazing grounds change with the seasons, nomads move to the best pastures on the plateaux and mountains; there no private land belonging to single families exists and there is no limitation on where animals may graze, except for the borders between different regions and some zones considered the private property of certain camps.

"Autumn is held to be a particularly good time for the accumulation of dairy produce. In fact, there is a saying amongst the nomads: 'Autumn milk is half butter.' In that season the herds are taken to luxuriant pastures near the encampments of the nomads. Each camp has an autumn pasture whose grass was left untouched during the summer, at a lower altitude than the summer grazing grounds, warmer and sheltered from wind and rain.

"Of all the pastures, however, the most important are those where the herds spend the winter. Each camp and most families own winter allotments, for private use. During summer and autumn no one, regardless of social position, is allowed to graze his animals on the winter pastures. If anyone violates this rule, the next spring he will have to pay damages to the family legally occupying those grounds for all their animals dead from hunger over the previous winter, sometimes a considerable number.

"The winter pastures usually lie in green hollows on mountain slopes, in sunny valleys and other warm places, sheltered from rain, snow and storms. There, the nomads build ample pens as high as a man, using animal dung to erect the walls; these enclosures serve to protect the livestock from the wind, storms and attacks of wolves and other wild animals …

"Spring is a difficult and demanding time for the nomads. Their animals, thin and weakened, cannot cover long distances to reach the pastures and at times sleet falls for many days in a row, causing the death from starvation of hundreds of stock. For this reason, the spring pastures, where the grass covered by snow in winter begins to grow again, must be very near the winter ones." (pp. 40-42)

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[44][10] The Dzachuka region is situated in the eastern part of present-day Yushu prefecture.

On Traditional Environmental Law

"*Rigya*, the general laws that govern relations with the environment, also forbid the gathering of certain tubers and roots such as the *dzayung*, the *yartsa gunbu*[45[11]] and the *karmog*. The nomads, in fact, often say that the *yartsa gunbu* and the *karmog* are the treasures of the earth spirits, while the *dzayung* is their very heart. If anyone should pick them, his community and their livestock will be struck by virulent epidemics that will spread all over the region.

"The gathering of these tubers and roots is very often a cause of conflict between different groups because young people, both male and female, secretly collect them outside their own territory. If discovered by the locals they are stripped of their booty and savagely beaten. This risk is taken because the young have little belief in the stories about those tubers and are far more interested in the tea, silk, cotton and ornaments they can procure bartering them with Chinese traders.

"Every nomad community carries out patrols known as *risher* over its entire territory in summer and autumn and these are very successful in maintaining order and have a reassuring effect. The youths with the best horses volunteer readily for these expeditions as they have a battle-loving spirit. On these patrols they are very likely to encounter hunters from other regions,[46[12]] thieves, bandits, people violating customary laws or even enemy spies or hostile band out on raids seeking victory in their vendettas. Only when one patrol has been completed is the date of the next one fixed…" (pp. 69-70)

A Tibetan on Tibet; Being the Travels and Observations of Mr. Paul Sherap (Dorje Zödba) of Tachienlu; with an Introductory Chapter on Buddhism and a Concluding Chapter on the Devil Dance (Combe 1989)

The following excerpts are based on the observations of Dorje Zödba during his travels across the Tibetan Plateau, and in particular from the region of present-day Suojia, shortly after the turn of the century.

On Dsagarnag and Adra Dsamar

"Next we come to … two small countries, of which the northern portions are inhabited by nomads, namely Dsagarnag[47[13]] and Adra Dsamar[48[14]]…. Dsagarnag adjoins

45[11] *Yartsa gunbu* is known as "caterpillar fungus" (*chongcao* in Chinese), a valuable traditional Chinese medicine.

46[12] These environmental patrols have their modern equivalent in the "Wild Yak Brigade" of Zhiduo's "Western Development Committee." This unique brigade patrols the vast Kekexili district, but its overall effectiveness has been limited by financial and other constraints (Shi 1997, Bay 1999). The 45,000 km^2 Kekexili (Hoh Xil) Nature Reserve is now being managed by the provincial forestry bureau, and plans for a 236,000 km^2 nature reserve – to encompass the source areas of the Yellow, Yangtze and Mekong rivers in Guoluo, Yushu and Haixi prefecture – were recently announced at the provincial and national levels ('China plans…' 2000). However, the county and township levels were not even consulted in its creation.

47[13] To the best of my knowledge, the area of Dsagarnag described here coincides with Zhahe Township of Zhiduo County. Zhahe is halfway between the Zhiduo administrative center and Suojia Township.

48[14] To the best of my knowledge, the area of Adra Dsamar described here coincides with Suojia Township of Zhiduo County.

Dsachuka[49[15]] and, in its northern part, is a poor country, with very few trees…. Its people live chiefly by hunting. In spring and summer such as possess rifles and horses hunt the stag.[50[16]] In the second or third Chinese moon, say about March-April, the stag's horns bleed; and there is a great demand in China for the bleeding horns, which are regarded as a strengthening medicine and fetch over Tls. 100 a pair. In winter time they snare the muskdeer,[51[17]] sending the musk to the Jyekundo[52[18]] market. Poor persons hunt the badger[53[19]] and the fox[54[20]] with sticks and dogs, the badger in summer, the fox in autumn, employing the winter in trading the fox-skins; there is nothing for them to do in spring except to go after badger in their burrows, not an easy business, as they go so deep. The fox is not the real fox, but an inferior animals called *Be* in Tibetan, and *Sha-hu* in Chinese, whose skin fetches not more than three or four rupees. The badger is called *Chü-wa* in Tibetan and *t'u-t'u-tzu* in Chinese; it is hunted both for its skin and for food. The skin is not traded, but made into garments: the flesh is almost as fat as pork. The people of Dsagarnag dress like Tibetans, but the men wear ornaments in their hair, which is not a common practice in Tibet. Unlike the Golok and Dsachuka peoples, the men have queues, and their customs vary much among themselves. Their lamaseries are most of the Karju sect.

"Adjoing Dsagarnag, and west of it, is Adra Dsamar, also a small country, not quite so poor as the former, but otherwise much the same…. The people are poorly clad and robbers abound. When I was there about twenty years ago [around 1906], the country was being terrorized by a robber chief styled Gedmo Dagjel, who wore princely clothes and had a following of about 100 men, all splendidly dressed, well mounted, and properly equipped with guns and tents. Adra Dsamar is all rocky hills and grassy plains, but the grass is poor, and, as in Dsagarnag, the people live chiefly by hunting, dwelling in yak-hair tents and wearing sheepskin coats." (pp. 110-111)

On the wild yak hunt

"[An] annual excursion takes place in autumn [in Guoluo] in pursuit of the wild yak, or Drung, an animal almost as big as the elephant, that lives in herds of one or two hundred all over the northern nomad country, but mostly in Golok and Dsachuka. … When living with the herd, the drung is not very fierce; but if solitary, he is a man-killer…" (p.108)

Gold Rush to the Forbidden Province (Aukatsang 1994)

The following excerpts are from an account of a trip that was made to Zhiduo in the early 1990s. Although I do not necessarily agree with all the views expressed here, it is nonetheless a unique and valuable description of this remote area in modern times.

[49[15]] Dsachuka is the situated in present-day Chengduo County (east of Zhiduo County) and in Shiqu County (in northwest Sichuan).

[50[16]] The stag referred to here is the white-lipped deer (Cervus albirostris), which still is in present in Zhiduo in small numbers. Around 200 deer now live in semi-captivity in the "farm" on the hillside behind town, primarily for the collection and sale of their antlers.

[51[17]] Musk deer (*Moschus sifanicus*, = *M. chrysogaster*)

[52[18]] Jyekundo is the old name of Yushu town, the prefecture administrative center, also known as Gyegu.

[53[19]] Himalayan marmot (*Marmota himalayana*)

[54[20]] Tibetan sand fox (*Vulpes ferrilata*)

Zhiduo, a Frontier Town in China's "Wild West"

"Each Spring, when the ground thaws, gold diggers rush to the Qinghai plateau. … Qinghai is one of the most remote and less known provinces of China. [The province] opened to the outside world less than five years ago, and every year, there are less then ten foreigners who have ventured as far as Yushu. The region is considered 'forbidden' and special permits are required[55[21]]…

"Gold fever has invaded the Chinese West. From April until the end of October, there are several hundred of carts traveling between Xining and Yushu, toward the sources of the great rivers.[56[22]] The Yellow river, the Blue river,[57[23]] and the Mekong all come from this area of the high Tibetan plateau. Gold is plentiful in the red sands of the region. According to the Chinese information agency (Xinhua), there are more than ten active gold mines, producing more than 200 kgs of gold in 1991. In 1992, more than 150,000 Chinese gold diggers made their way to Qinghai, according to the local authorities. Most of them are business owners, from the suburbs of Xining, the largest city in Qinghai… According to the local Tibetans, the first gold diggers started arriving in the early 1980's but over the last two years the number of adventurers and other types of pioneers can be likened to full fledged gold rush.

"Zhiduo, about 200 km [north]west of Yushu is a typical 'mushroom town.' Located in a spectacular area of red rocks covered with snow, [Zhiduo] is at the end of the 'road' on the maps. … Beyond Zhiduo lies the unknown: frozen marshes, the kingdom of the wild yaks, the snow leopard and the Tibetan wolves.[58[24]] A few nomads are the only ones to venture in this high desert (+16,000 feet); they do not talk about it. By the bridge over the river, there are many gold diggers busy panning for gold. But it is only a first stop. Thirty miles further[59[25]] lays the 'gold country,' where foreigners are prevented from going by the army.[60[26]] There, thousands upon thousands armed with a shovel and sieve are looking for gold.[61[27]] Zhiduo's only street is flanked by wood houses on both sides.[62[28]] Pool tables, right on the street, are surrounded by tens of unlucky Chinese adventurers wearing dark glasses against the intense light. At night, the yak oil plant in the middle of the village doubles as a saloon where the Chinese population and a few Tibetans gather and dance tangos and waltzes under the strobe lights. According to the Tibetans, the wave of Chinese settlers has been continually growing since the summer of 1992…

55[21] An "Alien Travel Permit" (ATP) is still required to travel to Zhiduo and many other places in Qinghai.

56[22] Many seasonal outsiders come to collect *chongcao*, or "caterpillar fungus" (also see Norbu 1997).

57[23] The "Blue River," or *Lancang*, is known outside China as the Mekong River. The correct name here is rather the *Nujiang*, also known as the Salween River.

58[24] The small administrative center of Suojia lies around 260 km beyond Zhiduo town.

59[25] Probably in Doucai Township. Zhahe, Doucai, and Suojia are the westernmost townships of Zhiduo.

60[26] It is now possible to travel anywhere in the province, including this area, as long as proper permits are secured. However, obtaining permits is never guaranteed. Permits for Zhiduo can be requested in Yushu.

61[27] Many gold miners were also present in October 1999. Lacking sufficient income, the local government has recently begun to give gold mining permits to outside individuals and businesses, most from Haidong in northeast Qinghai. The government is thus able to generate some additional revenues through taxation, which is now necessary to fund some of their routine operations and to pay government workers' salaries.

62[28] All the street-front buildings in Zhiduo were renovated (given a 'facelift') with ceramic tiles in 1999.

"Approximately 20 [nature] reserves have been [established on the Tibetan Plateau]… However, Chinese tourist agencies, such as the Hunting Association, organize safaris for foreigners interested in hunting threatened species. The price varies according to the trophy: From $50 for a Koslow pika[63][29] to $50,000 for a wild yak, a species that is considered threatened by extinction."[64][30]

[63] [29] This "hunting fee" is questionable, and probably refers to a "research fee" instead. Koslov's pika (*Ochotona koslowi*) was discovered in 1884 near the border of Xinjiang and Tibet. It is now extremely rare and has a very small geographic distribution (Smith et al. 1990, Li 1999).

[64][30] Schaller and Liu (1996) estimate that only 15,000 wild yak (*Bos grunniens*) survive in the world.

APPENDIX VII: THE LIFE AND DEATH OF SUONAN DAJIE

Suonan Gives Life for Homeland (Shi 1997)

"Kekexili Desert is called a no-man's land. Its hostile climate has made it inaccessible to human being, and thus a haven for wild animals. Since 1985, the discovery of gold reserves in Kekexili has caused a frenzied gold rush. Thousands of illegal miners swarmed into the Kekexili. As a result, the number of wild animals … dropped sharply. …

"As the director of the Western Development Committee of Zhiduo County, Suonan Dajie was very concerned about the situation. … Suonan Dajie took it as his mission to crack down on illegal mining and poaching to protect the desert's natural resources. Since the establishment of the committee in July 1992, Suonan Dajie had spent 354 days in the Kekexili Desert and travelled more than 60,000 kilometres. …

"In 1985 a catastrophic snowstorm hit Zhiduo County. Waist-high snow fell over most of the county and cut off all transportation and communication. The temperature fell to minus 40 degrees Celsius. Thousands of livestock froze to death. Suonan Dajie joined the rescue team to save the herdsmen buried by the storm. … Traditional livestock husbandry was so fragile, he realized. Overnight, the whole economy had collapsed. Was such a fragile economic base truly the road to prosperity? Suonan Dajie began to ponder this question.

"The next year Suonan Dajie was assigned to be chief of Suojia, the poorest of Zhiduo's townships. There, he began to lead his people to a new way of development. He built roads, surveyed rivers in search of sites for dams, and consulted engineers regarding mineral reserves. But, he saw that the county's biggest hope lay in Kekexili.

"In 1992 Suonan Dajie was promoted to deputy Party secretary of Zhiduo County. The first thing he did was to set up a Western Development Committee, whose mission was to crack down on illegal mining and poaching in Kekexili, and to protect and scientifically develop its resources. … In July 1993, his proposal finally got approved and Suonan Dajie became director of the committee. 'No one understood the significance of Kekexili to Zhiduo like Suonan Dajie,' recalled Zhaduo, a former assistant.[65[1]] …

"In January 1994, Suonan Dajie and six assistants entered Kekexili for the 12th time. From January 8-16, they captured seven groups of illegal poachers… [But] on January 16 they encountered another group of 20 poachers [who] fought back. Suonan Dajie was shot during the fight. Eight days later, he was found dead, still kneeling in the snow with the pistol in hand.[66[2]]"

[65[1]] Zhaduo now is Suonan Dajie's successor as the leader of Suojia Township. He also is the Director of the Upper Yangtze Integrated Conservation and Development Organization, which was established to further develop the work begun around a decade ago by Suonan Dajie. Zhaduo has said on several occasions that he considers Plateau Perspectives to be the "twin organization" (international counterpart organization) of the local, grassroots Upper Yangtze Organization.

[66[2]] This entire episode still remains in vivid memory of the people of Zhiduo, and also in the memory of many people throughout the Yushu Tibetan Autonomous Prefecture.

APPENDIX VIII: THE UPPER YANGTZE ORGANIZATION'S DEMONSTRATION AREA LAND LEASE

Translation of Suojia Township Government Document

Instructions Regarding the Establishment of the Upper Yangtze Integrated Conservation and Development Demonstration Area

We understand your application for grassland of 1 May 1998. The proposed project is a beneficial one that does not harm the surrounding area, and it will make a significant contribution to protecting the natural resources, to developing the region's economy, and to developing sustainable animal husbandry practices.

Our township therefore agrees to lend you 200,000 *mu* [i.e., 13,333 ha, or 133 km^2] of grassland. The relevant formalities will be dealt with according to the national "Rangeland Law."

[chopped]
The People's Government
Suojia Township (Zhiduo County)
4 May 1998

APPENDIX IX: OFFICIAL REGISTRATION DOCUMENT OF THE UPPER YANGTZE ORGANIZATION

Translation of Zhiduo County Civil Affairs Bureau Document

Official Reply Regarding the Application for Registration of the Upper Yangtze Integrated Conservation and Development Organization

To the preparatory committee of the Upper Yangtze Integrated Conservation and Development Organization:

After examining your application for registration of the Upper Yangtze Integrated Conservation and Development Organization and attached materials, we have decided that your organization is the first people's organization [social organization, non-governmental organization] in the history of Zhiduo County, and meets all legal requirements. The organization has a complete working structure, well-defined goals and objectives, and the members are representative and trustworthy. The registration materials are complete, and conform to the "Regulations on the Administration of Social Organizations." We hereby give official reply that your application for the registration of the organization is now formally accepted.

[chopped]
26 May 1998
Zhiduo County Civil Affairs Bureau

APPENDIX X: PLATEAU PERSPECTIVES REPORT: SUMMARY OF ACTIVITIES, NOVEMBER 1999

Summary Report of Our First Year (from Foggin 1999a)

General Description

Plateau Perspectives is a non-profit organization dedicated to helping local communities in the Tibetan Plateau area to protect the environment and to improve the lives of the poor through integrated development programs. We provide training and technical assistance in community health, literacy, basic education and the environment. Further, we emphasize the relationships between these fields and their joint contributions to poverty alleviation (income generation) and to a more sustainable future. All of our work is undertaken in cooperation with the local government and target communities from the early planning stages through to project implementation and final evaluation.

The founding principles (guidelines) of Plateau Perspectives are:

- to consider local environments, local ways and local knowledge;
- to adopt an integrated approach to development work;
- to partner with and encourage communities to help themselves;
- to integrate the physical, emotional, and social aspects of health;
- to emphasize replicability (training of trainers) in adult education; and
- to find sustainable ways of using resources and protecting biodiversity.

Plateau Perspectives was originally conceived in 1995, and was founded in Montreal, Canada, in October 1998.

Work Conducted to Date in Qinghai, Sichuan, and Tibet (1998-99)

1. Cooperation with the Upper Yangtze Organization

Plateau Perspectives' Director has assisted in the development of the Upper Yangtze Organization's work since December 1997, and continues to work closely with the UYO as well as the local township, county, and prefecture governments. The Upper Yangtze Organization (UYO) was established in May 1998. It is registered with the Civil Affairs Bureau of Zhiduo County, and the People's Government of Yushu Tibetan Autonomous Prefecture of Qinghai Province also endorsed the organization in one of its recent congresses (meetings) in the autumn of 1999. While the UYO has independent links with several provincial, national, and international organizations and bureaus, Plateau Perspectives remains its primary counterpart organization (and its sole counterpart organization that also focuses on the integration of socio-economic development with longer-term environmental protection and biodiversity conservation).

2. Research and planning for integrated development work in Suojia Township

Our current work and future plans are based on several work trips to Suojia Township (in total, eight weeks in the field), and on extensive discussions in Xining with the UYO's Director.

3. Work trip to Ge'ermu (Golmud) City

A project office may eventually need to be established in Ge'ermu (Golmud) City to provide easier access to Suojia Township. A trip was therefore made (in June 1999) to discuss this possibility with the city's Foreign Affairs Office. An invitation has now been extended for the purpose of opening a project office in Ge'ermu, on condition that the provincial Foreign Affairs Bureau is in agreement.

4. Community health survey

The UYO and the local government have requested assistance to determine what priority actions should be taken to improve community health in Suojia. To this effect, a questionnaire-survey was introduced in modified form to the UYO (this approach has previously been used among Cree and Inuit communities in northern Quebec, semi-nomadic pastoralists in Mongolia, and Miao communities in Yunnan). Initial training on the use of this questionnaire-survey was provided for several UYO members and leaders in October 1999.

5. Literacy work and participatory development

Part of the overall work planned in Suojia Township is to find ways of increasing literacy rates among local pastoralists. The UYO has already begun to design a literacy primer. A more participatory approach also may be useful (along the lines of the REFLECT method), and this continues to be encouraged by Plateau Perspectives for all of the UYO's work.

6. Guidebook to the ecology and culture of Qinghai's Alpine Grasslands

One of the local advisors to the UYO has recommended that the UYO write and publish a "guidebook" to the upper region of the Yangtze River, emphasizing the local culture and ecological conditions. This book would serve two purposes: to introduce the region to interested people (government officials, development organizations, tourists, etc.), and to promote the name and image of the UYO. At the UYO's request, Plateau Perspectives has suggested a brief outline for such a book.

7. Suojia Environment Bureau

In early 1999, the Suojia Township government established a new Environment Bureau with a small supervisory committee and 16 field staff (that is, the leaders of the 16 *shengtandui*, or former work teams, of the township). Plateau Perspectives purchased five canvas tents and 16 binoculars (for the field workers) in August 1999. An initial work plan was also provided to the local bureau in response to their request – a simple worksheet for monitoring local wildlife populations, with simple words and pictures that can also assist with their planned literacy work.

8. Four nature reserves and demonstration area

Following discussions held in July 1998 held on-site in Muqu Village, four township-level nature reserves were established in early 1999. The protected areas' focal species are the Snow Leopard, Tibetan Antelope, Tibetan Wild Ass, and Black-necked Crane – all internationally endangered species. The UYO's Director has indicated that Plateau Perspectives' Director was instrumental in conceptualizing, and hence in establishing, these reserves. An area of around 133 km^2 on the bank of the Yangtze River (adjacent to one of the four reserves) also has been set aside to serve as a demonstration area for sustainable animal husbandry and nature tourism.

9. Environmental awareness video

Plateau Perspectives provided an environmental awareness video (with Chinese translation of the transcript) to the UYO for its ecology classes at the Zhiduo Minorities' Middle School.

10. Yaqu Village tent school

Less than one year ago, the Yaqu community generally felt that there would be no benefit for their children to obtain a formal education. Since then, however, the village has been encouraged by the UYO (which in turn was encouraged by Plateau Perspectives) to find a way for their children to attend school. In response, the community has mobilized itself and set up a tent school. The nomads have provided the land, around 7 tents, and food and blankets to the school. The township government has provided two teachers and all the desks and chairs. There are presently 34 students in first grade, and up to 70 more children are ready to join if adequate facilities can be made available. Currently, however, the tents are only summer tents, yet winter has already arrived... Padded (winter) tents are needed if the students are to continue studying until the regular winter break that begins in mid-January... Hope has grown in this community, but this hope risks disappearing if their great efforts of this year lead to naught because the school cannot continue through the winter for lack of warm tents... [Early snows fell in Suojia in October 1999, leading to the early closure of the school. Plateau Perspectives had offered to raise funds for winter tents as early as August 1999, but the county government had already made plans in connection with Children in Crisis. The latter organization purchased year-round tents in April 2000.]

11. Muqu Village integrated development center

In a similar way to Yaqu, the Muqu community has begun to mobilize itself, particularly over the last couple of months, to improve their overall living conditions. It is now planned that a “community center” will be established where children can attend school (a tent school), where adult training can occur (adult education in literacy, health care, etc.), and which also would serve as a base for research on sustainable animal husbandry, limited nature tourism, and wildlife studies in the local nature reserve located in Muqu. A small grant from The Tides Foundation, by way of the Global Greengrants Fund (GGF), will allow the environmental awareness and research part of this work to begin, particularly the purchase of several tents, desks, beds, a stove, etc. [Unfortunately, the early snows that fell in October 1999 slowed this work significantly, and it also took longer than expected for the community to decide where the tent school and community center should be located. However, with encouragement from the UYO, the local community reached an agreement in April 2000. Plans for the community center have expanded compared to last year, and Plateau Perspectives also agreed in May 2000 to match the seed funds provided by GGF at a 2:1 ratio. Hence a tent school and training center (with environmental awareness training) will begin in the summer or early autumn of 2000.]

12. Suojia clinic and doctor training

A proposal was written in August 1998 (and funds obtained) to build a small clinic in Suojia, along with the provision of on-going medical training. [Unfortunately, it is unclear at this stage if and when this project will proceed; Plateau Perspectives was only an intermediary, and although we provided assistance in the design of the project, we do not have any direct control over the implementation phase of this project.]

13. Consultancy to the Care and Share Foundation

Care and Share Foundation (CSF) organized an “Ecotourism and Community Development Project” in July and August 1999. Specifically, Plateau Perspectives conducted a bird survey in Bengda Nature Reserve, provided consultancy on ecotourism development in the surrounding area, and provided consultancy on health care provision in Dengke Township (in Shiqu County, Ganzi Tibetan Autonomous Prefecture, Sichuan Province).

14. Gande County Child Sponsorship Program

Nineteen children are being sponsored for two years to attend the Gande Tibetan Middle School (1998-2000), and two additional children are being sponsored for one year (1999-2000). This middle school received an award as the best middle school in the Guoluo Tibetan Autonomous Prefecture in 1998.