

## Chapter 16

# Enclosure and Resettlement in the Eastern Tibetan Plateau: Dilemma of Pastoral Development During the Last Three Decades

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**Abstract** The eastern Tibetan Plateau (ETP) in China is one of the most productive pastoral areas in highland Asia, which has been always placed on the crest of policy-driven changes for pastoral development and rangeland management in the last few decades. Profound changes from traditional pastoralism in the eastern Tibetan Plateau included the collectivization of livestock and rangeland from the late 1950s, privatization of livestock from the early 1980s, enclosing rangelands for private utilization from the 1990s and massive settlement and resettlement of herders in 'Pastoral New Villages' from the twenty-first century. The policy-driven changes initially aimed only to maximize livestock production but later on added in a deliberate intention to modernize pastoralism and prevent rangeland degradation. What in some places of experimental site seemed to work well in rangeland privatization or pastoralists' settlement, nevertheless, brought in many other situations more pressures to both people and their environments. China is spending significantly increasing amount of resources in rangeland management, but the effectiveness of the programmes in achieving dual targets of fair pastoral development and environmental conservation are questionable. The challenge is becoming even greater and has given the impacts of global development and climatic change to the ecologically fragile and economically vulnerable eastern Tibetan Plateau. New policies for ecosystem compensation or payment for ecosystem services might be an alternative if wisely formulated and implemented.

**Keywords** Tibetan Plateau • Herder settlement • Pastoral development • Rangeland enclosure • Ecosystem compensation

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## 16.1 Introduction

The eastern Tibetan Plateau (ETP) covers northwestern Sichuan, southeastern Gansu, southeastern Qinghai and northwestern Yunnan Provinces in China. Most of the ETP is topographically mild with small hills interspersed with rivers, with an exception of high mountains and deep valleys of the Hengduan Mountain Range that cuts off the Tibetan Plateau in the east. ETP is generally pure pastoral, though small patches of barley or beans cultivation can be found in catchments. The whole ETP is the water source area of the Yangtze (Changjiang), Yellow (Huanghe) and Mekong (Lancangjian) Rivers. The average elevation in ETP is about 3,600 m above sea level, the annual precipitation is some 600–800 mm, and the annual mean temperature is about 1°C. Due to the winding rivers and changing riverbeds, much of ETP rangeland has extensive development of marshland and peatland. Various types of subalpine meadows are dominant plant communities in ETP. ETP rangeland is some of the most productive land on the Tibetan Plateau, with often 30–40 vascular plant species per square metre that produces an annual dry matter of 80–150 g.

Grazing of cold tolerant livestock mainly including yak, sheep and horse in ETP has been the dominant and environmentally sustainable land use pattern for thousands of years. However, due to a multitude of factors, rangeland resources in the Tibetan Plateau and in the eastern part in particular are increasingly under pressure to sustain increasing livestock production and to meet the increasing demand of local dwellers and an ever-growing market. Studies show about 50% biomass reduction in ETP from the 1950s to 2000s, accompanied by the increase of unpalatable species in plant community and the expanding desertification (Ze 2005). The key factors causing rangeland degradation on the Tibetan Plateau include population growth, climatic warming and policy changes. Dynamic policies have modified land use characteristics and have resulted in increased rangeland degradation and livelihood vulnerability (Dong et al. 2011).

As one of China's five major pastoral production areas, ETP is often chosen as a demonstration site for implementing new rangeland policies and pastoral development programmes. This section summarizes the authors' long-term study in China's rangeland policies and pastoral programmes, as well as field research findings from mainly Hongyuan and Ruergai (also as Zoige) counties of Sichuan Province and Maqu County of Gansu Province in ETP (see site No. 15 in Fig. 1.3). It focuses on a time frame of the last three decades since the privatization of livestock in 1983 but covers a wider time span for backgrounds.

## 16.2 Policy-Induced Rangeland Enclosure

### 16.2.1 Major Policy-Driven Changes in Rangeland Management

Before 1958, the Democratic Reform of China, local people in ETP practised tribe-based communal tenure and highly nomadic traditional livestock grazing systems. With low population and livestock density, the traditional system had

been able to retain its mobility and feasibility in adapting to the harsh environment without major changes for hundreds to thousands of years. Rangeland was however not open and accessible to all, but was controlled by different tribal leaders, rich families and monasteries with rough boundary demarcation by natural distinctive landmarks such as mountain ridges and water bodies. The average survival rate of young livestock was about 50%, and it was not uncommon for a family to lose all their livestock in a natural disaster, especially heavy snow in the early spring. The tribal leaders had generally unique decision-making privileges pertaining to rangeland use, and their herds were shifted to new rangelands ahead of others in the same community. Each year, they reallocated rangelands to different sub-tribes and determined grazing routes. They used to move their tents and herds in search for water and grass from late April to late October. When it got very cold in late October, they returned to their winter pastures and stayed there till next April.

Between 1958 and 1982, both rangelands and livestock were collectivized into two types of production units. One was 'Mutual Aid Agricultural Cooperation' (1958–1973) followed by 'People's Commune' (1973–1983) managing 'Production Brigades' and 'Production Teams', and another was the State-Owned Farm. During the period, livestock number in Hongyuan County alone increased from 130,120 to 486,500 heads (Hongyuan County History Editorial Committee 1996). Livestock owned by collectives was usually divided into different groups, like milking cows and calves, young yaks (2–3 years old), bulls, castrated and ready to sell yak, sheep, etc. Labour forces were accordingly divided into different groups, each having their own target livestock group, to accomplish their assigned tasks to earn work-points or wages. The ownership of pastures belonged to the state, but the actual use right was authorized to individual production units. The leadership of a production unit decided the division of tasks and grazing routes by listening to experienced herds-men. People could only follow given routes to graze their assigned group of livestock within production unit boundary.

Starting in 1983, all livestock of production units were equally allocated to individual households according to the number of families regardless of their age and sex, and the pastureland was still kept for common use until the mid-1990s. Herders no longer needed to work together in groups as they used to in the last decades, and they gained full authority for managing their own livestock. The introduction of household livestock contracts greatly stimulated pastoral productivity, which also resulted in most households attempting to raise as many livestock as they could on common pasture within their production unit. Pasture boundary fights between administrative communities were very common. It was difficult to get an exact number of livestock from individual households. Rangeland degradation, however, was becoming more rapid and serious than ever before as illustrated by the increasing desertification areas or piles of exposing black soil caused by rodents, due to over grazing. At the beginning of the twenty-first century, about 90% of China's rangeland was degraded of which half was seriously degraded. For example, the desertification area in Maqu County in ETP was 1,140 ha in 1985 but 53,400 ha in 2003, and in the meantime, the biomass of Maqu rangeland reduced from 5,860 kg/ha in 1981 to 4,000 kg/ha in 2004.

In 1995, as one of the 25 selected pastoral demonstration counties in China, Hongyuan County initiated an 'Integrated Pastoral Socio-Economic Development Programme'. Rangeland was divided amongst individual households or household groups (from 10 to 20 households) on a long-term contract base. Each household was required to build a house, an animal shed and a hay storage barn. Under the new programme, pastoralists were supposed to have responsibility to their contracted pastureland and to invest in pasture improvement. Ever since then, rangeland lease policy was made effective throughout pastoral China. By the end of 2003, about 70% of China's rangeland was leased through long-term contracts, of which 68% was contracted to individual households and the rest to groups of households or to villages (Yan et al. 2005). Those rangelands which were not leased out were either identified as unusable rangeland (not suitable for livestock grazing), protected areas or kept for special uses such as seed production and disaster defensive base. By the end of 2008, a total of 22.8 million ha or 71.5% of China's usable rangeland had been contracted (MOA 2009).

In Aba Prefecture in ETP (including Hongyuan, Ruoergai and some adjacent counties in Sichuan Province), 54.36 million *mu* (a Chinese land measure, 1 ha is equivalent to 15 *mu*) or 94% of the total usable rangelands was contracted by 2000. Of this, 29.90 million *mu* was winter pasture and 24.46 million *mu* summer pasture. A total of 57% of contracted pasture or 31.00 million *mu* went to 31,000 households; 20% or 10.77 million *mu* went to 674 household groups (a household group contracting shared rangeland consisted of 6–12 households, which might be formed at voluntary base or Village Committee assignment); 22% or 11.70 million *mu* went to 1,500 villages; and the rest was kept for emergency use or was used by work units (Sichuan AHB 2001). These figures show that 29.90 million out of 31.00 million *mu* of rangeland contracted to individual households was cold season pasture, and this indicates that most pastures for warm season use were allocated to household groups or villages. About 390 households, or one-twentieth of the rural households in Aba County, Sichuan Province, have been allocated one plot of rangeland each for year-round grazing. The ratio of traditional winter pasture was around 30–40% of total useable grazing lands. However, in the Aba Prefecture in ETP records for rangeland contracts, about 55% of allocated rangeland was cold season pasture. This means that some traditional summer pasture has been leased to herders in the name of winter pasture.

### 16.2.2 Rangeland Enclosure: Main Policy Items and Local Practice

The Rangeland Law of the People's Republic of China (1985, revision in 2002) articulates that all China's rangelands belong to the state, except for those having legally assured collective ownership. It has also regulated for the first time that state or collectively owned rangeland can be authorized to all-people-owned units or collective economic bodies for protection, construction and proper uses, which can

Table 16.1 Rangeland grades and the productivity of standard *mu*

Sites	No. of rangeland grades	Equivalence to standard <i>mu</i> , starting with grade 1	Green forage per standard <i>mu</i> (kg)	Percentage of standard <i>mu</i> in the county's useable rangeland (%)	Carrying capacity per sheep unit ( <i>mu</i> )	Average rangeland allocated to per person ( <i>mu</i> )
Hongyuan, Sichuan	6	1.4, 1.2, 1.0, 0.8, 0.6, 0.4	360	67	5	270–350
Ruoergai, Sichuan	4	1.0, 0.85, 0.65, 0.5	360	64	5	220–250
Maqu, Gansu	3	1.0, 0.9, 0.75	400	3	7.6	230–300

Source: Adapted from Yan et al. (2005)

*mu* is Chinese land measure and 15 *mu* equals 1 ha

then further lease the rangeland to individual households or household groups within its managerial territory. It is firmly believed by the decision-makers that privatization of pastureland should make herders more responsible for limiting their herd sizes and investing in rangeland improvement for sustainable use. The law has legalized rangeland enclosure, but did not give any instructions on how. Rangeland policy actually followed the great success of cropland privatization in China, without conducting in depth research on the differences of traditional management patterns and uses of these two types of land, or the heterogeneous nature of rangeland.

People living in pastoral areas nevertheless did their best to allocate rangeland within a village, which is the legal unit in dividing rangeland. Hongyuan County was in the first batch of 25 experimental counties to allocate rangeland to individuals in China. The pilot experiment allocation was carried out in two villages in Longrang Township near Hongyuan County Town, where there was good pasture and abundant water resources. Experimental rangeland allocation was then quickly extended in Hongyuan, Ruoergai and Maqu Counties, and massive rangeland distribution was done throughout ETP in 3 years time from 1996 to 1999. People applied standard *mu* to balance rangeland quality and quantity in the distribution process. One standard *mu* rangeland produces certain amount of forage, which means one actual *mu* of good rangeland with higher productivity is calculated as more than one standard *mu*, and vice versa. Grade levels and green forage productivity per standard *mu* were not the same in those three counties (Table 16.1).

The process of rangeland allocation in ETP mostly entailed, first, classifying and calculating the amount of village rangeland on a topographic or sketch map; second, calculating how much area each household could get according to their own agreed allocation criteria; third, having one representative from each household draw a numbered lot that matched a locality on map; fourth, allocating rangeland on map or in the field based on the locality and calculated area; and lastly, certifying each family's contracted area of rangeland by local government. The average rangeland area allocated per person ranged from 15 to 20 ha in ETP in different villages.

Rangeland allocation criteria included the number of family members at the time, number of livestock in 1982 when it was privatized (or occasionally that of the rangeland allocation time), the productivity of rangeland and the location of pastureland based on traditionally seasonal uses, but ratios of the weight varied between the different villages. Whilst many complaints and disputes emerged during the allocation process, it just went on, and most of the distribution results were non-changeable.

### 16.2.3 Local People's Perception About Rangeland Enclosure

Pastoralists' complaints about the rangeland allocation process in ETP were mainly with regard to the unfairness due to the rush without careful planning or assessment. Mr. Chike, a 65-year-old herder (in 2002) in No. 3 Village of Longrang Township, Hongyuan County, related the story of rangeland allocation in his village. Some experienced herders were firstly invited to look over all their available rangeland resources on horseback and give rough evaluation by classifying pasturelands into three grades. Much of pasture (or say usable rangeland) was categorized by them as the third class, but supervising leaders from the county town said later that there was far too much third class and revised a lot of the land into the second class. They used only 3 months from rough pasture evaluation by experienced herders in May to completing village rangeland allocation in August 1996. People responsible for rangeland allocation were not experienced, yet mistakes made in the process were not corrected. In the process, not enough consideration was given to the elevation or traditional uses in rangeland division, which resulted in some family contracting traditional summer or autumn pasture for year-round use – Huaerdeng family in the village, for instance, contracted over 2000 *mu* of pasture all of traditional winter pasture and they had to escape their own heavily snow covered land to rent pasture in lower area of 3,500–3,700 m every winter. In the same village, three *mu* of shrub land was calculated as one standard *mu* for allocation at the beginning, but it changed to two *mu* shrub land for one standard *mu* later on in the process due to insufficient pastureland being available for allocation. In No. 2 village of the same township, people also complained about the rush in rangeland allocation, going from a rough sketch map to unclear boundaries in the field. In Xiaman and Axi Townships of Ruergai County, herders' complaints focused on water resources availability, where 80% people and livestock faced drinking water shortage after rangeland allocation.

Local herders' reaction to the rangeland privatization policy itself has been diverse and dynamic. Generally speaking, a rich family with large number of livestock hardly appreciates the policy, whilst a poor family either hates about being more marginalized in remote areas through unfair rangeland allocation or embraces it welcomingly if they contract good size and location of pasture. After the rangelands had been allocated, rich families with big herds started renting other's pasture for livestock grazing. So it actually would benefit poor families and would narrow

down the wealth gap, if the distribution itself was open and fair. Most of the herders interviewed, rich or poor, mentioned increasing boundary conflicts after rangeland allocation, especially when boundary fences were not available. Many herders told about increases in cases of stolen livestock after rangeland allocation because of separating herder families by living far from neighbours. However, the majority of herders still seemed to support rangeland enclosure/privatization for the following reasons: (1) it promotes equitable access to rangeland, (2) poor families can rent out their land as an alternative source of livelihood, (3) it enhances herders' ownership and responsibility towards managing rangeland, (4) it is easier to manage a smaller area and (5) it reduces labour requirements for pastoral production and restricts livestock from running about and losing weight.

Herders who did not like rangeland allocation grouped themselves together by close kinship or neighbourhood to share their pasture, but lots of such voluntary small household groups eventually split up in the last 15 years except in the places where fencing is not available or feasible. For instance, people still practice community-based rangeland management in Upper and Lower Reer Villages of Tangke Township, Ruergai County where fair rangeland allocation is practically not feasible. People do not acknowledge that rangeland allocation *per se* can improve ecosystem, since, they argue, the same number of livestock is still in the same area after rangeland allocation, only rich families have choices of over grazing on own or rented pastures if not reducing their herd size.

### 16.2.4 Post-Rangeland Allocation Policies and Programmes

Even after the legalized distribution of rangeland in ETP, the ownership of rangeland still belongs to the state, and, therefore, the state government supervises and can readjust the use patterns. With improved understanding of the multiple functions and services of rangeland ecosystem, the Chinese government initiated a number of big programmes in ETP not long after the allocation of the rangelands to promote integrated pastoral development and proper rangeland management. In 2000, the State Council initiated a national project to force the return of non-productive sloping croplands to forests and rangelands in head water areas in 2000, for which semi-pastoralists received compensation of grain, cash and seedlings or seeds annually. This was followed by another national project on convert degraded grazing lands into grasslands from 2003 to 2005. For implementing the second project, all severely degraded rangeland was supposed to be fenced to restrict or ban livestock grazing. In return, pastoralists get compensation in the form of cash and/or food. By the end of 2008, rangeland periodically or permanently banned from livestock grazing in China reached 9.9 million hectares or a quarter of the total.

The Chinese government spent a huge amount of money on controlling livestock grazing in rangelands, but the results of this outlay are questionable. The government subsidized herders with an amount of 173.25 Yuan in 2002–2004 and 210 Yuan in 2005–2006 for fencing 1 ha of rangeland, and annual fodder

compensation of 82.5 kg grain per hectare or equivalent cash. From 2005 onwards, the state council has further increased restoration compensation to 300 Yuan per hectare rangeland, of which 70% is provided by the central government and the rest 30% is to be covered by local government and individuals. Meanwhile, herders could also receive 150 Yuan seeding fee per hectare for top sowing. In an extensive field survey on herders' perceptions about the programme in the summer of 2007, most of herders interviewed in ETP were not clear about the programme, and many of them thought the government subsidy was for poverty alleviation. As for the grazing ban either for year round or for the grass growing season, it did not seem to be very effective either. For instance, even around newly developed moving sand dunes in Hongyuan and Ruorgai Counties along Baihe (White River) and Heihe (Black River), we still found livestock grazing on supposedly grazing-free desertification rangelands. Local herders told us during interviews in summer 2007 that they were never strictly requested by anyone to ban grazing from sand dunes in their contracted rangelands.

## 16.3 Pastoral Settlement Programmes

### 16.3.1 Settlement on Individually Contracted Rangeland

Traditionally, most of herder families/households in ETP had their own simple winter shelters that were located on the warm and lee side of the foothills. The frame of the shelter was normally made of bush branches or sod layer blocks, which was covered with yak dung or clay to keep the heat in. The herders would stay in their winter camp from November to next April and then move to warm pastures from May to October (Richard et. al. 2006). Policy makers and scholars living in lowlands regard the traditional nomadic lifestyle as backward, something that needed improvement. As a result, massive programmes were initiated in ETP and throughout pastoral China to settle down herders in permanent houses.

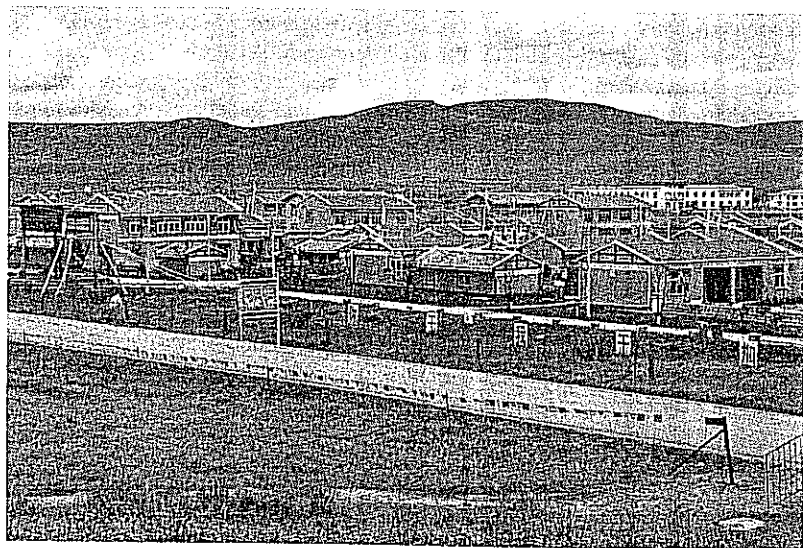
The early pastoral resettlement programme in ETP encouraged herders to build permanent houses on their own long-term contracted rangeland. Integrated pastoral development programmes called '*san peitao*' (three constructions' package), '*wu peitao*' (five constructions' package) or alike were initiated in 1996 to couple with rangeland distribution. The major focus of '*san peitao*' programme implementation in Hongyuan County was that all the herder households were to build up their own facilities including house construction for people, barn construction for livestock and forage construction including a shed for hay storage and fences on their winter pasture for winter grazing. Local governments provided no-interest or low-interest loans and subsidies to encourage herder families completing construction within a short period of time. By 2001, over 90% herder families in Hongyuan County has completed the building of a house, barn and shed on their own contracted land, and

the materials used ranged from locally available resources to steel cum concrete. The result was that for the first time in ETP, herders did not have to save their valuables only in the form of livestock or small and easy-to-carry items such as expensive clothes and ornaments, but bought heavy furniture and electronic goods to put in their own houses. They could watch television like other settled people do, and they appreciate the fact of being able to sleep in dry and warm beds which is good for the many rheumatic sufferers especially for the elderly generation. A noteworthy problem was that many herders had to build their individual houses on newly contracted rangeland even far from neighbours, which led to difficulties in services and market access and increased risk to livestock security.

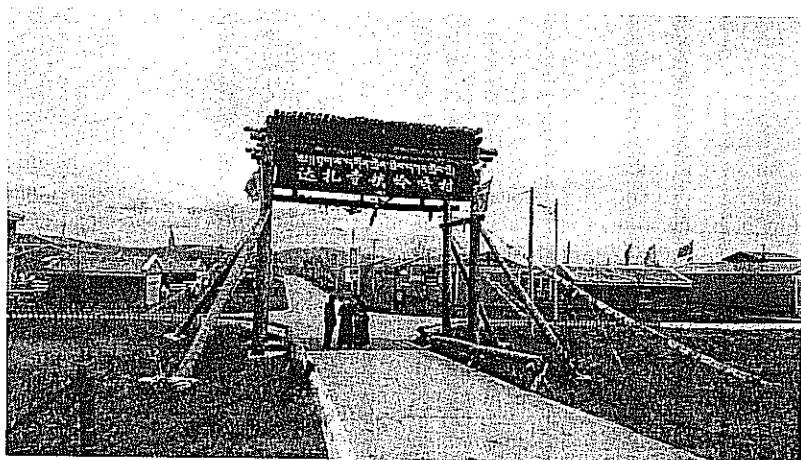
### 16.3.2 Resettlement of Pastoralists in Local Rangelands

A completely new Pastoral New Village (PNV), consisting of 120 two-storied concrete houses and a Village Committee Centre, was built in Waqie Township of Hongyuan County in 2001–2002 as a provincial demonstration trial. The new houses had advanced facilities such as tap water, metal stove, flush toilet and television and telephone cables. During that time, only two hotels in Hongyuan County town had such facilities, whereas the county town residential apartments did not have toilets attached. Each building of the PNV cost about 90,000–200,000 RMB Yuan (some 11,000–24,200 USD) depending on size. Herders from different villages of Waqie Township were encouraged to buy the new houses by paying about one-fifth of original cost and taking about same amount of loan (interest subsidized by the government). This was not very attractive to all herders since the cost was tremendously high for them, yet many had just built self-contained constructions on their own contracted pastures and had spent most of their savings if not all. Besides, the herders liked or had to stay close to their herds on rangeland instead of clustered concrete buildings.

Before Waqie PNV was completely built up, Sichuan Provincial leaders pinpointed that pastoral life needed qualitative improvement and that the general pastoralists should live a modern civilized life. The main leader requested putting overall efforts in improving economic, social and infrastructure conditions of pastoral areas, through the construction of Pastoral New Villages (Photo 16.1). At the same time, it was planned to build up at least one high-standard demonstration PNV in eight pastoral counties in Sichuan Province within 2 years time, so that to extend the demonstration effects. Another PNV construction in Hongyuan County started in 2002 in Anqu Township. PNV buildings were soon becoming popular not only in western Sichuan but also other pastoral places in ETP (Lu et al. 2009). Many new PNVs have been built in the following years to provide herders better living condition (Photo 16.2), but people were not all settled, and the main labour force of each family still move in tents with their livestock especially during summer.



**Photo 16.1** Linga Village, a new settlement that was built for Tibetan pastoralists in Ruergui County, Sichuan Province, in 2009. In order to improve the living and productive conditions of Tibetan herders, many new settlement clusters were established in pastoral regions of western Sichuan since 2008 under the support of national and provincial governments (Photograph © Sun Geng)



**Photo 16.2** The gate of Linga Village, Ruergui County, Sichuan Province (Photograph © Sun Geng)

### 16.3.3 Resettlement of Pastoralists at Different Location

Some PNVs were also built under resettlement programmes to move herders away from badly threatened but ecologically vital rangeland ecosystems. In Gansu province, the construction of high-standard PNVs was to move pastoralists away from degraded rangeland or key conservation areas such as core zone of a Maqu National Wetland Preserve. From 2004 to 2009, 62 new PNVs for 6,375 households, costing 5.28 billion Yuan on over 27,000-square-metre house constructions were built in Maqu, Luqu and other four neighbouring counties in Gannan Prefecture of Gansu Province. Qinghai Province has also resettled thousands of herders from the watershed of Three Rivers (*Sanjiang yuan*), namely, the Yangtze, Yellow and Mekong Rivers. Qinghai provincial government subsidized 30,000–80,000 Yuan (some 4,615–12,308 USD) to each family for construction costs in town, whilst subsidizing a herder family 3,000–8,000 Yuan (462–1,231 USD) annual fodder and forage compensation fee for an initially determined 5 years (Chen and Luo 2009). Chen and Luo (2009) also reported a total of 30.16 million Yuan (4.64 million USD) to be spent in Duoma County of Qinghai Province to move out 1,800 people of 388 household that would ban livestock grazing from 372,000 ha rangeland (or a reduction of 110,000 sheep unit) in 2003–2004. Many of the migrants, resettled in a completely new area, had to abandon pastoralism, by receiving least income insurance as urban citizens do.

We have no statistics on the number of PNV sites built in ETP or how many herders have been affected in the last 10 years or so. In the nation's 11th Five-Year Plan (2006–2010), a number of new policies were made focusing on rural development, especially the improvement of agricultural production and rural infrastructures including housing. From 2006 onwards, China has exempted all agricultural taxes and spent an ever-growing amount of money (300 billion Yuan 2005) in supporting rural development. By the end of 2008, the average living area of Chinese rural residents reached 32.4 square metres per person, of which 34.3% is concrete and 58.8% wooden-brick buildings, and 17.5% houses had flush toilet (MOA 2009).

## 16.4 Dilemma on Pastoral Development and Discussion

Throughout history, pastoral and non-pastoral stakeholders all over the world often adopt extreme positions because they have been shaped by different cultural and environmental exigencies and therefore subscribe to different paradigms of development. China has long been dominated by agricultural societies and the pastoral sector has always been considered only as one small part in agricultural policies and programmes. As a result, rangeland policies are being made and implemented by people who do not necessarily recognize or appreciate indigenous pastoral systems, nor seek to understand the interaction between pastoralists and environment under dynamic climatic and socio-economic constraints. The intention of policies on

rangeland enclosure and resettlement to convert nomadic pastoralism to a ranching system through rational use of rangeland resources, has caused an obvious paradox since policies in favour of individual usufruct rights and sedentarization do not really favour sustainable rangeland management in the Tibetan Plateau.

#### 16.4.1 Economic Viability

Livestock production is the foremost important means and in many cases the only feasible way to sustain people's livelihoods in the Tibetan Plateau. Total income contribution of pastoralism to China's overall GDP is rather small. In Sichuan Province, for instance, pastoral and semi-pastoral western land produces only 5% of the provincial GDP. Before the end of 1990s the investment of central and local governments in rangelands mainly aimed at its animal products without any appreciating its crucial ecosystem functions. There were little government inputs in China in rangeland from 1950 to 1977. From 1978, when the country's opened up to a more market economy till 1999, central government invested annually less than 2% Yuan per *mu* of rangeland (less than 5 USD cents per hectare). Even today, with an increasing input since 2000, the investment has been far from enough to stop rangeland degradation and desertification.

Whilst there is no question that winter pasture allocation has contributed to improving income for some households in the region, the vast majority of inputs require heavy subsidies from the government. Demographic and economic changes are triggering adaptive responses in nomadic societies of the Plateau, such as towards market-driven livestock production; thus, traditional barter economies and associated systems of cooperation are declining in importance, especially those adjacent to population centres, increasing reliance on cash income and widening the gap between rich and poor (Wu 1997; Miller 1998).

The investment required for fencing and house construction is a big amount and often too costly to herders. The cost of a settlement programme requirement for building a house for people, a barn for livestock, a shed for hay storage and fence on their winter pasture ranges some 30,000–70,000 Yuan. Very few households, mostly those having contracted pasture along main roads, are selected as demonstration families, who get a significant part of their cost subsidized by the government and have relatively easy access to long-term credits. The majority of other herder families, on the contrary, can barely afford all the required construction costs. The cost for resettlement is much higher than settlement, which ranges from 70,000 to 200,000 Yuan including basic living facilities. Governmental investment in pastoral settlement, resettlement and grazing ban has been increasing in last one decade, but never was it enough to cover all herders' costs. For those people resettling in a completely different place, they need also to invest in starting a totally new life, which could be mentally and financially a lot more costly than physical resettlement facilities.

Meanwhile, the cost-effectiveness of facilities like fencing on the Tibetan Plateau is questionable. At some extent, fencing winter pasture and developing artificial

pasture for supplementary foodstuff could help increase livestock off-take and pastoral incomes through more intensive management. Due to climatic and topographic constraints, however, the grass growing season in the Tibetan Plateau is from May to September, yet the livestock have to spend lot of calories to cope with winter cold. Therefore, both primary and secondary productivity of the Tibetan Plateau is low, with a carrying capacity of 1 ha pasture for two sheep unit even in the most productive ETP. Such natural restraints have decided that it is impossible to apply advanced ranching system technologies to enhance pastoral production on the plateau as lowland decision-makers wish. When the fencing scale is too large that becomes only boundary marks of allocated pastures, the investment is difficult to balance by any economic outputs of pastoral production. Moreover, the cost-effectiveness is not necessarily commercialization per se. Rangeland is rather a complex ecosystem with multiple functions that provide various ecosystem services to the wellbeing of people living locally and downstream.

#### 16.4.2 Ecological Feasibility

For thousands of years, Tibetan pastoralists have kept their livestock and stayed in harmony with rangeland ecosystem, through flexible responses to short-term variations in climatic conditions particularly in the way of mobile livestock grazing. They evolved a system employing migratory, semi-sedentary and deferred grazing practices to produce ample quantities of animal products for their own households and for trade. Chinese government officials and researchers all confess that the nation's pastoral production enhancement oriented policy approaches from 1960s to 1970s, such as plough of rangeland, draining up wetland and blindly increasing livestock numbers, have been harmful to rangeland ecosystem. As for the ecological effects of rangeland enclosure and application of forage improvement technologies, there are debates. Wu and Du (2007) reviewed different authors' reports of 68.5–158.3% increase in the productivity of palatable species by fencing alone, but scholars (Wu and Richard 1999, Yan and Wu 2005; Yan et al. 2005) argued that rangeland enclosure cause ecosystem fragmentation and the constraints in wildlife movement and seeds disperse. Besides, depopulation areas and the reduction of livestock stocking levels might result in pronounced changes in ecosystem functions and dynamics in the Tibetan Plateau (Dong et al. 2007, 2011).

The Tibetan Plateau rangeland ecosystem has been increasingly recognized as a priority eco-region for conserving biodiversity because of its highly distinctive fauna and flora species, ecological processes and evolutionary phenomena. This eco-region is the headwater environment for many major rivers, and what takes place in these rangeland landscapes has important implications for billions of people living downstream. It also plays an important role in climate change. Main policy concern about rangeland enclosure and pastoralists settlement is to enhance rangeland ecosystem health and to impede rangeland degradation and desertification, in addition to improve pastoral livelihoods and living conditions. The importance of conserving Tibetan

Plateau rangelands is beyond all doubt, but the question is to find out how fencing and settlement actually affects rangeland ecosystem and its integrity in the long run, which has to be studied carefully in the context of global change.

### 16.4.3 People's Vulnerability

The pastoralists are generally vulnerable because their livelihood has to depend largely on highly variable climatic conditions. In traditional ways, livestock in the Tibetan Plateau grew in an annual cycle of 'replete in summer, fat in autumn, emaciated in winter, and shattered in spring'. Adult livestock (yak, Tibetan sheep and goats) lose about 20–40% of their body weight during an ordinary cold season, when many animals, particularly the weak ones, die in severely harsh winters especially when there is heavy snow disaster at the end of winter or in the early spring. Risk imposed by environmental conditions is always a factor in meeting animal demands and livelihood needs in a pastoral system. Pastoralists have to learn to cope with the changes and to mitigate risks and avert disasters, but even so it is not uncommon for a family to lose most or even all of their livestock during a heavy snow disaster (Wu and Yan 2002). The need of grazing animals to be productive and to survive well must continually be balanced with the availability of feed, water and shelter. In this aspect, fencing winter pasture, storing hay and building livestock shed for challenging times can help to reduce herder's vulnerability or exposure to risks.

In the meantime, the surest way of reducing risk in livestock production and ensuring sustainable livelihoods is to maintain flexibility of decision-making in animal production activities, mobility of adapted animals and access to a variety of spatially and temporally distributed resources. The policy-induced enclosing of rangeland has restricted livestock mobility from searching for grass and water in a reasonable scale, which indeed increases herder's exposure to uncertainties and risks in still climate-dependent livestock production systems in the Tibetan Plateau. Likewise, government-forced reduction of herd size is good for sustainable use of rangeland resources on the one hand, but it destroys herders' traditional way of insurance on the other – herders used to keep large herd sizes as a means of insuring more survivals from disasters (Wu 1997).

## 16.5 Suggestions and Way Forward

China's first priority for Tibetan and other rangelands has been clear in maintaining and restoring the ecological sustainability of the rangeland ecosystems for present and future generations, which means that the country is changing its rangeland policy focus from sustaining livestock outputs to sustaining ecological services and a wide variety of goods and values of rangelands. This should however not be at the cost of

local dwellers' suffering, but requires well balancing the diverse economic and social needs of pastoralists along with conserving biodiversity and watershed values.

Rangeland in nature is heterogeneous that requires adaptive management, for which mobile livestock grazing has been proven to be the most effective scheme from African dry lands and more (Scoones 1994; Niamir-Fuller 1999). In this regard, fencing and settlement is not in favour of sustainable rangeland, but we cannot deny that the modernization programmes do help to improve access and services to remote pastoral areas in the Tibetan Plateau. As a matter of fact, mobility of livestock does not mean people cannot be settled. If pastoralists want, they can build winter houses where the old and young can live and easily go to hospital or school, but some people from a family or community should keep taking livestock to different seasonal pastures. Pastoralists should also have their own choices of living a way they like, be it mobile, settlement or resettlement.

There are always numerous uncertainties and risks that can hardly be controlled in accomplishing ecological sustainability into development plans for Tibetan rangelands, especially given notably greater than ever impacts of climate change and globalization. The following features of pastoral systems should thus be acknowledged when sustainability of Tibetan rangeland was planned: the dynamic nature of ecological systems, the significance of natural processes, the uncertainty and inherent variability of ecological systems, cumulative effects, preserved options, indigenous knowledge in natural resource management, conserved habitat for native species and productivity of ecological systems and reduced uncertainty through adaptive management and continuous learning.

Since the end of 1990s sustainable management of pastoral production system and rangeland ecosystem in the Tibetan Plateau has been adopted by Chinese government. From 2011 onwards, the central government has planned to spend an annually *ad hoc* rangeland ecosystem compensation fee of 13.4 billion Yuan for its eight western pastoral provinces and autonomous regions. Other than fencing and settlement programmes or simply giving money to herders, however, it is essential to involve pastoralists in the decision-making process and active actions for an integrated ecosystem. The ecosystem approach focuses on protecting and conserving entire ecosystems and well acknowledges positive roles of people living in it, which identifies specific objectives in relation to scale, social considerations and management.

Rangeland ecosystems of the Tibetan Plateau are not only the concern of local development but also ecological security of China and far beyond. Despite the ever increasing input from Chinese government in subsidizing rangeland ecosystem management in the Tibetan Plateau, it is still not enough to change rangeland degradation trends immediately or significantly. Therefore, more societal efforts and resources should be mobilized in conserving Tibetan rangeland and its multiple ecosystem services through means of carbon trade, voluntary environmental education and protection programmes and international aid.

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## Chapter 17

# Pastoral Communities' Perspectives on Climate Change and Their Adaptation Strategies in the Hindukush-Karakoram-Himalaya

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**Abstract** This chapter is based on four case studies carried out respectively in Afghanistan, Pakistan and Nepal by using semi-structured household interviews. Climate changes, especially rising temperature and more erratic precipitation, are strongly felt by pastoralists and are affecting their livelihoods strategies. Local communities have adapted to these changes, passively or proactively, by enhancing water resources management, changing the temporal and spatial pattern of seasonal migration, introducing drought-resistant crops or animal varieties or diversifying income-generating activities. However, the adaptive capacity of the pastoral communities to deal with the changes has been severely limited by multiple factors.

**Keywords** Climate change adaptation • Hindukush-Karakoram-Himalaya • Pastoral communities • Adaptability • Transformation • Rangelands

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