Modernisation with Local Characteristics: Development Efforts and the Environment on the Zoige Grass and Wetlands, 1949–2005

JACK PATRICK HAYES

Norwich University
Harmon Drive, Northfield, VT 05663 USA
Email: jhayes@norwich.edu

ABSTRACT

The Zoige grasslands (Chinese, Ruo'er gai) on the eastern edge of the Tibetan Plateau are a wetland and grassland region composed of marshes, bogs, wet meadows and shallow lakes interspersed with low hills and sub-alpine meadows. These grass and wetlands are recognised as an important grazing zone for western China, a globally significant biodiversity hotspot and major bird flyway. Since the late 1980s, research on the region has highlighted increasing regional environmental degradation. This study is an overview of the state-led development projects and local efforts to 'improve' local conditions on the grass and wetlands since 1949 and their impact on the regional ecological and social environment. It focuses mainly on historical state-led development projects to study and alter the wetlands, as well as more recent efforts to raise environmental awareness of the importance of Chinese wetlands. Development efforts by the Chinese state have led to both positive and negative outcomes for local Tibetan residents who had little or no say in modernisation efforts until the late 1980s, but who have received most of the blame for regional environmental problems. Despite recognised problems with water use and wetland degradation, as well as administrative emphasis on fencing, settlement and official land use management in nature reserves, the Chinese state continues to dominate discourse and management of the Zoige wetlands. However, local Tibetans have played an increasing role in regional wetland management. A historical assessment, in contrast to media portrayals and official discourses of the origins of grass and wetland degradation, explains more about the processes of degradation, and with increased local participation, points a new way forward to help in the formulation of more effective policies and mitigation measures.

KEYWORDS

China wetlands, Western China; state-led development, Tibetan environmentalism, Zoige, Ruo'er gai

Environment and History **16** (2010): 323–347.
 doi: 10.3197/096734010X519780

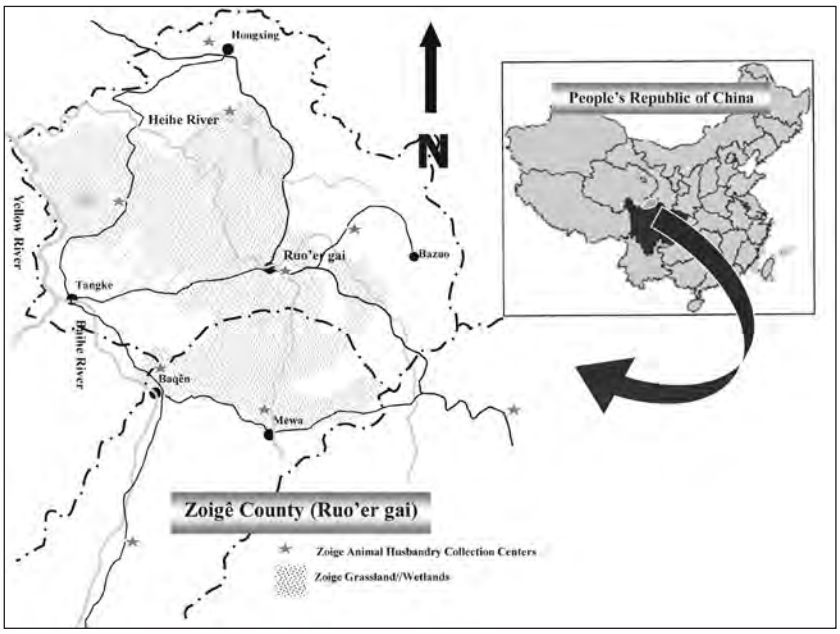
INTRODUCTION

This paper seeks to analyse how key development projects have impacted local Tibetans and landscapes in one region of northern Sichuan since 1949. In particular, it asks questions of how and to what degree these projects have actually helped local Tibetans of the Zoige Grass and wetlands, and how relatively recent policies and programmes, environmental protectionism, and local ecological degradation mitigation projects have transformed the local environment.[1] In order to address these questions, this paper first examines the context of the local Tibetan economy and government programmes prior to 1949. It then examines the key socialist programmes of the 1950s, 1960s and early 1970s that set the stage for most of the contemporary development and environmental programmes in the region – in particular, issues related to state sedentarisation programmes, water control projects and grassland creation, and herd expansion. It then examines the expansion and creation of new development programmes tied to rangeland privatisation, infrastructure development, and environmental protection and eco-tourism in the wake of the political and economic reforms of the 1980s. Finally, it takes a more careful look at how, in practice, tourism and state and grassroots environmental protection programmes have affected and been utilised by local Tibetans in both positive and negative ways.[2]

Much of Chinese literature on the region and its grassland issues emphasises national and provincial programmes at the expense of local and grassroots developments. This literature has emphasised fencing and sedentarisation of pastoral households and is premised on the idea that the industrialisation of natural resources (including pastoral resources in western China) can only be coordinated by a more economic and individual management of grasslands by a settled population. Chinese scientific literature on the grasslands has developed a baseline of data on the region, but tends to focus only the past twenty-five years.[3] While the development programmes in question have impacted the northern Sichuan in general, the majority of examples in this article relate to Zoige County in northern Sichuan Province, People's Republic of China (PRC). By examining the historical antecedents to contemporary policies and environmental practices, a clearer picture of the nature of Tibetan and state roles in environmental degradation comes to the fore. It also points out productive ways in which both state and local environmental and landscape degradation can be tackled in a less supervisory, contentious, or potentially problematic manner.

THE ZOIGE GRASSLANDS-WETLANDS AND ENVIRONMENTAL DEGRADATION

The Tibetan Plateau is one of the world's major rangeland ecosystems and the largest pastoral area in Asia.[4] With rangeland accounting for almost 70 per cent



MAP 1. Ruo'er gai/Zoige County and China

of the regional total area or about half of China's total rangeland area, the Tibetan Plateau in China is home to approximately 2 million Tibetan pastoralists, some 3 million agro-pastoralists, and it supports a population of over 10 million yak and 30 million sheep and goats.[5] Cold-tolerant livestock grazing by Tibetan herders and agro-pastoralists has been the dominant land use regime for the region for the past 1000 years.[6] In the last 55 years, the rangeland management regime of the Tibetan Plateau, as in other areas of China, has undergone significant policy changes. It is now widely accepted that the rangeland deterioration on the Tibetan Plateau is more severe than ever before, even though the extent and causes of it are contested.[7]

The lakes, wetlands and mires of the Tibetan Plateau make up China's largest 'intact' wetlands.[8] These wetlands, like others in China, and the diverse species they support, are under constant threat of deterioration, mostly associated with human development pressures. The Zoige grass and wetlands are located in north-central Sichuan near the Gansu Province border and at the first major bend of the Yellow River. The Yellow River and its major branches in Zoige County (the Baishui and Heishui Rivers) meander thought the area and create one of the world's highest-altitude marshes. Its ecosystems are characterised by variety, sensitivity and uncertain successional trends.

The Zoige wetlands and grasslands of northern Sichuan cover an area of 19,600 km^2 and average elevation in the Zoige highlands (*Ruo'er gai gaoyuan*, chi.) is 3400–3600 m. About 48 per cent of Zoige Basin rangelands are marshlands, and Zoige County in the basin centre has about 79 per cent of its rangeland as marshland, 76 per cent of which can be used for livestock grazing.[9] Small lakes, connecting streams and bog and fen once spread all over the Zoige wetlands, especially along the lower Heishui River, '…like stars in the sky and scattered like the pieces on a chessboard'.[10] However, the current wetlands are much smaller and concentrated in north central and west central Zoige County, with man-made and water cut canals draining significant portions of the overall Zoige grassland and wetland basin [see Map 1]. Although the Zoige region is relatively more productive and populated than the rest of the Tibetan Plateau, it is still one of the most sparsely populated areas in China, with only 125,000 people on over one million hectares of rangeland. It is also one of the poorest marginalised and remote areas of China. Zoige County itself (the core of the Zoige Basin wet and grasslands) has 19,400 people and 1.12 million livestock. Approximately 83 per cent of the local people are Tibetan pastoralists who have depended for family survival on water and grassland health to support their herds. The annual per capita income of local people in Zoige County was approximately 1600 *Renminbi* (RMB) (US $194) in 2001.[11]

Many claims have been made regarding overgrazing and degradation, particularly the perceived link between upper basin degradation and lower basin flooding, leading to a number of policy initiatives over the past 50 years, and more recently a timber ban though the upper Yangtze and Yellow River basins[12] and enactment of environmental legislation to relocate pastoral populations out of the upper watershed areas.[13] In the process, several causes for Zoige grassland and wetland degradation have been proposed, including: 1) a drying climate,[14] 2) in-migration and population increase,[15] 3) increases in burrowing rodent populations due to ineffective control and rampant hunting of predators,[16] 4) increasing concentration of livestock near winter settlements,[17] 5) reduced mobility due to restrictive pasture tenure laws,[18] and 6) breakdown of traditional regulatory mechanisms.[19] All but the first have been strongly influenced by policy initiatives enacted between 1956 and 1998.

In many Chinese policy studies of environmental degradation related to the Zoige grasslands, Tibetans have received much of the blame for changes in their local environment and rangeland degradation.[20] Zoige Tibetan herders are certainly linked directly to some of the practices and policies that have degraded the grass and wetlands, but in primarily blaming a local ethnic group for regional problems, the Chinese state has missed their own significant role in instigating, leading and continuing some of the more problematic policies.[21] Recent policy and development studies have also largely overlooked local initiatives since the 1990s to help address and attempt to mitigate some of the problems of local land degradation. At the same time, certain state-level initiatives like the protection

of wetlands as national nature reserves have also helped to mitigate some local problems. However, the state approach, combining a history of social surveillance with more recent environmental protection and limited deregulation,[22] part of China's new western eco-culture[23] has done little to engage local Tibetans in sustainable management.[24] As shown below, approaches that engage local Tibetans in degradation mitigation (as the group Green Camel have done), or allowing local Tibetan communities to continue traditional regulatory mechanisms that control herd expansion, water rights, and wetland conservation seem to have had equally or more positive outcomes.

TIBETAN PRACTICES, DEVELOPMENT PROJECTS AND STATE POLICIES IN HISTORICAL CONTEXT

Tibetans have lived and herded on the Zoige wetlands and grasslands for over 1000 years. Since the late sixteenth century the region has been characterised by widespread nomadic herding practices, limited agriculture along the banks of the Baishui and Heishui Rivers, small scale regional trade of traditional medicines to China (via the Sichuan Basin) and Tibet (via the Aba region), and a thriving local trade in animals, medicinals and local foodstuffs. In order to support the extensive seasonal animal pastoralism in a harsh summer/winter climate (annual temperatures in the Zoige basin range between -25° and 28° Celsius), local Tibetans historically used fire to clear regional timber for summer and winter pasturage on the grasslands, and cleared much of the surrounding mountainous terrain on south-facing slopes. Prior to the 1950s, local herding depended on a careful rotation of herds of yak, sheep and goat between the winter basin pastures along water courses, late spring and early autumn hillside and basin pastures, and summer high-meadow pastures in the mountains.[25] While grass and marshland have dominated the landscape of the modern Zoige Basin, this was not always the case, as a few relict stands of juniper and recent paleoecological research show that many more forested areas and brushy steppe ecotones once existed in the region.[26] The basic landscape, a clear grassland and wetland region, was fundamentally shaped by hundreds of years of Tibetan herding and burning practices that continued well into the twentieth century. However, there was little if any attempt at water or hydrology management in the marshlands, and the waterways of the region worked more as a hindrance to outside control and expanding herd sizes.[27]

By the late eighteenth century, long distance animal trade between the region and wider China expanded with an influx of Hui (Chinese Muslim) and Han Chinese settlers in the northern and southern-most parts of the region. This led, according to Qing Dynastic sources, to some expansion of local herd sizes as well as a Chinese state presence (however marginal it may have been).[28] Local governance was limited to regional headmen (*Go'ba*, Tibetan, hereafter tib.;

tusi, Chinese, hereafter chi.), local monasteries and their leaders who helped determine the rotation of herds into and out of the basin, collected a limited amount of local taxes, and largely ignored the regional Qing officials located many miles to the north (Xining) and south (Songpan). Until the 1940s, little changed in the region in terms of local land use, governance and agro-pastoral pursuits, even though the wartime Nationalist government of Jiang Jieshi did carry out several animal herd surveys and attempt to create a new policy structure to increase local trade and ties with the Sichuan Basin.[29] While there were increasing attempts to govern the region by Chinese authorities, it was remote enough and lacked the road infrastructure to effectively control or often even impact local trade and conditions.

The generally limited economic trade from the Zoige region, as well as its links to the Chinese government and national policy radically changed in the 1950s. For the first time, after 1953–4 (when the region was incorporated into the new state) the Zoige basin and its peoples came under state level scrutiny. In the 1950s, the new socialist government of Mao Zedong successfully carried out a policy of incorporation and administration, state-led social, economic and infrastructure engineering of the grasslands and Tibetans. After 1953 the Chinese sent so-called 'work groups' to Zoige and gradually set up a network of small administrative centres at different strategic points.[30] The new state then carried out land and herd redistribution (taken largely from local headmen and monasteries), built new and better roads into the area, created health clinics and veterinary centres (mostly in tents), new jobs, and allowed some local Tibetans into the fledgling government. These development projects served both local people and the state, in that the PRC government proceeded at the same time to rename local landmarks and station ever increasing numbers of military troops and state administrators in the region to bring Zoige into the national administrative fold. State officials also endeavoured to further incorporate the region more tightly into the wider national economy by shipping larger and larger numbers of livestock out of the region to southern and central provinces from the new administrative centre based in Zoige County Township (modern Ruo'er gai town). The expanded infrastructure, particularly roads, was completed using military and local resources. Initially, these development projects were well received in the Zoige region. However, as local Tibetans became increasingly aware of and opposed to growing Chinese influence, they finally joined the on-going Khampa Tibetan revolt in 1958.

In the 1960s, there was a less successful and more antagonistic kind of 'high modernism' that further incorporated the region into the wider economic and administrative networks of greater China. In 1958, the socialist government enthusiastically launched a new national campaign, the Great Leap Forward (1958–60). However, this campaign, which called for the quick modernisation and industrialisation of the countryside, together with the idea of gaining local autarchy, turned out to be a disaster for the Chinese economy, because its provi-

sions were blindly applied regardless of feasibility and local conditions.[31] As the government started to rectify these mistakes, the Cultural Revolution (1966–76) pushed the country into a new state of anarchy and turmoil.

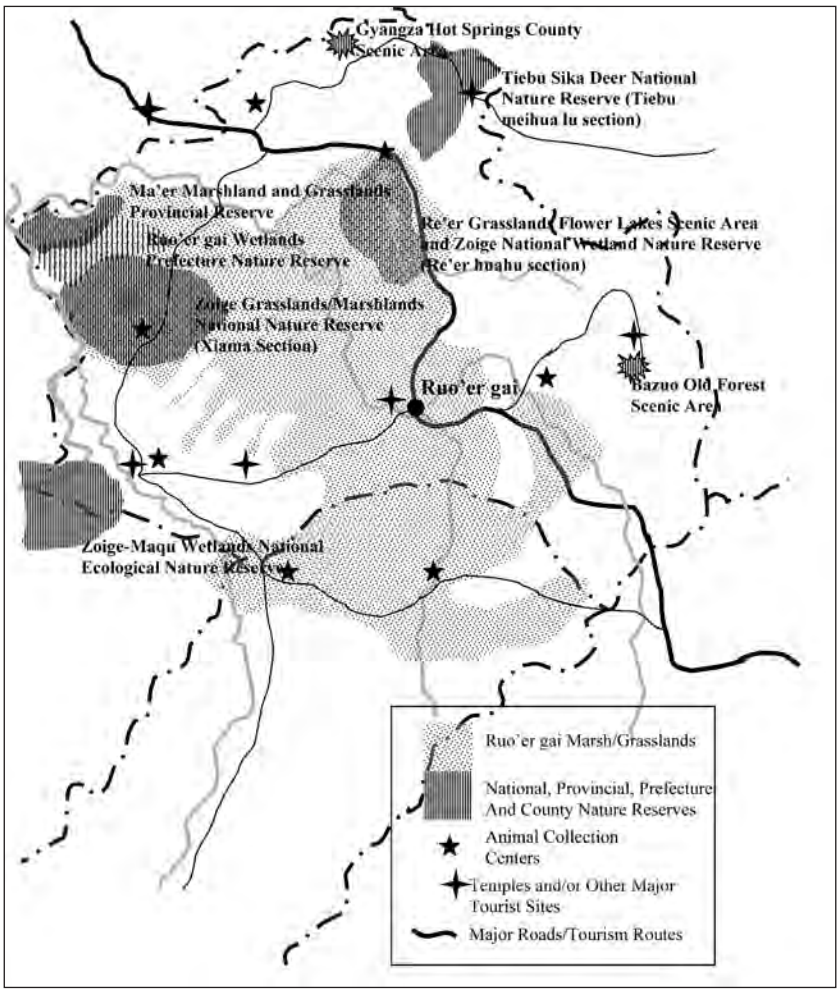
In Zoige Basin, where the Chinese had to quell part of the wider Khampa Tibetan revolt of 1958–60, the Great Leap Forward and the Cultural Revolution later on served as ready means to further consolidate China's rule over this fractious region. The early Chinese efforts at economic modernisation in the Zoige wetlands and grasslands proved very problematic. In the late 1950s, government sources indicate that over 40 per cent of regional livestock were lost in the Tibetan revolt and through a combination of negligence, mismanagement, and the establishment of unviable agricultural and animal husbandry farms and factories that ignored the realities of local summer and winter conditions.[32] For example, new pastoral farm units (*mucheng*, chi.) based on new pastoral collectives (*jiti muye*, chi.) were created in a very few locations convenient to new, local roads that put greater and greater pressure on area grasslands. The grasslands around these units were quickly desertified. Few attempts were made to set up large scale meat slaughtering and packing facilities in the 1950s and 1960s, so a limited amount of the animal products actually made it out of the region – but these were at the same time made unavailable or unpalatable for local consumption. After 1958, the Zoige Basin collectives began to suffer from famines for the first time.[33] With the onset of the Cultural Revolution, the overall situation in the area deteriorated even more and intensified 'class struggles' that specifically targeted Tibetans led to further economic and social problems. In particular, many Tibetans were pulled from managing their herds into 'patriotic re-education' sessions that left fewer and fewer individuals managing larger and larger collective herds. Local and regional reports admit that even in the mid-1960s, land degradation was an increasing problem for the Zoige Basin around its county centre and larger animal husbandry centres.[34] The remaining few monasteries and newly founded county and tent schools were closed and private trade was prohibited. Compared to the relatively stable and regionally thriving trade of the pre-1950s period, the first two decades of socialist modernisation witnessed poor state-local relations and considerable retrogression of economic development.

The greatest state-led environmental impact on Zoige marsh and grasslands in the 1960s and early 1970s was the attempt to drain the marshlands for the greater socialist good and increased economic output. At the beginning of the Cultural Revolution a major state study was completed on the nature of the wetlands and ways forward in 'improving' the local 'wastelands'. This study, Chai Jia's 'Marshes of Ruo'er gai Highlands' (*Ruo'er gai gaoyuan de zhaoze*, 1965), provides a scientific study of the nature of the wetlands, their extent, the water volume and hydrological features of the Zoige Basin, and a few policy recommendations to better utilise the wetlands.[35] One of the central elements of his policy recommendations was a project of canalisation of the wetlands that

was approved by provincial level administrators. Work on canalisation started in 1969 as part of the national 'Learn From Dazhai' (*dazhai lu*, chi.) and 'Take Grain as the Key Link' (*yiliang weigang*, chi.) construction and social campaigns.[36] The premise of this project was to increase functional grassland area and decrease mire and bog land (the chief characteristic of the Zoige marshlands) by channelling water from the wetlands into the Baishui and Heishui Rivers. This would not only open up more grassland for larger herds, it would theoretically increase the amount of water flowing in the Yellow River to downstream, drought-prone areas.

While this plan appealed to administrators searching for viable high labour, low cost and material projects during the Cultural Revolution, in practice, the policy implementation ignored another key finding of the same study – that there is no deep artesian water in Zoige but only phreatic (shallow surface) water in the subsoil on top of a deep, impermeable clay formation. In other words, to re-channel the wetlands was to fundamentally reshape the hydrology of the region. The labour used to build the subsequent channel project was almost completely Tibetan, and many of the labourers were being 're-educated' because of participation in the late 1950s Tibetan revolt or because of their social ties to elite Tibetan families or regional monasteries.

In the northern and western sections of the Zoige Basin, the channelisation project of the late 1960s and early 1970s served to fundamentally reroute local hydrology and permanently change the amount of water available to and on the grasslands. For example, in the northern zone of the Zoige National Wetland Nature Reserve [see Map 2], an area of 32,000 hectares composed of five lakes, connecting marshes, streams and springs, the underlying aquifers around the marshes have dropped as much as 10 to 15 metres.[37] As early as 1970, hydrobureau staff and local Tibetans had to start drilling and chipping pumping wells for animals to maintain year-round water supplies in an area that had previously never had any water problems. Three other examples typify how the nature of the water channel project has changed local water tables. First, because the water was channelled into the main rivers, every summer since 1974 has seen the wetland core areas not covered by lakes nearly completely dry up and turn into dustbowls. Over time, this has led to actual desertification (sandification and permanent loss of ground cover) in parts of the northern wetlands near the Yellow River. Second, a major machinery-pumped well dug only 20 metres from the Heishui River near the town of Mewa in the 1970s was re-excavated only 10 years later when it only pumped water if deeper than 70 metres. Finally, and more recently, the Zoige Nature Reserve administration had to build its conservation station and tourist centre inside its core protected zone (nearly on the remaining three lakes of the wetlands) close to a spring and lakes because it could not tap a significant enough source of water farther away. And this despite national environmental regulations that forbid units or individuals to build in core nature reserve zones except for approved scientific activities.



MAP 2. Zoige Infrastructure, 1996–2005

From 1982 to 2004, however, a new set of policies have come to define local land use on the grass and wetlands. In the 1980s, when economic reform swept China, socialist collectives were gradually dismantled and they ceased to function as the primary administrative and economic unit for villages and individuals. At this time, livestock were again redistributed to individual households, but rangelands were still used communally (until 2002). In 1982, the state, citing the success of reforms in the early 1980s like the Individual Household Responsibility system (*ziliushan*, chi.) in agricultural areas, formulated the Grassland Law

and implemented it throughout western China.[38] Land contracts were granted to individual households as a long-term lease (50 years), renewable provided that land management 'was satisfactory', while ownership of the land remained in the hands of the government. The Chinese government justified their continued ownership of land on grounds of the difficulty in providing nomads with social services like education and health care, and in responding to heavy snowfalls and snow disasters that had historically led to livestock losses.[39] The household contracting of the grasslands in turn led to a renewed 'sedentarisation' policy of settling Tibetans in centrally located and roadway-supported locations, first in the 1980s, and more thoroughly in the late 1990s and first five years of the twenty-first century. A third major policy initiative of the last five years has been the fencing of rangeland and grassland conservation (the *Tuigeng huancao* programme).

In Zoige County, herd and rangeland privatisation by the state has led to as many problems as solutions for sustainable land use and local environmental degradation. From the late 1980s, increasing human and livestock populations and redistribution of communal land holdings due to administrative boundaries have led to conflicts over resource use[40] and to subsequent overgrazing in many low-lying and wetland areas as a result of restricting movements of herds and people as more and more households have had to settle on their leases.[41] Furthermore, the majority of locals since the 1980s have had to depend on diverse livelihood practices besides animal husbandry, such as seasonal cropping, trade, migratory labour, tourism and handicrafts. Given this reality, the allocation of grasslands to individual families (and its concomitant settlement) may not be the most efficacious means of ensuring access to pasture resources. What has resulted is a split between gender and age groups working the majority of herding, with women, most girls and some boys, and elderly on the rangelands, and men working in towns or beyond the county and elder boys going to school in the county or township schools.

When the herds were contracted to individual households using long-term leases in the mid 1980s, there was little effective control of grazing patterns or stocking rates on the newly 'privatised' lands. Grazing on expanding sand dunes on many of the interspersing hills of the Zoige Basin has accelerated desertification of the hills. The trend in hill desertification, coupled with continued heavy use and dust-bowl effects in heavily drained parts of the Zoige wetland basin represent a further threat to the wetlands of the region. When lacustrine sediment, sand and dust emerge from heavy grazing and animal trampling and from wind action in dry seasons, because of high solar radiation and high sand and ground temperature in the daytime, the displaced sand and dirt burns pressed plants and destroys the top layers of sod, bog and fen. They also blow into watercourses, increasing the amount of sedimentation in local watercourses. Over the past decade, several heavily grazed locations, including previously 'lush' ones, have created and expanded existing dune areas in and adjacent to the wetlands.[42]

Between 1996 and 1998 almost every household in Zoige County was allocated one parcel of rangeland for year-round grazing, whereas many other households in western Sichuan were allocated one patch of rangeland as winter pasture and shared summer pasture with the rest of their household group or 'natural village'.[43] However, these new policies were very problematic for local Tibetans. The result of enlarging the seasonal pastures and parcelling them regardless of traditional grazing patterns prior to the 1950s was that no-one knows the actual ratio of winter to summer pasture after rangeland allocation. Many pieces of land parcelled out to families for winter and spring or year long grazing were soon found unsuitable for winter grazing because of severe or heavy snowfall. Rangeland parcelled out above 3,500 metres or in certain bog/lake locations to individual households in the county proved impossible to use except in summer or deep winter – and the families holding those leases have had to rent (at high rates) lower pastures ever since rangeland allocation in the mid 1990s.

In 1998–9 this was further complicated by the 'Pastoral three self-containing constructions' (*san peitao jainshe*, chi.). This infrastructure, housing and settlement project constructed homes, barns and sheds for Tibetans in Zoige County largely at government expense. However, in Zoige County, most communities already had centralised and electrified winter sites with houses for each family and household. What this programme did was disperse Tibetan communities on to their leased rangeland to graze and care for their livestock – without, however, rural electrification in the majority of rural households. In the process, local Tibetan families also lost easy access to many of the facilities, water and schools in their village-based communities. While the state policy ideal is to continue the process of privatisation, the reality for most Tibetan herders in Zoige is the need for more facilities, for water, electricity and road access. Under the current system (as of 2006), local people are being artificially put into inequitable situations and the lives of some families are becoming more difficult by being settled further from their original home villages.

In Zoige County, where over 75 per cent of the rangeland was on marsh or bog land, parcelisation of the landscape to individual households has caused serious problems with access to and the viability of water resources. Before rangelands were allocated, all livestock were taken to nearby rivers, streams or lakes to drink. At the same time people from a large number of households were also able to share one water source (whether a stream, spring, wetland lake or a well). With privatisation and parcelisation in the 1980s and 1990s and increased fencing after 2000, this was no longer possible. Like other rangeland areas of the world, Zoige County water resources are unevenly distributed due to local topographic diversity or in some cases an overabundance of wetland and lakes. Partitioning rangeland and wetlands into small private parcels and fencing individual lands, especially since 2000, has led not only to a lack of water availability on many private individual lands, but also to difficulties in obtaining water from or through other's lands. An estimated 60–70 per cent of

pastoralists in Zoige County are facing drinking water problems, three times the number that faced water problems before rangeland allocation.[44] Furthermore, household herds are trapped in the same cycle. Some rangelands finished up water supplies (especially on small parcels of land) and householders have to dig wells on their own lands by hand. During the summer season households would generally move their family tents three to six times a year. New wells would have to be dug after each move as old wells would fill up with sediment or dry up because of lower water tables after earlier moves. Fetching water for people and livestock has thus become much more difficult on private lands faced with chronic low water tables and distant surface water sources.

In terms of the general health of the wetlands and grasslands of the Zoige Basin, the policy changes of the 'reform period' have not been particularly kind. Ostensibly increasing numbers of animals on the grasslands, and a slow but debated rise in Tibetan population since the 1970s seem to be exacerbating local land degradation.[45] Herd size expanded significantly under state and then individual management – according to official estimates, from some 345,000 livestock in the late 1950s to over 910,000 by 1998.[46] While these numbers may be problematic (there is no real way to tell the exact number of animals prior to the 1970s and subsequent numbers in the 1980s and '90s are regularly debated), it is commonly accepted by both foreign and domestic academics that herd sizes have increased since the late 1970s – based on tax and sales receipts, increased water use, and increased desertification related to animal grazing (especially goats).[47]

Three examples in particular point to the human causes, both state-led and local Tibetan, in local grass and wetland degradation. In terms of grass and wetland degradation, some of the most severely degraded areas are along or near roads and animal collection points. In Zoige County, there are six major animal husbandry collection locations (*mucheng*, chi.) with another three major ones in the Zoige Basin (in neighboring Hongyuan and Maqu Counties). Zoige is designated as both a milk and meat production zone, which has dramatically impacted herd distribution. Most families want to keep their lactating herds near the road and milk collection points, while the herds of sheep, goats and some yak for meat production concentrate around primary government shipping locations. These individual households (and sometimes whole villages) rent tent sites and pastures from those families who were allocated roadside allotments. The impacts of overgrazing have become quite severe along roadsides near these collection points, and water sources themselves in the areas of collection are not only overburdened, but also face increased pollution from waste products, animal waste and increased human use.

Second, fragmentation of the landscape due to increased fencing has influenced the nature of the wetlands directly and indirectly. Wire fences that use both steel posts and cement pillars have become more and more common on the wetlands and grasslands of Zoige County. Up to 2005, a total of 500,000 metres

of wire fence was installed along the edges of the Zoige Nature Reserve and another 650,000 metres along individual land parcels throughout the county.[48] These fences are viewed by local, provincial and national levels of government as indicators of appropriate animal husbandry technology and socio-economic development. While this fencing may make sense in some parts of the grasslands and hill regions, as well as around the nature reserves, it is redundant in the well-watered areas that make up most of the flat wetlands as most of the domestic animals cannot cross the deeper streams, canals and lakes.

In addition to fencing issues, another element of landscape fragmentation is the renewed burning of tussock mounds in and around the wetlands beginning in the mid-1980s. These tussock mounds retain a great deal of water but, as recent research has shown, in their natural state do not support plant life conducive to grazing.[49] Local Tibetans regularly clear the tussock mounds by fire in the spring, and the county animal husbandry bureau has experimented using disc harrows and ploughs to clear tussocks for more 'productive fodder'.[50] Fencing and clearing tussock mounds impede corridors between patches of wetland in Zoige, leading to fragmentation and drying up isolated small wetlands. Wetland and bog species of grasses and other forbs and the general plant community of the wetlands has been directly impacted by these actions – compared to earlier plant surveys,[51] field vegetation investigation has shown a significant vegetation composition, biomass and height change in the last decade and seen the disappearance of some plant species altogether.[52] Not only has burning and overgrazing been shown to damage the local hydrological system, but fencing and burning have increasingly impacted local wild animal species. Tibetans shaped the Zoige landscape and environment through burning and herding long before the 1980s, but recent developments, in combination with overgrazing and fencing seem to be altering the hydrology of the wetlands not only at a faster pace (leading to desertification and sandification), but on an even wider scale. With herds increasingly fenced in, they have a greater impact on plant and water sources – coupled with burning, previously linked bog and wetland areas have dried up or dry up more quickly after the rain season.[53]

Rangeland privatisation in the 1990s led to a doubling of winter pasturage in the lowlands of the county[54] – settlements and fencing erected by herders for this winter pasturage on previously seasonal and open wetland pastures constrain wildlife activity especially when it is cold. As the wild animals move down from higher elevations in the winter, they have found it harder to access open areas for food when snow accumulation is too deep around their natural habitat. While little is known about the current dynamics and impacts on wild animal species, local herders have taken to killing some of them in winter months to protect forage areas for their own yak and sheep; thus, wild animals like the endangered Tibetan antelope and musk deer, with their own highland nature reserves, are having increasing trouble in the lowlands.[55] Research is ongoing on this issue, but is unlikely that local Tibetans will be willing to give up more

of their rangeland than they already have through expropriation for the core areas of nature reserves.

A third major, contemporary issue with the wetlands and water table relates to well digging. No statistics are yet available to show how many new wells are dug each year to extract perched water from the Zoige Basin. These wells, as previously noted, reach both the shallow water sources from the marshes and bogs and the substrata aquifer deep below the rivers and wetlands. Extensive well digging was started in the wake of the channelisation projects of the late 1960s, and deeper wells excavated, according to local hydrology officials by the late 1980s.[56] Some research has surmised that the Zoige wetlands are naturally drying up due to the Tibetan Plateau's gradual uplift,[57] as the Yellow River is continually cutting deeper and deeper into the basin,[58] and because of global warming.[59] Recent dry years have posed a threat to wetland habitats and to the spectre of increased dust bowls or desertification, and the Zoige wetlands are considered to under moderate to significant threat.[60] With the increase in shallow wells dug since the 1990s under land reform and parcelisation, some researchers believe that water extracting practices are not only exacerbating the situation, but are likely one of the root causes of Zoige wetland degradation.[61]

ENVIRONMENTAL PROTECTION AND SUSTAINABLE MANAGEMENT ON THE ZOIGE WETLANDS

The Rio Conference in 1992[62] played a major role in the involvement of Chinese authorities in expanding protected areas in China and in switching their priorities to a 'sustainable development' model in which resources were to be exploited to meet current needs without being detrimental to the environment or future generations.[63] The Zoige wetlands and environment of western China were no exception. In 1994, the Zoige Wetlands Nature Reserve was created to begin to protect what was viewed as the organic wetland 'kidneys' that keep the Yellow River clean and flowing. Since 2001, the original Zoige wetlands nature reserve has expanded to incorporate not just the three lakes and marshes of central Zoige County, but wetlands to the northwest along the Yellow River, a provincial level nature reserve in nearby mountains (protecting indigenous red deer and snub-nosed monkey populations), a prefecture reserve in the western part of the county, and three multi-use county level protection areas for eco-tourism, environmental protection, and the scenic area of the 'First Bend of the Yellow River'.

Tourism was a significant factor in the creation of the nature reserve system in the region and was seen as a major resource for bringing the area out of poverty. Zoige County has consistently been listed as a 'poverty stricken region' (*jiaqing pinkun diqu*, chi.) since the inception of China's modern poverty alleviation programme in the 1980s. Until 2001, household income very slowly rose to

1,600 RMB (US $194) and well below national norms. Since 1996, under the rubric of poverty alleviation, tourism has been targeted and transformed into the third largest market sector in the county (after animal production and medicinal products production). Increased tourism, both domestic and foreign to the region, has directly contributed to local household income rising to 2,100 RMB (US $254) by 2006.[64]

Most visitors come to the Zoige basin to visit its nature reserves and Tibetan Buddhist monasteries. A total of four nature reserves in the wetlands have been created and marketed to tourist audiences to promote wetland biodiversity conservation and sustainable use. One hundred and seventy-eight plant and 218 animal and bird species have been identified in the Zoige nature reserve and about one-third of the birds and two-fifths of the mammal species are listed on international or national protected bird and animal species lists.[65] The principal endangered species (and tourist draws) in the nature reserve include the black-necked crane, Tibetan antelope and Tiebu-Sika Deer. In addition, some unique plant life and the central lakes of the nature reserves are also a major draw. Important historical, large and relatively wealthy Buddhist monasteries in the area are located at Tangke, Ruo'er gai town and Kang'er on the Gansu border, and other 'cultural' sites like the Gyangza Hotsprings and First Bend of the Yellow River outside of Tangke.

These tourist sites have been developed on and about the wetlands for tourism, environmental protection and herding simultaneously. Despite national and provincial environmental laws passed in 1994 that forbid local households and governments from developing in the core areas of duly designated nature reserves, the nature reserves at all levels of the administration in Zoige County continue to be multi-use.[66] How can this be? How can local officials and Tibetan herdsmen flout Chinese national law? Beyond the obvious questions, we might also ask if there are any local sustainable practices or environmentally sensitive practices on the rise outside of state-led developments.

To begin with, even though the first nature reserve in the county was created in 1994, almost all of the wetlands 'protected' in practice since 2000–2002 were allocated to individual households with 50 year leases in 1996–1998. Since that time, individual households have continued to use major portions of the core nature reserves as rangeland, and in some areas, even continued to destroy wetland hummocks with fire to expand rangeland. Individual household lease rights are considered to largely trump environmental protection and tourism rights based on *China's Grassland Law* (1985) and *Rural Land Contracting Law* (2002). In a related fashion, because of consistent water scarcity problems, even the State Environmental Protection Administration (SEPA) administrative office and tourism bureau centre for the Zoige National Wetlands Nature reserve was placed in the heart of the nature reserve meant to protect Black-neck Crane habitat (over 350,000 visitors in 2005).[67] This centre now sits roughly half a

kilometre from the edge of the primary lake of the nature reserve and draws its water from a local spring that would normally feed into the lake.

Perhaps the main reason that local nature reserves remain multi-use areas despite the documented problems of herding and rangeland management on the wetlands relates to local management. Management of the wetland reserves is fragmented among a variety of competing national, provincial and local administrative bureaus, including the SEPA, county and provincial Forestry Bureaus, prefecture level animal husbandry bureaus, and local county administrative units.[68] The state and provincial tourism bureaus are also involved in local environmental management. Under such a fragmented management system, with a variety of decision-making bodies and policy proscriptions, it makes it very difficult to effectively manage the wetlands in any comprehensive manner.

But these serious issues and questions aside, tourism and environmental awareness premised on environmental protection are part of the local landscape. Many local Tibetans, village associations, Chinese activists and local officials have recognised the key problems facing their wetlands and rangeland, and have been trying to mitigate local environmental degradation. Three examples of local, environmental protection and degradation mitigation practices suffice to show how attitudes toward the wetlands are changing in Zoige County among Tibetans and some officials.

In Re'er Township (and village) in central Zoige County, the Tibetan community has in effect 'recollectivised' their grazing lands due to the difficulties in allocating rangeland equally to individual households. Re'er Township has also worked to reduce herd size in some areas adjacent to the Zoige wetlands and other 'high risk' degraded hillsides in order to try to mitigate herd access to tourist and nature reserve areas. According to local village leaders, Tibetan herders in their area have always stayed and worked in groups, managing their livestock through mobile grazing systems until the 1980s. As their 'group' efforts have largely coincided with earlier socialist collectivisation activities, they have had few problems with county officials. They have also continued to use collective style group leadership to settle any boundary and rangeland disputes that have helped the village township as a corporate entity vis-à-vis individual and county offices since 2003. Their agreements to help mitigate what they see as rangeland and wetland degradation (specifically water source degradation) are formed mainly around grazing routes, camping sites and timing, and some limited agreements to 'share the wealth' and resources between rich and poor households.[69] This fits naturally into the recommendations of a number of recent papers studying grazing rights and practices in the eastern Tibetan Plateau region, which call for increased public awareness of wetlands functions, local participation and 'traditional' forms of community management.[70]

A second local initiative by many individual households in and around the major nature reserves in central and eastern Zoige County has been a significant reduction in tussock burning and increased fencing near reserves. While this

segues nicely with over 50 years of national and provincial anti-burning laws in northern Sichuan, these laws were especially flouted in the 1980s and 1990s in order to create more grassland. Since 2002, increased awareness of the fragility of the local ecosystem and hydrology, greater local administrative efforts to achieve bans on burning tussocks in marshland and bog areas (by education, not legislation), and the activities of local NGO groups have given rise to a large number of household agreements to halt burning in several sections of the wetlands. As this has largely been a process of individual agreements not to burn, it is interesting to note the rise in local awareness of the outcomes of what are considered local and traditional practices.[71]

Finally, a local, Chinese environmental NGO that has been increasingly active in Zoige County has specifically called for and worked with local communities on wetland degradation issues and mitigation techniques. Mr Rao Yong's Green Camel NGO, a group of six full-time activist volunteers and groups of short-term university student volunteers from eastern China have based themselves out of Xiaman village in northwestern Zoige County. This group has worked in the surrounding range and wetlands, along with local Tibetan work teams they have gathered, to combat increasing desertification in the most over-grazed areas of the wetlands by planting trees and grass, and carried out small development projects like education courses on the local eco-landscape, public reading rooms and lectures to local villages since 2002.[72]

CONCLUSION

What can this overview of development projects, state led management, and local practices tell us about wetland and rangeland management in Zoige County and western China? Three larger points can be made based on this overview of development and environment issues in Zoige County between 1949 and 2005. In the first place, development of the wetlands and rangelands of the Zoige Basin have been both state-led, and, more importantly, local. Local characteristics and Tibetan practices have played as significant a role as socialist and reform-era PRC policies in shaping the landscape. Prior to the late 1990s, as Toni Huber among others has shown, there was no such thing as 'Green Tibetans' as portrayed in the world-wide media.[73] Tibetans shaped the landscape of the wetlands and rearranged elements of the local forests and grasslands until the 1950s to suit their grazing needs and local economy. However, since the 1950s, the Chinese PRC state, first under socialist 'high modernist' policies and then with the free-wheeling market reforms of the 1980s and '90s sought to reshape how Tibetans and the Chinese state utilised the grasslands and wetlands in order to make maximal use of these wide open spaces. While local characteristics of rangeland management have never really disappeared, even during the Cultural Revolution (as Tibetans continued to manage the vast collective herds in as

functional manner as possible), the economic regimes and policies of the state have dominated. Furthermore, by the late 1990s and early twenty-first century, there have emerged 'Green Tibetans' and 'Green Han Chinese' in the Zoige Basin seeking to mitigate some of the problems facing the wetlands.

Second, since the reforms of the early 1980s, the real standard of living for local Tibetans has improved under parcelisation and privatisation of herds and rangeland. Real assets of even 'poor' Tibetans have improved with herd expansion, increased tourism, and government inputs into the region – household incomes ranged from at least 8–10 yak, 20–30 sheep (net worth approximately 6,000 RMB) to families with 200–300 yak and 1000+ sheep/goats (net worth from 25–50,000 RMB).[74] Poverty alleviation and development projects worked to some degree. The two sides of recent developments show that Tibetans, local Chinese NGOs and some local officials can and will work to mitigate environmental degradation while caring for the basic needs and wants of local communities. That said, the high technology and modernism approach of the state, centred on fencing; sedentarisation of nomadic Tibetans; and the various versions of herd and land reversion to locals have led to more problems for local people. While moving or settling Tibetans based on government programmes and environmental protection may have helped the national and provincial government on the global scene, market effects, infrastructure development and some land expropriation have hurt local individuals and in some cases worsened the plight of roadside and wetland environments.

Third, state policies to govern and modernise Zoige County since 1949 have led to increasing local environmental degradation as well as increased awareness of the environmental issues facing the region. Tibetans fundamentally shaped the wetlands until the 1960s, but state-led development has since taken over and has more radically and quickly altered the hydrology and vegetation of the region. While some of these issues are no doubt related to climate change and the very slow but sure uplift of the Tibetan Plateau, these massive forces have been ongoing for centuries with little documented impact (whether in the archive or in popular memory). Rather, the policies of the socialist and reform PRC state since the late 1960s have radically changed the wetlands and their hydrology both in scope and in scale.

Among many Zoige County Tibetans, it is recognised that the state and 'bad' Tibetans (locals who blatantly overstock their grazing land) have been part of the process of change for the wetlands. However, in terms of scope and scale, it was the state policy and projects that fundamentally shifted natural water courses, altered hydrological forces in the wetlands, fragmented the wetlands through overgrazing, parcelisation, fencing and settlement programmes, and created the nodal points for the modern market economy that has put tremendous stress on roadside and animal collection centres for its own convenience. Furthermore, the continued fragmentation of local environmental and nature reserve management has continued to contribute to the problem. The official purpose of

rangeland privatisation was to maintain rangeland health and promote livestock production through assigning long-term rangeland use rights to individuals. Privatisation has had some positive effects in raising local Tibetan standard of living and protective responsibility and awareness of the fragility of their local landscape. However, one should note that rangeland and wetland management in Zoige County was traditionally the purview of collective entities, not individuals, due to the inherent spatial and use characteristics of herding practices in this high-altitude environment. Thus, the 'success' of China's privatisation of agricultural land reform in the late 1970s and early 1980s was not mirrored in rangeland areas. To achieve rangeland sustainability and management, the government and local Tibetans have to look to the land itself and the traditional ways in which it was used.

By examining the historical antecedents to contemporary policies and environmental practices, a clearer picture of the nature of Tibetan and state roles in environmental degradation can come to the fore in a way that scientific and some sociological literature misses. This overview of Zoige County wetlands and Tibetans points out productive ways in which both state and local environmental and landscape degradation can be tackled in a less supervisory, contentious, or potentially problematic manner – that is, when the PRC state lets local communities and officials raise awareness of the issues and environment at stake, allows local NGOs to function, and creates more effective institutional arrangements to mitigate the very problems state administrators and scientists perceive. In the end, the activities of local Tibetan communities, Chinese NGOs and local officials do point the way to helping retain the nature of the wetlands while allowing them to serve the greater local good.

NOTES

[1] This study was conducted in connection with a research project on the social, economic and environmental history of the Songpan Region, 1700–2005. I would like to thank Emily Yeh and Melvyn Goldstein for their valuable comments on an earlier version of this paper.

[2] Current studies on local Tibetan involvement in grasslands management include Emily Yeh, 'Tibetan Range Wars: Spatial Politics and Authority on the Grasslands of Amdo', *Development and Change* 34,3 (2003): 499–523; Jack Patrick Hayes, ''Jig rTen (A Shift in Worlds) and Grassland Management: Tibetan Ranching and Social Systems in North-Central Sichuan', paper presented for *Contemporary Tibet Lecture Series*, Institute of Asian Research, Vancouver BC, March 2006 (in press); Emily Yeh, 'Emergent Environmentalism on the Tibetan Plateau: The Case of Green Camel', Paper presented for the University of British Columbia, Institute of Asian Research *Conference on Economic Development in Tibet* (November 2007) (in press).

[3] Much of the Chinese research on the environmental and developmental issues of the Zoige region tends to highlight government projects and prospects and downplay local involvement, or to analyse particular aspects of grasslands problems or Tibetan economic

underdevelopment. For example, see *Special Issue of Journal of Central University for Nationalities* (2001): articles by Na Ri, et al., Li Zhuqing and others; see also the Sichuan Provincial journals *Sichuan Caodi* and *Sichuan Caoyuan* 2001–2004 (articles by Zi Bai in particular). The *Sichuan Caodi* articles include studies of rodent populations, grazing practices and perceived overgrazing, settlement programmes and their impact on herd size, and changes in forage cover in northern Sichuan.

[4] Daniel Miller, 'Fields of Grass: Pastoralists of the Pastoral Landscape and Nomads of the Tibetan Plateau and Himalayas', ICIMOD (Kathmandu, 1998); Wu Ning and Yan Zhaoli, 'Climate Variability and Social Vulnerability on the Tibetan Plateau', *Erdkunde* 56 (2002): 1–14.

[5] Peter Ho, 'Rangeland Degradation in China Revisited?', *Journal of Development Studies* 37,3 (2001): 99–132, 100; Hu Zizhi, *Qingzang gaoyuan de caoye fazhan yu shengtai huanjing* [Qinghai-Tibet Plateau Grasslands development and the Ecological Environment] (Beijing: Zhongguo zangxue chubanshe, 1996), 26–38; Miller, 'Fields of Grass'.

[6] See Jack Patrick Hayes, 'Environmental Change, Economic Growth, and Local Societies: "Change in Worlds" in the Songpan Region, 1800–2005', PhD Dissertation, University of British Columbia, Vancouver, BC (2008). For related information, see Brian Frenzel and S.J. Liu, 'On the Upper Quaternary Palaeoecology of Eastern Tibet: Preliminary Results of an Expedition to the Eastern Tibetan Plateau', in *Science in China* (Series B) 38,4 (1995): 485–494.

[7] Justin Lowe, 'The Scorched Earth: China's Assault on Tibet's Environment', *Multinational Monitor* (Oct 1992), http://www.multinationalmonitor.org/hyper/issues/1992/10/mm1092.html#scorched; Wolfgang Holzner and Monika Kriechbaum, 'Man's Impact on the Vegetation and Landscape of the Inner Himalaya and Tibet', in M. Elvin and T.J. Liu (eds.), *Sediments of Time* (Cambridge: Cambridge University Press, 1998): 53–106. See also Ho, 'Rangeland Degradation', and Committee on Scholarly Communication with the PRC (ed.), *Grasslands and Grassland Sciences in Northern China* (Washington DC: National Academy Press, 1992).

[8] Lang Hui, Zu Wen and Jin Shuran, *Zhongguo zhaoze* [China's Marshes] (Jinan: Shandong kexue chubanshe, 1983): 268–9.

[9] Franz Lehmkuhl and Shulin Liu, 'Desertification of the Zoige Basin on the Northeastern Tibetan Plateau' (in Chinese with English abstract), *Shandi yanjiu* [Journal of Mountain Research] 15,2 (1997): 119–123, 118.

[10] Chai Jia, Lang Hui and Jin Shuran, eds., *Ruo'er gai gaoyuan zhaoze* [Zoige Highland Marshes] (Beijing: Zhongguo kexue chubanshe, 1965), 5.

[11] Yan Zhaoli, 'Ecosystem Health Assessment of the Zoige Wetlands on the Eastern Tibetan Plateau', PhD Thesis, Sichuan University, Chengdu Sichuan (2003).

[12] Xie He, Camille Richard, Xu Jin and Wang Jiang, 'Collective Management of Improved Forage in Zhongdian County, Deqin Prefecture, Yunnan Province, PRC', in Jianlin He and Camille Richard (eds.), *Yak Production in Central Asian Highlands: Proceedings of the Third International Congress on the Yak (Lhasa)* (Nairobi: International Livestock Research Institute, 2002): 158–64, 161; Hayes, 'Environmental Change'.

[13] Camille Richard and Ben Jiao, 'Pastoral Development Sector Consulting Report', submitted to the Bridge Fund (unpublished manuscript, 2004).

[14] Guoli Miehe, 'Geoecological Reconnaissance in the Alpine Belt in Southern Tibet', *GeoJournal* 17,4: 635–48.

[15] Miller, 'Fields of Grass', 18.

[16] Andrew Smith and Michael Foggin, 'The Plateau Pika is a Keystone Species for Biodiversity on the Tibetan Plateau', in Z. Lu and J. Springer (eds.), *Tibet's Biodiversity: Conservation and Management* (Beijing: Zhongguo linye chubanshe, 2000): 131–140, 133.

[17] Wu Ning, *Ecological Situation of High-Frigid Rangeland and its Sustainability: A Case Study on the Constraints and Approaches in Pastoral Western Sichuan* (Berlin: Dietrich Reimer Verlag, 1997), 281; Hayes, ''Jig rTen'; see also, Hayes, 'Environmental Change', chs. 4 and 5.

[18] Camille Richard, 'The Potential for Rangeland Management in Yak Rearing Areas of the Tibetan Plateau', in Jianlin and Richard, *Yak Production*: 11–20, 15; Emily Yeh, 'Tibetan Range Wars'.

[19] Richard, 'The Potential for Rangeland Management', 17.

[20] See, for example, Huang Zhiling, 'Grasslands Could turn into Desert', *Renmin ribao* [People's Daily], 4 November 2005; Chinese State Environmental Protection Administration, 'Report of State of the Environment in China (2004)' at http://www.sepa.gov.cn/english/SOE/soechina2004/grassland.htm (accessed Oct 16, 2007); Hu Zizhi, ed., *Qingzang gaoyuan de caoye fazhan yu shengtai huanjing* [Qinghai-Tibet Plateau Grasslands Development and the Ecological Environment] (Beijing: Zhongguo zangxue chubanshe, 1996); Wen Houyi, *Qingzang gaoyuan dongbu zangzu diqu xumuye ziyuan fazhan yanjiu* [Research on the Development of Animal Husbandry Resources in the Tibetan Areas of the Eastern Qinghai-Tibet Plateau Uplands] (Chengdu: Sichuan kexue zimu chubanshe, 1993); Yang Ming, *Zangzu youmu buluo ji shehuizhuyi xiandaihua* [Tibetan Nomadic Tribal Society and Socialist Modernisation] (Chengdu: Chengdu Dianru gonghe xueyuan chubanshe, 1988).

[21] Jack Hayes, 'From Unsettled Grasslands to Wetland Eco-Tourism: Local and State Development on the Zoige Grasslands', publication forthcoming. This paper was also presented at the University of British Columbia, Institute of Asian Research *Conference on Economic Development in Tibet* (November 2007).

[22] See Ran Guangrong and Ou Zegao, *Sichuan zangqu de fazhan zhi lu* [The Development Path in Sichuan Tibetan Areas] (Chengdu: Sichuan renmin chubanshe, 2000): 108–109; Hu, *Qingzang gaoyuan*, 100, 176–183.

[23] Emily Yeh, 'Emergent Environmentalism'.

[24] The approach taken to environmentalism in both Yeh, 'Emergent Environmentalism' and Hayes, 'From Unsettled Grasslands to Wetland Eco-Tourism' at the *Conference on Economic Development in Tibet* (November 2007) was in part inspired by the recent work of Arun Agrawal on concepts of environmentality and governmentality in northern India. In Agrawal's work, local engagement in environmentalist activity, environmental awareness and social change are a product of nineteenth-century struggles between indigenous communities and the British Raj along the edge of the Himalayan Plateau. Indigenous groups, first disenfranchised and exploited under Raj law eventually used their landscape, indigenous knowledge and, once they were a part of the emerging modernist legal process, national laws to regain control of their local natural resources and landscape. Agrawal points out that while local peoples were and are often part of the environmental problems they face, they in turn often not only have a great deal to offer in terms of indigenous knowledge of resource management (in the James Scott sense of 'seeing like a state' and indigenous knowledge), but can also be part and parcel of a

process to create both local and regional policies and processes to mitigate environmental degradation. See Arun Agrawal, *Environmentality: Technologies of Government and the Making of Subjects* (Durham: Duke University Press, 2005) and James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition have Failed* (New Haven: Yale University Press, 1998).

[25] Hayes, 'Environmental Change', 81–83.

[26] Frenzel and Liu, 'On the Upper Quaternary Palaeoecology', 492–4.

[27] As noted in the *Ruo'er gai xianzhi*, these high altitude wetlands and marshes have traditionally supported animal husbandry, but also provided a barrier to outside control, a dangerous zone for armies in the region, and location of retreat. See Aba Prefecture Ruo'er gai County Editorial Board, *Ruo'er gai xianzhi* [Ruo'er gai County Gazetteer] (Beijing: Minzu chubanshe, 1998): 57–8, 105–7; Chai et al., *Ruo'er gai gaoyuan zhaoze*: 4–5.

[28] Hayes, 'From Unsettled Grasslands to Wetland Eco-Tourism'; Hayes, 'Environmental Change', 83–4.

[29] See *Zhan mu xinbao* (Chengdu Rural Development Committee newsletter, 1931–35) that includes both policy recommendations for development and studies of the easiest ways to move animals and products to Chengdu and Chongqing, and occasional studies of the grassland areas of northern Sichuan that include the Chang Xinqien, *Sichuan Songpan caodi muqu jingji ziliao* [Sichuan's Songpan Grassland Pastoral-Agriculture Economics Report] (Chengdu/Songpan County: Sichuan Province Government Construction Office Study Group, 1928) who predicted that the region would be major supplier of meat and animal products to Chengdu via Dujiangyan due to the region's remoteness from major warlord conflicts.

[30] Ran and Ou, *Sichuan zangqu de fazhan zhi lu*: 101–3. See also, Hayes, 'Environmental Change', ch. 4.

[31] Excellent studies of the Great Leap and its implications in China include: Jasper Becker, *Hungry Ghosts: Mao's Secret Famine* (New York: Free Press, 1996); Dali Yang, *Calamity and Reform in China: State, Rural Society, and Institutional Change Since the Great Leap Famine* (Stanford: Stanford University Press, 1996); and Judith Shapiro, *Mao's War Against Nature: Politics and the Environment in Revolutionary China* (Cambridge: Cambridge University Press, 2001).

[32] Aba Prefecture Editorial Board, *Aba zangzu zizhizhou gaikuang* [A General Description of Aba Tibetan Autonomous Prefecture] (Chengdu: Minzu chubanshe, 1985): 120.

[33] Local Interviews, May 2005. See also Robert Ekvall, *Fields on the Hoof* (New York: Holt, Rinehart and Winston, 1968): 96.

[34] Aba Prefecture Editorial Board, *Aba zangzu zizhizhou gaikuang*: 296–7; Ran and Ou, *Sichuan zangqu de fazhan zhi lu*: 105.

[35] Chai et al., *Ruo'er gai gaoyuan zhaoze*: 68–71.

[36] Yang Ming, *Zangzu youmu*: 86. See also Peter Ho, 'Mao's War Against Nature? The Environmental Impact of the Grain First Campaign of China', *The China Journal* 50 (2003): 37–59. In this article, Ho clearly and correctly expands the definition of the 'Grain First' campaign to include new approaches to animal husbandry in China's northern grasslands from the Great Leap Forward to the end of the Cultural Revolution.

[37] Yan and Wu 2005, 111; local interview conducted May 2005.

[38] Tony Banks, Camille Richard, Li Ping and Yan Zhaoli, 'Community Based Grassland Management in Western China: Rationale, Pilot Project Experience, and Policy Implications', *Mountain Research and Development* 23,2 (2003): 132–140, 134; Dee Mack Williams, 'Grassland Enclosures: Catalyst of Land Degradation in Inner Mongolia', *Human Organization* 55,3 (1996): 307–313; Wu Ning, *Ecological Situation*.

[39] Wu and Richard 1999:

[40] Hayes, 'From Unsettled Grasslands to Wetland Eco-Tourism'; see also Yeh, 'Tibetan Range Wars.

[41] Richard, 'The Potential for Rangeland Management', 19.

[42] Yan and Wu 2005, 112; Hayes, 'From Unsettled Grasslands to Wetland Eco-Tourism'; *Ruo'er gai xianzhi* 1998, 374.

[43] See Yan and Wu 2005, 39; local interviews (May 2005); Sichuan Animal Husbandry Bureau, 'The Grassland Protection and Construction Situation: Problems facing and Strategic Recommendations for Sichuan Province', Set 1: Inspection Report of Grassland Law Implementation in Sichuan Province [in Chinese] (Chengdu: Sichuan sheng muqu ju, 2001).

[44] Yan and Wu 2005, 40.

[45] Population increases in northern Sichuan and on the Tibetan Plateau, like the herd size numbers in the following sentence, are regularly debated in scholarly circles. According to Geoff Childs, Tibetan populations have fallen, while Steven Marshal and Susette Cooke (1997) demonstrate in their analysis of statistics a regional rise in local populations based on Chinese sources. Chinese scholars regularly point to population increase in the region as one of the reasons for rangeland degradation (see Ran and Ou, *Sichuan zangqu de fazhan zhi lu*). Geoff Childs, *Tibetan Transitions: Historical and Contemporary Perspectives on Fertility, Family Planning, and Demographic Change* (Leiden: Brill, 2008); Steven Marshall and Susette Cooke, *Tibet Outside the TAR: Control, Exploitation, and Assimilation – Development with Chinese Characteristics* (CD, Alliance for Research in Tibet, 1997).

[46] Ran and Ou, *Sichuan zangqu de fazhan zhi lu*, 112; Hayes, 'From Unsettled Grasslands to Wetland Eco-Tourism'.

[47] Yan and Wu 2005; Ran and Ou, *Sichuan zangqu de fazhan zhi lu*; Camille Richard, Yan Zhaoli and Du Guozhen, 'The Paradox of the Individual Household Responsibility System in the Grasslands of the Tibetan Plateau, China', *USDA Forest Service Proceedings* RMRS-P-39 (2006).

[48] Local interviews with Animal Husbandry Bureau official (May 2005).

[49] Shiro Tsuyuzaki and Tatsuichi Tsujii, 'Preliminary Study on Grassy Marshland Vegetation, Western Part of Sichuan Province, China, in Relation to Yak Grazing', *Ecological Research* 5 (1990): 271–276, 275.

[50] Local interviews (May 2005).

[51] Tsuyuzaki and Tsujii, 'Preliminary Study'; Zhao Ziyao, Yang Yuanming and Yang Fei, 'A Study on the Flora of Peaty Swamp Plants in Hongyuan, Sichuan, China' (in Chinese with English abstract), *Journal of Wuhan Botanical Research* 14,3 (1995): 30–36; Zhao Ziyao, 'A Study of Communities of Aquatic Vascular Plants in Hongyuan County of Sichuan Province' (in Chinese with English Abstract), *Journal of Wuhan Botanical Research* 14,3 (1996): 213–222.

[52] Yan and Wu 2005, 113.

[53] In my own interviews (2005–6), numerous Tibetans in the southern and northern sections of the Zoige wetlands pointed out areas that even in the late 1970s supported wetland areas or tussock mounds – but now are solidly grass covered, in various stages of sandification or desertification, or simply bare soil. When asked if the areas in question had been burned off in the last two decades, they almost invariably admitted they were burned to help stimulate grass growth – sometimes with the knowledge and help of local administrators, and other times without official permission.

[54] Yan, 'Ecosystem Health Assessment.

[55] Liu Benjiao and Jiang Z., 'Impacts of Grassland Fencing on Plant Communities and Conservation of a rare Gazelle', (in Chinese with an English Abstract) in *Biodiversity Science* 10:3 (2002): 326–331.

[56] Local interviews (May 2005).

[57] Zhong Du, 'Studies on the Process and Mechanism of the Qinghai-Tibet Plateau Uplift' (in Chinese with an English abstract) in *Zhongguo kexue* [China's Science] 26:4 (1996): 289–296.

[58] Chai et al., *Ruo'er gai gaoyuan zhaoze*.

[59] Tang Meng, Bai C. and Liu X., 'Recent Climate Change on the Tibetan Plateau' (in Chinese with an English abstract) in *Proceedings of the First Academic Workshop of the Qinghai-Tibet Plateau Research Association* (Beijing: Zhongguo kexue chubanshe, 1998): 42–48; Wu and Yan 2005.

[60] Paul McNamee, 'Management Plan for Ruo'er gai National Nature Reserve', in Report to GEF/UNDP-PR/98G32 *Wetland Biodiversity Conservation and Sustainable Use in China* (2003).

[61] Yan and Wu 2005, 112; Richard et al., 'The Paradox of the Individual Household Responsibility System'; Yan et al. 2005, 39–40.

[62] The Rio United Nations Framework Convention on Climate Change took place on July 2, 1992. China ratified the Framework Convention, completed a paper assessing the impact of climate change on China using Global Circulation Model results, and conducted various pilot studies on least-cost emissions reduction. In effect the Rio Conference and its related studies was intended to help create a framework for many countries on the planet to cut fossil-fuel emissions and set up 'sustainable development' models to help protect the environment and resources for future generations; however, like many other countries, including the United States, China has moved very cautiously in this regard and done most of its work on paper. See Lester Ross, 'China: Environmental Protection, Domestic Policy Trends, Patterns of Participation in Regimes and Compliance with International Norms', in Richard Louis Edmonds (ed.), *Managing the Chinese Environment* (Oxford: Oxford University Press, 2000), 85–111; 93.

[63] Michael Palmer, 'Environmental Regulation in the People's Republic of China: The Face of Domestic Law', *China Quarterly* 156 (1998): 788–808, 789–90.

[64] See Hayes, 'From Unsettled Grasslands to Wetland Eco-Tourism (Based on statistics from the Aba Prefecture Statistical Yearbook, 1998, 2004 and 2005, and on local interview material from June 2006).

[65] McNamee, 'Management Plan for Ruo'er gai National Nature Reserve'.

[66] Nature reserves in China have multi-use zones. However, the Zoige wetlands seem to be multi-use in all sectors of the nature reserves. As late as 2006, the author observed widespread yak, sheep and goat grazing in all zones, including the central (technically off limits) lake region, in all five of the national and provincial wetlands nature reserves of northern Sichuan. A discussion of nature reserve zones and multi-use characteristics in eastern China is also in the final chapter of Chris Coggins, *The Tiger and the Pangolin: Nature, Culture and Conservation in China* (Honolulu: University of Hawaii Press, 2003).

[67] Local interview with tourism official (May 2005).

[68] Sichuan Institute of Forestry and Sichuan Wildlife Resource Investigation Conservation and Management Station, *A Comprehensive Survey Report on Sichuan Xiaman Nature Reserve* (internal document, in Chinese) (1997).

[69] Local interviews (May 2005).

[70] Banks et al., 'Community Based Grassland Management'; Yan et al. 2005; Richard et al., 'The Paradox of the Individual Household Responsibility System'.

[71] Local interviews (May 2005).

[72] See also Mr Yong's Green Camel website at http://www.Greencamel.ngo.cn.

[73] Toni Huber, 'Traditional Environmental Protectionism in Tibet Reconsidered', *Tibet Journal* 16,3 (1991): 63–77; and Toni Huber and Poul Pedersen, 'Meteorological Knowledge and Environmental Ideas in Traditional and Modern Societies: The Case of Tibet', *Journal of the Royal Anthropological Institute* 3,3 (1997): 577–597.

[74] See Hayes, 'Environmental Change', 276.

FIRST OF A NEW SERIES FROM THE WHITE HORSE PRESS: 'THEMES IN ENVIRONMENTAL HISTORY'

BIO-INVADERS

ISBN 9781874267553 PB 280pp. £15/ $22.50 / €18.50 Halftones, black and white drawings, maps, graphs, tables.
Publication date 31 July 2010
Published by The White Horse Press. For ordering information, please see www.whpress.co.uk

We are pleased to announce a new series of environmental history readers, suitable for students. Comprising essays selected from our journals, *Environment and History* and *Environmental Values*, each inexpensive paperback volume will address an important theme in environmental history, combining underlying theory and specific case-studies. The first volume, *Bio-invaders*, investigates the rhetoric and realities of exotic, introduced and 'alien' species. The book comprises a number of general essays, exploring and challenging common perceptions about such species, and a series of case studies of specific species in specific contexts. Its geographical coverage ranges from the United Kingdom to New Zealand by way of South Africa, India and Palestine; and the essays cover both historical and recent introductions.

TABLE OF CONTENTS