

Pastoral farming on the Qinghai-Tibet Plateau

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ABSTRACT

We report on pastoral farming systems in Henan County (altitude 3600 metres) within the Sanjiangyuan (Three-River Headwaters) Region of the Qinghai-Tibet Plateau. Our information comes from in-depth interviews of 16 pastoral farming families, one focus group, plus discussions with key local informants. Traditional nomadic pastoral farming systems are in transition to semi-nomadic, with permanent housing and associated animal shelters for much of the year but still with grassland tent-living by pastoral farming families in summer. Yaks and Tibetan sheep are the dominant livestock. Livestock products in Henan include meat, milk, butter and cheese (*gula*) from yaks, and meat, wool and skins from sheep. Yak dung is the main source of fuel for cooking and heating. Dung is also a commercial product. Yaks calve in spring, typically having their first calf at four years of age and then calve every second year. Sheep lamb in autumn, typically having their first lamb at three or four years of age. Predation by wolves is a major issue with sheep. Overall animal productivity is low. Sustainability issues are a major concern due to ongoing nutrient removal from dung and animal products, combined with high rodent plateau pika (*Ochotona curzoniae*) populations and general overgrazing.

KEYWORDS: Qinghai-Tibet Plateau; semi-nomadic pastoral farming systems; Henan County; yaks; Tibetan sheep

1. Introduction

The Qinghai-Tibet Plateau covers an area of 2.6 million square kilometres. It comprises grassland, desert and high-altitude mountains, bounded on four sides by the Himalayas, Pamirs and Karakoram, Kunlun and Qilian Mountains, plus Hengduan Mountains. To the east, the Plateau flows into mid-level valleys that feed into the plains of China. Most of the Plateau lies within the current borders of China, spanning 31 degrees in longitude and nearly 25 degrees in latitude (张懿铨 *et al.*, 2002). The grassland area comprises 1.7 million square kilometres and has been the traditional home of Tibetan nomadic herders (Miller, 1999, Miller, 2000).

Our interest within this paper relates to the Sanjiangyuan (三江源, Three-River Headwaters) Region, an area of 302,000 square kilometres on the north-eastern part of the Plateau within Qinghai Province. The traditional name for this and surrounding regions is Amdo. The Sanjiangyuan Region is where the three major rivers of China (the Yellow, Yangtze and Mekong (known as Lancang in China)) all arise. Accordingly, it is perceived as having major environmental significance for all of China. Having designated the region as a nature reserve, the Government requires that all production systems use organic methods, with no use of chemical fertilisers. There are some 556,000 people living within this Sanjiangyuan

Region, with over 90 percent of them being of Tibetan ethnicity (China Institute of Water Resources and Hydro-power Research, 2016).

The human population of the Sanjiangyuan Region has increased rapidly over recent decades, as China's One-Child Policy was never applied to the homelands of ethnic minorities such as the Tibetan people. The region also has significant problems related to rodent populations. Accordingly, there are major issues of degradation and sustainability, with some debate as to the fundamental causes (Cao *et al.*, 2013, Goldstein *et al.*, 1990, Harris, 2010, Miller, 1999, Miller, 2000, Ptackova, 2011, Waldron *et al.*, 2010, Wang *et al.*, 2016, Yan *et al.*, 2011, Yeh, 2003, Yeh, 2005).

For the people who live here, the farming systems are pastoral, with an almost total focus on yaks and Tibetan sheep, and are heavily constrained by the short growing seasons. Crops have typically only been planted in very small areas adjacent to houses as limited winter supplements for livestock.

There has also been an ongoing process of sedentarisation, where the local people are assisted with the building of permanent houses either within townships or on farms. Families have long-term use-rights over specific land areas, after 1981, when the Household Responsibility System was introduced, but the land areas held by a farming family are not always contiguous.

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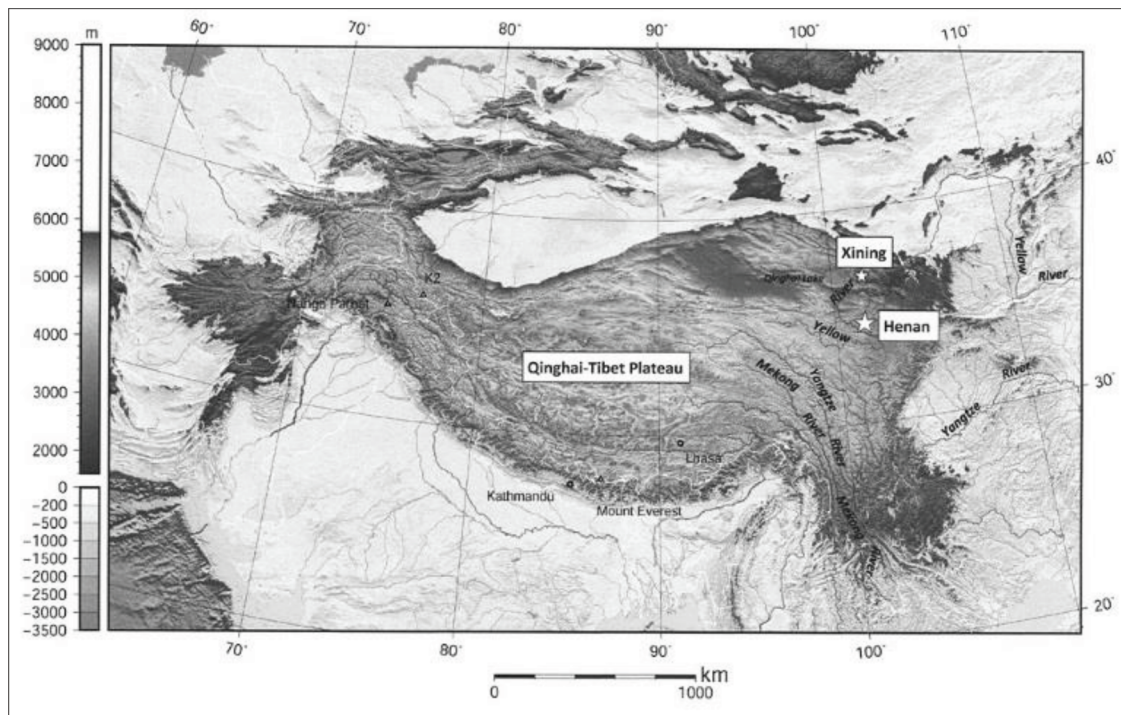


Figure 1: Map of Qinghai-Tibet Plateau (adapted from public commons)

Accordingly, and also due to a well-observed tradition, although most farming families now have a permanent house, they still live in tents out on the grasslands during summer.

Our particular interest here is in the County of Henan, within Huangnan Prefecture in the east of Sanjiangyuan Region (Figure 1). We have been visiting here informally since 2012. Since 2015, we have been part of a sustainable systems research project between Lincoln University in New Zealand and Qinghai University in China, with trial sites in both countries, and funding from both the New Zealand and Chinese Governments (Project numbers MBIE LINX1404 and MOST 2015DFG31870). Our broader aim relating to the Qinghai-Tibet Plateau is to try to first understand and then address issues of sustainability, within a very complex environment. However, in this paper we limit ourselves to describing and interpreting aspects of the pastoral system as we have identified within Henan County.

2. Methods

Our approach lies within the qualitative paradigm whereby we have sought to ask ‘what’, ‘how’ and ‘why’ questions about the phenomena under study. Our approach has been influenced by many writers within the qualitative paradigm, but particularly by elements within grounded theory (Bowen, 2006, Charmaz, 2006) and also by the inductive theory building principles of Eisenhardt (Eisenhardt, 1989, Eisenhardt and Graebner, 2007). In essence, the approach has been to observe and to let the informants ‘tell their stories’ of actual events together with their thoughts, and then to identify emergent insights from the data. It is important to note that this qualitative research philosophy encompasses the use of numeric data, wherever it is available, as part of the descriptive and interpretive process.

Much of the pastoral farming information that we present has come from semi-structured interviews of 13 farming families undertaken in the summers of 2015 and 2016, then another three farming families and one focus group in the spring of 2017. The families were chosen conveniently – wherever we saw a farming family on the grasslands, or smoke coming from a tent, we would introduce ourselves to these people and ask if we might interview them. There were no refusals, and the interviews typically took place within their summer tent-homes. For the focus group, we used our local contacts to pre-arrange a meeting time and place, and then conducted the interview. Because the farmers typically speak Tibetan but not Chinese (Mandarin), we used a local bilingual person (whom we had previously come to know) to interpret from Tibetan to Chinese. Although we had a set of open-ended questions to guide the interviews, the aim was to let them flow as conversations wherever possible. The interviews were undertaken without any official being present and most were recorded digitally, with subsequent transcription thereof in Chinese.

We observed a male-dominated family environment. For the farming-family interviews, often both genders of the family were present, but the women said almost nothing unless specifically addressed. On one occasion, when a woman was present for part of the interview in the absence of men, it was evident that she had equivalent farming knowledge. For the focus group that we pre-arranged, only men turned up for the meeting.

Our interpretive assumption is that our interviewees, both male and female, had minimal literacy skills, and there was no evidence of any record-keeping or written materials. In contrast, the children of these families that we met were literate and had Chinese as well as Tibetan language skills.

Most of the on-farm and focus-group interviewees were aged between 25 and 50. We consider this reflects early marriage (with women traditionally marrying at about

16 years of age), short generation intervals, and with older people having retired to Henan county centre where they also look after the school-age grandchildren.

The information we report here is also influenced by our own observations on the Qinghai-Tibet Plateau between 2012 and 2017, together with discussions we have had with local business people and officials, who have always shown willingness to answer our probing and at times naïve questions.

3. Results

The locale

Henan County is some 300 km south of Xining, the capital city of Qinghai Province. Whereas the majority of the population of Xining (altitude 2,275m) is Han Chinese, with smaller groups of various ethnic minorities, up on the grasslands the majority of the people speak Tibetan, wear Tibetan clothing, observe Tibetan customs and follow Tibetan Buddhism. Within Henan County itself, although all of these behaviours accurately describe the people, they actually consider themselves Mongolian, and hence also celebrate Mongolian festivals. Our local contacts informed us that their Mongolian heritage comes from the time of Genghis Khan through to his grandsons and thereafter, when Henan County was a staging area for Mongolian invasions heading elsewhere across the Plateau.

Henan County lies in the headwaters of the Yellow River, at an altitude of approximately 3,600 metres. Annual rainfall averages 600 mm and is summer dominant. Our observations are that pastures lie dormant until early May owing to low temperatures, and that the growing season is essentially over in September, primarily due to declining temperatures and soil moisture having been exhausted. Within Henan County, the population increased from 25,644 in 1991 to 39,508 in 2014 (1.9 percent compound growth per annum); during this time the farming population increased from 21,868 to 32,977 (1.8 percent compound growth per annum) (河南蒙古族自治县统计局, 2015, 河南蒙古族自治县年鉴编委会, 2004).

The pastoral system

Our observations are that pastures are grass and herb dominant in Henan, and legumes make minimal contribution to livestock feed supply. Pasture degradation from rodents, in particular the plateau pika (*Ochotona curzoniae*), is very obvious. The farmers consistently stated that pasture quality had declined during their lifetime.

Land areas depend on initial family allocations in about 1995 (following multi-family allocations in about 1985) and reflect the family size at that time. Most of our interviewee families have access to between 1000 and 2000 mu (1ha = 15 mu) on 50- to 70-year leases from the Government. Some also rent additional land from community members, typically for two- to three-year periods, but with some longer-term leases.

The farmers typically considered blocks within their allocated areas as being either for winter/spring, summer, or autumn. In some cases, the categorisation is a function of altitude and also whether it lies to the sun. However, a key determinant can also be proximity to the permanent winter house and associated livestock shelters. When livestock are on summer pastures, farmers need to be nearby

during the night, and animals are corralled with temporary fencing as a predation-avoidance strategy.

The land areas held by each family typically have external fences. Much of this fencing has occurred within the last 20 years, with major subsidies from Government. This reflects the official policy that 'sedentarisation' is the path that should be followed, which reflects the philosophy of avoiding "tragedy of the commons". Some families also have limited internal fencing of up to four blocks, and practice some level of rotational grazing.

Most land is grazed by individual families, although families sometimes share summer land. One farming family worked within a communal farming system of 23 families. They said they were the only such group of communal farmers in the prefecture, and that they did it by choice, as they liked being able to share the work and enjoy the community spirit. All families within this group accept and obey a communal decision of setting a limit to the number of livestock that can be returned to the communal winter pasture, for sustainability purposes.

Livestock and livestock products

All farmers have yaks and most have Tibetan sheep. The yaks are farmed both for their meat and milk. The sheep are farmed mainly for meat, with wool apparently being a declining product. Sheep skins are sometimes used for clothing, particularly for making traditional Tibetan costumes. It also became evident during the interviews that dried yak dung is an important product. The dung is collected from the night corrals, and also at times from paddocks. It is then dried and sometimes bagged. Given that this altitude is above the tree line, farming families typically use yak dung as their only source of energy for cooking and warmth. They also supply the dung to the grandparents living in the county centre, and then sell surplus dung that has been collected to be further processed into organic fertiliser and sold on the lowlands. Some families reported selling up to 200 bags of dried dung per year, each of 25 kg. Combined with the lack of fertiliser-use due to the official mandate of maintaining organic production, we see a significant loss of nutrient from the Plateau from this widely practiced removal of dung.

Milking yaks are typically milked twice per day. Both the milking and subsequent processing of the milk is always women's work. First, the animals are herded and tied to a pegged rope. The calf is initially given access to stimulate milk let-down, and is then pushed away. Milking is by hand, with milk drunk fresh, and also processed into both cheese, locally known as *qula*, and butter. Female yaks often remain in lactation for over a year, from calving in the first spring through to the end of the second summer. But her milk may not always be used for human consumption during the winter, depending on the conditions of the female yak and her calf.

Yak herds ranged from 50 to 200, and sheep flocks typically ranged from 10 to 350 in size. Invariably, farmers would state their inventory numbers in units of 10, reflecting uncertainty as to precise numbers, although more precise numbers were stated for sales.

The most important period of slaughter is around November, as winter closes in, and while animals are still in good condition. Farmers will also slaughter a few animals for themselves to last through the winter.

We learned that the outdoor meat storage facility is made with a dung and water mix, which was said to provide good ventilation and insulation.

Animal productivity

Animal productivity is low. Yaks typically calve in spring, first at four years of age, and thereafter every two years, although some may calve in two consecutive years under good pasture conditions. Female yaks may be retained for 10 years or more. Males are sold between two and seven years of age. Sheep are mated to produce lambs in the autumn after returning from the summer pastures, with first lambing at the age of three or four. Predation from wolves is a major issue with sheep. Also, in harsh winters sheep are more likely than yaks to succumb to cold and under-feeding, hence often being kept in covered shelters overnight. We estimate that overall mortalities may approach 10 percent per annum and possibly more, particularly for sheep. Given that animals aged less than one year typically comprise less than 20 percent of the total herd and flock for each family, then we estimate that annual offtake (births minus mortalities) may be no more than 10 percent of the total inventory, and on occasions lower.

Many farmers also have 'Buddha' yaks and sheep. These animals are dedicated to Buddha, often as a sign of offering and redemption of ailment of family members. Although the milk and wool from these animals can be harvested and used, they are never killed, eventually dying of old-age or other natural causes.

Livestock and product values

Livestock are always sold 'on the hoof' and values are only known on a per-head basis, with all sale transactions undertaken with cash. Prices vary considerably depending on supply and demand, but typical values for yaks are 3500 to 4000 RMB (1 USD is approximately 6 RMB). Adult Tibetan sheep are worth 600 to 1000 RMB and lambs are worth 300 to 400 RMB at one year of age. The dominant sheep breed is known as the *Oula* breed. They are large-framed, with adult sheep perhaps 60kg in live weight. We were informed that because all farmers are Tibetan Buddhism believers, who abstain from killing of lives wherever possible, they sell animals to mostly Muslim abattoirs and butchers, therefore take whatever price is on offer.

Livestock, and particularly yaks, are seen as a stock of wealth. In the Tibetan language, the word '*nor*' means both yak and wealth. Farmers appeared to want to hold onto as many livestock as possible. Additionally, farmers only use their bank accounts as repository for the annual Government subsidy payment, which they access using a bank card. The combined effect is that animals tend to be sold only when there is a need for cash.

Prices that farmers receive for milk products vary between products and also different times of year, largely due to supply and demand. Milk (approximately 7 percent fat, 5 percent protein) is worth about 8 RMB per kilo, but may be up to 10 RMB per kilo during winter, with yaks producing about 1.5 litres per day in the first year of lactation. Butter sells for approximately 50 RMB per kg and cheese sells for 20 to 40 RMB per kg, and again increasing in prices during winter when there is a shortage in supply. Dried dung, however, seems to remain a stable price over the years during our interviews, which sells for 7–8 RMB per 25 kg bag.

4. Discussion and Conclusions

The farming systems on the Qinghai-Tibet Plateau are under transition. One key factor driving the transition is that population has increased greatly over the last 50 years linked at least in part to improved health conditions, combined with higher birth rates than in the Han-dominant parts of China. Another key factor driving the transition is a Government policy of sedentarisation, which links to health, education and environmental management policies.

We note that livestock values and product values might seem high compared to many less developed countries. These values reflect not only that pastoral products are the sustenance of life and are highly valued by the locals, but are also in demand by a wider market on the lowland. For the farmers, we learned that there is no Tibetan word for 'vegetables', and some women told us they would not know how to cook them, or only learned how to cook them as they became accessible from the local markets. They also purchase some flour (barley or wheat) from the county centre, and use it as an important dietary component. The inclusion of wheat and vegetables, which were not part of the traditional nomadic diet, as we were informed, is a reflection of increased connection with the world beyond the Plateau.

We consider that Henan County at 3,600 metres altitude has superior pastoral conditions to many other parts of the Qinghai-Tibet Plateau, where altitudes of pastoral land may exceed 4000 metres. There are also some parts of the Plateau that have lower altitudes (down to approximately 3000 metres) than Henan, but rainfall typically becomes more limiting in those locales than in Henan. Also, our interviewees were typically living within 20 km of the county centre. As such, we are cautious of generalising specific pastoral findings more broadly across the Plateau. We note that the animal productivity is similar to that reported for the Qinghai-Tibet Plateau in a review by Long *et al.* (2008), but it is unclear as to the original sourcing of their production parameters, which are referenced back to a 1994 Chinese publication. We are not aware of any previous studies that have interviewed Plateau families in the way we have done here.

The greatest challenge to the current farming systems, which is the essence of the issues that emerged from our research and observations, relates to sustainability thereof. A key insight from our own work is the major loss of nutrients from the system through burning and sale of yak dung. Also, there is now considerable removal of livestock products from the Plateau down to major cities such as Xining. We saw yak products being sold in supermarkets in Beijing, which is about 1,700 kilometres by road from the Plateau. In contrast, there is no obvious entry of nutrients into the pastoral system beyond natural mineralisation. This lack of nutrient cycling contrasts to the traditional nomadic systems whereby products were consumed on the Plateau, and with this occurring within a nomadic lifestyle where even human excreta also returned directly to the pastoral system.

From a technical perspective, it is easy to identify that animal performance is constrained by inadequate nutrition, with much of the available feed being of low energy and protein. However, the implications of dealing with these issues within a bio-socio-economic system, and in a locale where people have lived for many thousands of years,

albeit at much lower population levels, raise profound issues. We reflect that these issues of grassland sustainability are pervasive across much of the world's mountains, but with each region having its own specific biological and social environment. We are reminded of a phrase from American President Dwight Eisenhower in 1956, that "farming looks mighty easy when your plough is a pencil and you're one thousand miles from the corn field" (Eisenhower, 1956). The same perspective, with appropriate specifics and reinforcement of the message in relation to outsiders looking in, can be applied to the Qinghai-Tibet Plateau. There are no easy answers on the Qinghai-Tibet Plateau.

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