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China's Rangeland Law and Implications of the Expansion of the Beef Cattle Industry for Sustainable Development in Pastoral Areas

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China's rangelands are being degraded at an alarming rate. The National Rangeland Law, that provides the broad legal framework for the regulation of rangeland use in China, is currently under revision.

Existing regulatory and 'natural' constraints to non-sustainable development of the rangelands, that occurs principally as a result of excessive and increasing livestock stocking rates, have proved ineffective. There is scope for tightening land use regulations within the framework of the Rangeland Law. However, the implementation of more sustainable rangeland use at the 'grass roots' also requires that local policies are in place and appropriate economic incentives exist to encourage rather than inhibit compliance with the National Rangeland Law.

The paper examines the impact of the rapid expansion (especially during the 1990s) of China's cattle and beef industry on sustainable development in pastoral areas. The emergence of this dynamic new rural industry has created a fresh set of challenges and opportunities in relation to rangeland management in China's pastoral region, especially for the semi-pastoral parts of this region. In particular, opportunities now exist for herders to increase their turn-off of cattle without necessarily increasing grazing pressure on the fragile rangelands at critical times of the year. The potential of this approach to contribute to the sustainable development of the rangelands is understood by a significant number of technical and administrative personnel in the pastoral region. Nevertheless, it is not reflected in a systematic set of local policies.

This paper suggests a range of measures that could form the core of such a systematic micro-level policy package within the framework of a revised National Rangeland Law. However, the paper concludes that the new Law needs to integrate provision for such micro policies with genuine macro policy reform. Only such a comprehensive approach would enable it to make a meaningful contribution to the future sustainable development of the pastoral areas.

Key words: China, Rangeland Law, cattle, beef, pastoral region, rangelands, pasture degradation, regional development, sustainable development, agro-industrialisation.

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1. Introduction

Enacted in 1985, the Chinese Rangeland Law contains a laudable set of goals or pillars for: protecting and improving the rangeland ecology; developing a modern animal husbandry industry; and promoting a prosperous economy especially in autonomous minority areas.[1] Although this Law represented an important recognition of problems in the pastoral region, subsequent studies and analyses have revealed that these objectives remain unmet. With the Rangeland Law before the People's Congress for review in 1999/2000, this paper examines whether the rapid growth in the Chinese beef industry has facilitated or hindered efforts to achieve the objectives of the Rangeland Law.

The World Bank [11] estimated that 1.3 million hectares of natural pasture in China are becoming degraded each year, and that the total area of degraded pasture exceeded 30 million hectares or over one-tenth of China's useable pasture. Other studies depict a much greater problem arguing that virtually all native pastures are degraded to some extent (Longworth and Williamson [7]). Livestock numbers have grown 16% in pastoral provinces since 1985, with obvious implications for the state of already degraded pastures. Herders have sought to increase herd sizes as a means of raising relatively low incomes. The interaction of these forces has embedded a cycle of rangeland degradation in China's pastoral region.

Longworth and Williamson [7, Chapter 18] identify some systematic causes of this cycle of degrading pastures and declining household incomes. These include population pressures, market distortions, institutional uncertainties and the inappropriate use of new technologies. Because of high population densities and the large amounts of marginal land used for cropping, degradation problems are particularly pronounced in the semi-pastoral parts of the pastoral region. These semi-pastoral areas are a primary focus of this paper.[2] In the absence of macro-level solutions, such as mass outmigration of herders from the pastoral region, decision-makers have been forced to consider more local micro-level approaches such as imposing regulations and creating economic incentives conducive to more sustainable use of the rangelands.

A key development in China that poses both threats and opportunities to more sustainable use of the rangelands has been rapid growth in the size and sophistication of the beef cattle industry. The next section, Section 2, briefly places the pastoral region in the context of what has been happening in China's cattle and beef industry. The remaining three major sections of the paper are then structured around the various major pillars of the Rangeland Law and the impact of the cattle and beef industry developments on them.

In addressing the first pillar of the Rangeland Law—of protecting and improving the rangeland ecology—officials have relied upon regulatory as well as natural constraints to limit livestock numbers and rangeland degradation. However, as will be outlined in Section 3, neither current regulatory measures (such as pasture use fees and stocking rate limits) nor natural constraints (such as the availability of winter feed) appear to have been sufficient to halt further pasture degradation.

The ineffectiveness of regulatory and natural constraints in arresting rangeland degradation has led to interest in market mechanisms such as increasing the value of livestock output for a given grazing pressure. This approach ties in with the second pillar of the Rangeland Law, namely the development of a modern animal husbandry industry. In Section 4 , the various production and marketing systems that have developed with the rapid growth in the cattle and beef industry are examined for their impact on herder incomes and rangeland degradation. Of particular interest is whether some of the emerging marketing channels and production systems provide herders with new management options better suited to sustainable use of the grasslands.

Lessening the pressure on pastures by providing alternative opportunities for surplus labour from pastoral households is the rationale behind many regional development schemes that aim to diversify and strengthen local regional economies. This is the third pillar of the Rangeland Law. Some of the investment in this area is in further processing of animal husbandry products, and so this strategy also impacts on the second pillar of developing modern animal husbandry industries and

increasing the marketing options open to herders. Section 5 briefly examines these issues in the context of cattle marketing and slaughtering.

1) For an English translation of the Rangeland Law as it applies in the Inner Mongolia Autonomous Region, see Longworth and Williamson [7, Appendix 5A].
2) Rural administrative units (prefectures, counties, townships *etc.*) in China are classified as agricultural, semi-pastoral or pastoral. Of the 2,833 county-level administrative units in China, 146 are designated semi-pastoral and 120 pastoral counties. See Longworth and Williamson [7, Section 3.3] for detailed definitions and the location of the semi-pastoral and pastoral counties in China.

2. Background

Cattle have long been associated with China's pastoral region. In 1980, one quarter of the 72 million head of bovines in China and 44% of the nation's beef came from the six pastoral provinces/autonomous regions of Inner Mongolia, Qinghai, Ningxia, Xinjiang, Gansu and Tibet (Zhang and Longworth [12]). The remaining cattle were primarily used for draught purposes in China's agricultural areas (Lu *et al.* [9]).

However, economic reforms and the liberalisation of meat markets in the 1980s, together with government support programs in the 1990s, have brought about a dramatic expansion of the Chinese cattle and beef industry. By 1997, China's bovine herd had grown to around 117 million head (SSB [10]). In relative terms, this expansion has occurred not in the pastoral areas but in the agricultural areas of China. Of particular importance has been the so-called "Central Plains (*Zhongyuan*) Beef Belt" that includes parts of Shandong, Henan, Hebei, Anhui and Shanxi Provinces. In this area, although individual households raising only one to three head of cattle dominate cattle and beef production, the feedlot and modern abattoir sector also expanded significantly during the 1990s. Another predominantly agricultural part of China that has experienced a rapid expansion in its cattle and beef industry has been the grain-surplus northeastern provinces of Heilongjiang, Jilin and Liaoning.

One of the main rationales for government support of the industry is that cattle are thought to be able to convert China's massive straw surplus into beef partly to displace consumption of grain-intensive meats, and into manure partly to replace chemical fertilisers. The "Straw for Beef" program that began in 1992, has now been re-named "Straw for Ruminants" because sheep and goats have become an important part of the program (Li *et al.* [4]). Given the objectives of the "Straw for Ruminants" program, it has had the most dramatic effect in the agricultural regions of China. However, some semi-pastoral areas (such as the three so-called "pastoral" counties in Chengde Prefecture in the northern part of Hebei Province) have also been targeted for assistance under the "Straw for Ruminants" program.

Cattle numbers in the six pastoral provinces / autonomous regions mentioned above have grown significantly from 18 million in 1980 to 21 million in 1997. However, this increase is small compared to what has occurred elsewhere in China over this period. By 1997, the six pastoral provinces combined accounted for only 18% of cattle numbers in China and a disproportionately small 14% of national beef production (SSB [10]). Beef output from some of the agricultural provinces has increased remarkably, especially in the first half of the 1990s. Henan Province, for example, produced more beef in 1997 (647 kt) than all six pastoral provinces mentioned above combined (573 kt).

The regional shift in the focus of the national cattle and beef industry has serious implications for pastoral areas in China. Most pastoral counties have economies that are heavily reliant on livestock industries.[1] Furthermore, these areas have relatively few other development options. The response in many counties has been to increase cattle and beef production.[2] To compete directly with agricultural areas by increasing cattle numbers and beef output entails potentially disastrous consequences for the state of the grasslands. On the other hand, developments in the agricultural areas may provide new opportunities for at least some parts of the pastoral region. In particular, the development of feedlots and household fattening systems in agricultural areas could create a demand for feeder cattle from pastoral areas.

Whether the recent expansion of the cattle and beef industry in China has been advantageous or detrimental to the pastoral region is

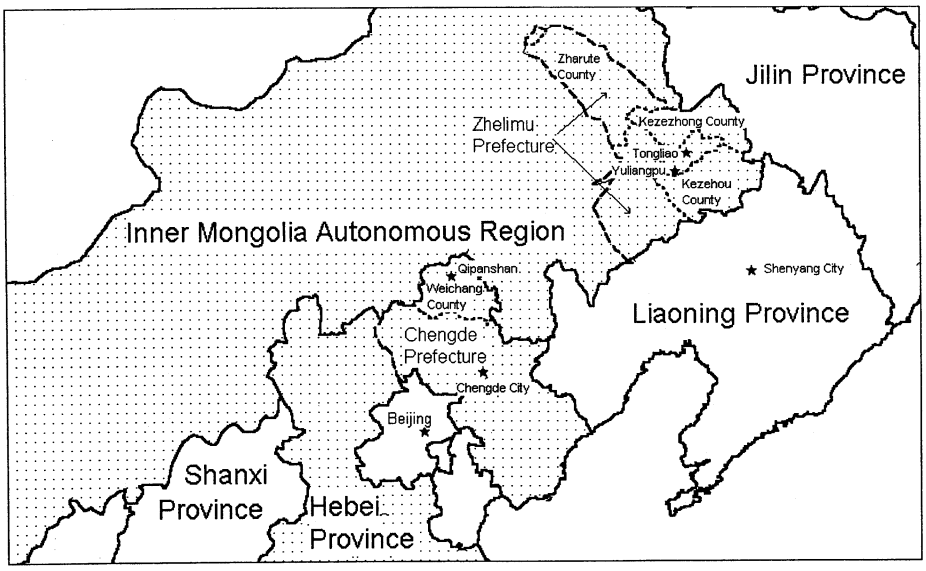

Figure 1. Fieldwork sites in Inner Mongolia Autonomous Region and Hebei Province

not a straightforward matter. To examine the issues involved in more detail, the situation in Zhelimu Prefecture in the southeast of Inner Mongolia and Chengde Prefecture in the far north of Hebei Province will be considered.[3]

Both these essentially semi-pastoral areas are well situated to take advantage of the developments in relatively nearby agricultural areas. Figure 1 shows their proximity to major cattle fattening and beef consumption regions in Hebei, Liaoning, Jilin and Beijing Provinces. With the important exceptions of the northern counties of Zhelimu and Chengde, cattle raising areas in these two prefectures are linked to agricultural areas by generally good transport infrastructure. Both prefectures already have live cattle markets of national significance.[4]

Compared with other parts of the pastoral region in China, semi-pastoral areas such as Zhelimu and Chengde are more susceptible to pasture degradation because of their high population densities, low incomes, high stocking rates, and the incidence of cropping on marginal land.[5] In 1988, 40% of pastureland in Zhelimu Prefecture was classified as "heavily degraded",[6] the highest rate of any prefecture in Inner Mongolia, and 67% of land was "degraded". Some 48% of pastoral land in Chengde Prefecture was said to be degraded. According to prefecture level officials, pasture degradation is becoming steadily worse.

1) For example, in Kezehou County which is a pastoral county in Zhelimu Prefecture of eastern Inner Mongolia, cattle account for about 30% of the county gross production value and about 20% of county government tax revenues.
2) In Kezehou County, for instance, officials planned to increase the total cattle herd from 240,000 head in 1997 to 400,000 by the year 2000 while Weichang County, a pastoral county in northern Hebei, intended to expand its cattle herd from 300,000 to 500,000 over the same period. These ambitious expansion plans are partly motivated by the desire of the local officials to take part in the national push for an expansion in cattle and beef production (which enjoys high-level official political support). However, these pastoral counties also want to retain their traditional status as cattle raising areas in competition with nearby agricultural areas where beef cattle numbers have expanded rapidly.
3) These areas were investigated in detail as part of the fieldwork in 1997 and 1998 undertaken in connection with the research project on which this paper is based. For further information about this research project see the www site at http://www.nrsm.uq.edu.au/nrsm/research/chinap.htm
4) In Chengde Prefecture, about 200,000 head of cattle (valued at Rmb 500 million) are traded per year in 13 markets. About three-quarters of the cattle turned off in Chengde are sold out of the prefecture. The largest market in Chengde is in Qipanshan Town in Weichang County. This market traded 51,000 head of cattle in 1997. Yuliangpu Town in Zhelimu Prefecture has a market that

sells about 60,000 head of cattle per year.

5) In 1988, Zhelimu was the most densely populated prefecture in Inner Mongolia with 46 persons per square kilometer. Average annual per capita incomes in Zhelimu were similar to average incomes in other Inner Mongolian prefectures. Of the seven counties in Zhelimu, four are designated as eligible for national or provincial poverty alleviation schemes. Chengde Prefecture has a population of 3.3 million. In Chengde, six of the eight counties are officially designated as poverty stricken counties. In Weichang, one of the poverty-declared counties in Chengde, average per capita rural income in 1997 was Rmb1,860.

6) "Heavy" degradation is based on three criteria, namely: (a) a large change in the types of herbage grass where most edible grasses are replaced by weeds; (b) the annual yield of usable dry matter decreases by more than 80%; and (c) there is no grazing potential and grasslands are no longer usable for grazing (Longworth and Williamson [7, p. 83]).

3. Protecting and Improving Rangeland Ecology

The Rangeland Law comprises part of a detailed set of regulations pertaining to land rights and pasture management that have been promulgated by national and provincial authorities.[1] However, as discussed by Longworth *et al.* [8], the interpretation and implementation of national and provincial government measures at the local level are often very different to what was intended.

Property rights in the pastoral region have undergone dramatic change in post-liberation China.[2] Population and over-stocking pressures of the centrally planned era (1955-1978) took a severe toll on the pastoral ecology. The Household Production Responsibility System was implemented unevenly in the pastoral region from 1978. Under this system, individual households and herders are entitled to own animals and lease land for exclusive household use, particularly cultivation land. Herders also have certain rights to use grazing land managed by the village collective.[3]

For example, in Zhelimu Prefecture and in Weichang County of northern Chengde Prefecture, households typically run 10 to 20 head of cattle, while the better resource-endowed households run 20 to 30 head. Herd size is partly determined by herding costs, that are potentially high if herd sizes are large relative to available household labour. Feed availability during winter months, however, is generally an even more important determinant of herd size. Despite these major "natural" constraints, interviews with herders conducted by the authors revealed that most intend to increase their herd size.

Grazing practices and regulations

Provincial governments set "proper stocking capacities" for different pastures in different areas. Stocking rate standards vary enormously by season of the year and according to the type of pastures grazed (Longworth and Williamson [7, p. 115]). For instance, in Zhelimu Prefecture, the official stocking rate limit was an average of 150 mu per head of cattle. The comparable figure was 35 mu per head of cattle in Chengde Prefecture.[4] Because of the diversity of the pastures throughout China, stocking rate regulations are interpreted and administered at a county, township and village level.

Owing to deteriorating pasture productivity, official stocking rate capacities in nearly all pastoral areas have decreased over the last decade.[5] Concurrently, government-promulgated stocking rates are not adequately enforced.[6] Village, township and county officials have little incentive to enforce official stocking rate limits. Indeed, there are several good reasons why they can be expected to prefer more rather than fewer livestock. For instance, the revenue from livestock taxes and pasture-use/management-fees may represent useful sources of additional fiscal revenue with which local officials can balance their over-stretched budgets or perhaps even initiate some development projects. Balanced budgets and new projects, along with higher production figures in the short term, improve the administrative reputation and promotional prospects of these officials, many of whom serve in each locality for only a few years before being transferred elsewhere.

Grazing or pasture-use / management-fees were introduced in the beginning of the 1990s. Fees are paid by pasture users to village collectives that are responsible for pasture management, fencing and water supplies. Grazing fees do not appear to act as an important deterrent to over-stocking, partly because the fees are low at around Rmb10 per head of cattle or less than 0.5% of the value of the cattle. In some areas, such as Lanqikalun Township in Weic-

hang County, herders do not pay grazing fees for access to mountain, valley or roadside grasslands. Despite the relatively low level of the fees, in many parts of the pastoral region fiscal revenues from these fees are declining. Herders are becoming less willing to pay fees because of the decreasing productivity of the pastures and officials are becoming more reluctant to extract fees from struggling herders. In a self-perpetuating cycle, lower grazing fees induce herders to over-stock collective grazing land that is not adequately maintained because there is no money to invest in pasture improvement.[7]

Thus, grazing management systems are far from conducive to decreasing stocking rates or promoting investment in the grasslands. As already mentioned, pasture management fees on communal land are too low to act as a constraint to overstocking. Local officials have a trade-off between enforcing low stocking rates to protect grasslands on the one hand, and improving incomes in the short-run on the other hand. In an environment of low incomes and an unstable government revenue base, high stock numbers are thereby effectively encouraged.

Feed constraints

A consideration of cutting and cultivation land leased by herders is crucial to any discussion of rangeland degradation and feed constraints for at least two reasons. First, agricultural expansion effectively encroaches on pastureland, and cropping land is not easily re-converted back to pasture.[8] Semi-pastoral regions are particularly vulnerable to this problem. Second, the amount of cutting and cultivation land available to herders places an important restriction on the amount of winter feed that can be conserved and, therefore, on the number of livestock they can hold over winter. Indeed, analysis of the constraints and costs associated with the production of winter cattle feed presented below, suggests that this factor sets a stricter limit on herd numbers than do the more direct costs associated with grazing cattle.

Winter months are severe in many of the northern parts of China's pastoral region. The time in which there is total snow cover and very low grass coverage rates varies according to locality and altitude. However, pastures can not be grazed for an average of 70 days of the year, and cattle must be fed and housed over this period. Supplementary feeding is required for 30 days either side of these winter months, particularly in early spring when, importantly, pastures are most vulnerable to over-grazing. Feed supplies include stored grass hay and crop stubble together with supplements of grain (mostly corn but also limited amounts of oilseeds like soybean and rape seed cake). There are obvious variations in the nutritional values between and within these feed types. However, in general terms, herders in several localities indicated that cows should be fed at least 10 kg of hay and stubble and 0.5 to 1 kg of grain per day to enable them to maintain their condition over winter and reach full calving potential. Unfortunately, most herders apparently do not feed their cows a ration of this order, with calving rates in the areas visited during fieldwork being less than 66%.

The bulk of the winter feed reserves of pastoral households comes from either cutting land or from the stubble and grain produced on their own cultivation land. Over winter periods, a herder that owns 20 cattle and who is sourcing their hay entirely from cutting land requires exclusive access to about 100 mu of cutting land. The scarcity of cutting land in areas such as Zhelimu and Chengde means that herders generally have access to much less cutting land than they require to make the hay needed to feed their herds adequately through an average winter. With respect to cultivated land, herders in these areas may cultivate up to 20 mu but often much less. Consequently, most herder households also find it difficult to grow enough grain for their animals. Furthermore, less than half of the corn harvested is generally used for cattle feed.

The shortage of cutting and cultivating land used to produce cattle fodder suggests that most herders may find that some off-farm feed purchases are necessary. However, there are substantial costs involved in purchasing cattle feed off-farm.[9] Apart from the cost implications, there are several other socio-economic factors that mean pastoral households are keen to remain basically "self sufficient" in their livestock farming systems. Consequently, many herders subject their cattle to severe winter feed stress, especially towards the end of winter.

Implications

The analysis above suggests that costs to individual herders of providing winter feed are higher than actual full year costs of accessing pastures. Thus, policies applied to privately leased cutting and cultivation land are an important but neglected aspect of controlling stocking rates in the pastoral region. In the light of endemic problems of directly controlling stocking rates and the use of collectively-grazed pastures, it may be more effective to adopt an indirect approach by strengthening the regulations applicable to the leasing of cutting and cultivation land.

Although almost all herders interviewed completely lacked any capacity to produce more cattle feed, as noted earlier, most of them still claim to want to increase the size of their individual herds. To the extent that total cattle numbers do continue to expand, there will be increasing pressure on communal pastureland especially in the critical early spring period. At the same time, it can be expected that stock mortality rates will increase (particularly in early spring),[10] calving rates will decline, and constraints will be imposed on the potential growth rate of young cattle. Clearly, there are major "natural" constraints on the number of livestock that herders can hold over winter and these constraints can be expected to become more severe if herd sizes are increased from current levels.

These obvious "natural" checks and balances on escalating livestock numbers in pastoral areas can also have potentially serious negative implications for household incomes. Furthermore, the implementation of policies designed to constrain livestock numbers, such as raising grazing fees to a level where they will influence stocking rates, can also have immediate adverse effects on the finances of pastoral households. Faced with the need to develop measures and policies that enhance rather than damage household incomes, Chinese officials are looking for new ideas.

One new approach is to promote market-based incentives for herders to increase the value of their livestock without increasing the grazing pressure and perhaps even reducing it. The next major section of this paper examines whether the recent nation-wide development of a significant beef and cattle industry in China has broadened income options for herders within the ecological constraints imposed by the rangelands.

1) For translated transcripts of rangeland regulations and the intricate means of calculating stocking rate limits, see Longworth and Williamson [7].
2) For an overview see Liu [5] and Longworth and Williamson [7].
3) Similarly, most State farms also lease cultivation land and issue grazing rights.
4) There are approximately 15 mu in one hectare.
5) In Chengde Prefecture, for example, on a prefecture-wide basis, the area of pasture required per "sheep equivalent grazing unit" has increased from around 5 mu to about 7 mu over the last decade. In China, one adult head of cattle is regarded as equivalent to five adult sheep in terms of grazing units.
6) For instance, in Zhelimu prefecture officials conceded that the actual stocking rate was closer to 75 mu per head of cattle compared with the legal limit mentioned above of 150 mu per head. In Balinyou County in Chifeng Prefecture, a neighbouring prefecture to Zhelimu, the number of herbivorous animals exceeded theoretical carrying capacity by 8% in 1963, 45% in 1980 and 79% in 1989 (Longworth and Williamson [7, p. 169]).
7) Village collectives generally lack funds for investing in the improvement and better management of their grasslands owing to the inadequate revenues from grazing fees. Individual herders also lack incentives to invest in pasture improvement given the current property rights situation.
8) Land exposed to wind and rain by cultivation is easily degraded, particularly if it is not well maintained and the land is of marginal suitability for cropping. For this reason, regulations in Zhelimu Prefecture since 1984 have stipulated that pastoral households can cultivate only 5 mu per household member. While in most cases, this means a maximum of 30 mu per household, households sometimes cultivated more land. From 1992, households were encouraged to plant one-third of their land to trees. Based on the Russian model, land in Inner Mongolia suffering from desertification are offered to settlers on what is called the "3-3-3 system". Land is allocated to settlers on the basis of 5 mu per household member on a 30-year lease. One-third of the land must be planted to trees, one-third cultivated and one third seeded by grass. Although the government provides the seeds and trees, households are reluctant to plant and maintain the trees. The sustainability of cropping marginal lands and measures to facilitate further settlement of such land could also be questioned.
9) Feed prices in the pastoral region vary from place to place and from month to month and are usually

substantially higher than the national average. However, the following prices recorded in 1998 are illustrative. Straw in Zhelimu Prefecture cost around Rmb0.2/kg including transport. Straw processing costs are also substantial. In Lanqikalun Township, corn could be bought for about Rmb 1.20/kg and soybean meal for up to Rmb 2.50/kg. Generally speaking, a cow of 400 kg would require approximately 12 kg of dry matter (assuming dry matter requirements are about 3% of body weight) per day to maintain her condition. If all the straw required was bought in, daily per head costs of the straw alone in 1998 would have been around Rmb2.4 per day or Rmb288 over a four-month winter period. Grain supplements are also required to maximise calving potential. Although animal feedstuffs are available for purchase throughout Zhelimu and the pastoral areas of Chengde, feeding cattle predominately on feed bought off-farm is an option that would be open only to wealthier herders, particularly those with established marketing channels in place.

10) Most stock deaths as a result of a lack of feed occur in early spring. That is, with a severe or "white" winter, feed resources available to the herder are gradually used up. If these feed reserves are exhausted before the spring pastures have rejuvenated sufficiently, the animals starve to death.

4. Developing a Modern Animal Husbandry Industry

The second stated objective of the Rangeland Law is to develop a modern animal husbandry industry. However, the push to modernise and commercialise the cattle and beef industry since the early 1980s has been independent of the Rangeland Law, and has a very different set of goals and objectives. The process of modernisation has been most profound in the agricultural areas where there has been a shift from cattle being used for draught purposes only, to the emergence of specialist beef cattle. At the same time, cattle production and marketing systems have also become more sophisticated in pastoral areas. Given that cattle and beef industry development is being pursued for reasons essentially unrelated to the Rangeland Law, then it is important to examine whether the modernisation of the cattle industry complements, coincides with, or is at odds with what the Rangeland Law is designed to achieve.

Productive cow-calf operations

One way of reducing pressure on feed reserves in winter and on pastures during the critical early spring periods identified in Section 3, is to turn off feeder cattle before winter. Although the production of feeder, rather than slaughter, cattle is not a new proposal, applying this on a widespread basis in pastoral areas requires a large change in entrenched systems. Herders prefer to sell cattle at high liveweights in the belief that this will bring in more income.[1)] Inner Mongolia has been considered primarily as a supplier of slaughter cattle. In live cattle markets, the majority of cattle traded to southern agricultural regions have a liveweight of more than 400 kg. These are bought for slaughter or for short-term fattening in agricultural areas. In summary, herders generally try to increase the size of their herds through natural increase and seem reluctant to run cow-calf operations.

Despite the predominance of this traditional system, some feeder cattle are turned off in the pastoral region. Officials in parts of Inner Mongolia encourage herders to sell cattle before winter, although most breeders do not conform. In Weichang County, many cattle turned off from pastures in the county were between 12 and 18 months old. These cattle were traded to agricultural regions through the Qipanshan markets, or were fattened for about 3 months in the south of Weichang before being sent to integrated feedlot/abattoirs near Beijing. However, Weichang County was an exception in this regard. The sale of cattle before they reach slaughter weight usually only occurs on a speculative, *ad-hoc* basis in most parts of the pastoral region. There are no systematic channels through which feeder cattle are marketed.

The timing of artificial insemination (AI) procedures for cows, as well as feeding regimes including mineral supplementation, should be designed to achieve the desired marketing strategy. For cow-calf operations to be an economically viable alternative for pastoral households, yearly calf drops need to be as close to 100% as possible (compared with current calving rates in the pastoral areas surveyed of around 66% or less). Weaners turned off in late autumn should be about nine months of age when sold. This allows calves time to grow on summer pastures and coincides with the beginning of the peak cattle-slaughtering season in China. Cows should

also be lactating well in summer. Calves could be supplemented with grain if market conditions are conducive to the production of good quality weaners. To permit the sale of weaners according to this production schedule, cows should be artificially inseminated at the end of spring or at the beginning of summer for calving at the end of winter or in early spring. Consequently, cows should be in peak condition leading into summer to maximise the chance of pregnancy. That is, breeders need access to good feed supplies during late winter and early spring. Given the limits to feed supplies produced on-farm, this requires that only fertile cows and good quality replacement heifers be held over winter. Older steers and unproductive infertile cows need to be culled before winter. Traditionally, cattle production systems in China's pastoral areas involve cows being culled on the basis of age at 10 to 12 years. Selection for performance and breeding characteristics is almost non-existent with little culling on the basis of low fertility. The introduction of selective culling, therefore, involves fundamental changes to long-established production practices. Clear and widely understood incentives are needed before the majority of herders are likely to consider such a dramatic shift in their production systems.

Feedlotting in pastoral and semi-pastoral areas

Further development of the feedlot sector in pastoral and semi-pastoral areas could reduce the number of cattle traditional herders have to feed through the winter and, therefore, reduce pressure on spring pastures. The feedlots would need to accept young cattle off grasslands at an early age, perhaps around nine months of age and up to 200 kg liveweight. These cattle could then be fattened on either an intermediate or long-term feeding regime. The intermediate regime entails fattening cattle for between 90 and 120 days (at an average daily weight gain of 1 kg per day). Such feedlots would be turning off prime feeder cattle at around 12 months of age at a weight of about 300 kg for finishing in other feedlots or fattening areas closer to the main consuming areas. Long-term fattening involves feeding for up to 240 days (at an initial average of 1kg per day gain with decreasing marginal gains over time). These feedlots would be aiming to produce prime slaughter cattle of around 450 kg at less than 18 months of age.

Feedlotting is conducted in the semi-pastoral and pastoral regions of China. However, the feedlots vary markedly in size, ownership, feeding regimes and location. In general, the structure of the feedlot industry in pastoral areas does not involve the intake of young cattle from these areas. Although long-term fattening is emphasized in technical and extension literature in China, it is not widely practiced in either the agricultural or pastoral areas. Surveys of feedlots during fieldwork revealed that the high costs of grain and other feeds relative to product value make long-term feeding a much less attractive proposition than short-term feeding.

Almost all of the feedlots in the pastoral areas are short-term feedlots. However, only a small proportion are specialised finishing feedlots, with most of these feedlots and household fattening units being opportunistic. Thus there is the scope for these short-term, opportunistic fattening households and small-scale feedlots to become intermediate fattening units in terms of fattening the nine month old feeder cattle for a relatively short period before they are finished by another feedlot elsewhere prior to slaughter. Such specialised intermediate fattening units are relatively common in other parts of China such as Shandong Province.

The most vibrant and viable feedlots and fattening households in these semi-pastoral areas are located near the larger regional live cattle markets such as the Yuliangpu market in Zhelimu Prefecture and the Qipanshan market in Weichang county.[2] Both of these markets trade in excess of 50,000 head of cattle per year, have good transportation linkages with other parts of China, and are characterised by the presence of a plethora of buyers and dealers from outside the local area. In these market towns, feed supplies are plentiful because they are essentially agricultural localities. Furthermore, any local feed shortages can easily be resolved because there is good transport infrastructure connecting these towns to other feed sources.

While small feedlots and fattening households are common around the larger live cattle markets in pastoral areas, there are few such units located on the rangelands themselves, except in some Hui villages. As elsewhere in

China, the Hui minority people are the traditional cattle, sheep and goat slaughtermen in pastoral areas.

Fattening households and small feedlots located close to markets in pastoral areas use their cattle husbandry and cattle marketing expertise to take advantage of price movements, seasons and variable cattle quality and weights. This sort of "speculative fattening" activity involves highly variable feeding programs and periods. Surveys conducted of specialised fattening households near the market towns in Zhelimu and Chengde in 1998 indicated that they were making good net profits per head at a time when many larger-scale feedlots in other parts of China were incurring losses. Reasons behind their success included low overhead costs and flexibility in responding to changing cattle and feed prices.

Thus cattle fattening in pastoral areas, either in formal feedlots or by fattening households, is not presently structured around feeding young cattle. However, it might be feasible to introduce measures that would encourage household fatteners to become more involved with the intermediate fattening of younger cattle. This approach might be especially attractive if the household fattening operations were located on the rangelands. Such measures or concessions might include waiving grain quota obligations or providing tax incentives (or subsidies) for such things as the purchase of cattle transport vehicles or the use of *baijiu* waste products for feed. These incentive measures could also be targeted at feedlots involved with the intermediate fattening of young feeder cattle.

To the extent that the above measures involved public subsidies, they might be justified in terms of the favourable externalities generated. These external benefits could include encouraging more sustainable use of the fragile pastures and raising the household incomes of poor herders, many of whom belong to disadvantaged minorities. Presently available public funds for poverty alleviation, grassland protection, and the "Straw for Ruminants" program, among others, could all conceivably be used for this purpose. However, such specific incentives would be difficult to monitor and open to potential abuse.

Breed improvement

Another key element of modernising the Chinese cattle industry has been the programs aimed at genetic improvement. In the longer term, problems could arise from the enthusiastic implementation of herd improvement in pastoral areas.

Inner Mongolia, in particular, has a long history of cattle improvement, mainly through the infusion of the Simmental breed. An extensive AI system is in place at low cost to cattle-owners. There are policies prohibiting herders from owning their own bulls, although this policy is difficult to enforce. While modernisation and commercialisation of the cattle and beef industry will require the continued infusion of foreign breeds, there is a danger that valuable local cattle genes may be lost. In particular, local cattle are better adapted to the harsh rangeland conditions and have the capacity to reproduce efficiently without the need for intensive or supplementary feeding. As local cattle are upgraded towards foreign breeds such as Simmentals, they require better feeding over winter to achieve reasonable calving rates, and they become generally less capable of tolerating the harsh rangeland conditions.

1) Young cattle of around one year of age in these eastern pastoral areas in 1997 sold for Rmb1,500 to 1,800 compared with Rmb2,500 to 3,000 for a fully-grown animal at three years of age.
2) One private feedlot surveyed near the Yuliangpu Town market was integrated with a *baijiu* (alcoholic beverage) plant operated by the family that owned the feedlot. The cattle were fed on the by-products from the *baijiu* plant. Although this feedlot had several contracts to supply cattle to certain processors, it was largely operated in conjunction with "speculative cattle trading" where the feedlot was used to hold and fatten cattle when necessary. The fattening households located around the Yuliangpu and Qipanshan markets generally have a one-time capacity in the range 20 to 50 head. They too tended to concentrate on opportunistic fattening and speculative cattle trading

5. Promoting a Prosperous Regional Economy

Given the limited range of economic opportunities in some pastoral and semi-pastoral areas, local and regional governments have turned to animal husbandry product processing as a way of promoting regional development.

Although an explicit goal of the Rangeland Law, the need to promote regional development in pastoral areas and the desire to achieve it through further processing of livestock products was driven predominantly by other policy measures such as the fiscal reforms in the 1980s. Efforts to date to develop local pastoral economies have not been particularly successful. Brown and Longworth [1] and Longworth and Brown [6, Chapter 9] highlighted the problems faced by governments in the pastoral areas when they attempted to establish wool scouring plants. A lack of co-ordination between neighbouring local governments led to destructive competition and excess capacity. These problems were exacerbated by a lack of expertise in both the technical operation of these plants and the marketing of the processed products.

Recent local government initiatives to build cattle slaughtering and beef processing capacity have mirrored the case of the wool scours and other types of livestock product processing. Many pastoral counties established abattoirs in the second half of the 1980s and first half of the 1990s. However, the majority of these abattoirs are now currently either "mothballed" or operating at very low capacity and incurring significant losses. Local and regional governments are desperately seeking external partners to assist in the support and restructuring of these ailing enterprises.

Once again, efforts at restructuring lack any degree of regional co-ordination. The economics of abattoirs in the pastoral areas suggests that it is impossible for all the existing abattoirs to become viable.[1] Particular abattoirs need to be permanently closed while other selected abattoirs need to be upgraded. But which counties or townships are to retain their abattoirs? Counties or other local administrative units losing their abattoirs need to be convinced that there will be benefits. These benefits are likely to take the form of a greater derived demand for their slaughter cattle and the savings to be made by abandoning a loss-generating works that drains scarce local government funds away from other regional development projects (including rangeland development such as pasture improvement and fencing).

Part of the problem with abattoirs in the pastoral region is that they are selling into a highly competitive, undifferentiated, mass market located in distant urban areas (Cai *et al.* [3]). Some abattoirs in China currently operate at a profit. These viable operations are characterised by having access to the limited premium market for beef that exists in certain segments of the Chinese market.[2] To avail themselves of this market, abattoirs need access to a level of marketing skills not commonly available in the pastoral areas. The pastoral "grass fed" product does have a potential market niche in the premium market. But this market niche is one that requires detailed market development and will not simply materialise.

Rather than focussing just on abattoirs, attention should be directed at other livestock marketing infrastructure. That is, it may be that more value can be added to the local economy by exporting higher value cattle rather than unprofitable, low-value beef. Pursuing some of the strategies discussed in the previous sections of this paper, for instance, may require a better developed set of live cattle marketing channels to increase potential demand both for young feeder cattle and for the advanced feeder cattle emerging from the opportunistic intermediate feedlots. From the viewpoint of local governments, investments in saleyards, therefore, may have potentially larger returns than abattoirs for the regional economy. If more saleyards and better live cattle marketing channels led to cattle being turned-off at a much earlier age, these developments could also help prevent further damage to the rangelands. As indicated earlier, the most rapid and viable development of fattening units has been concentrated around live cattle markets.

Perhaps a more fundamental consideration at the national level is how to encourage regional development in China's vast rural sector. Should it involve large-scale agro-industrial projects such as integrated abattoirs /feedlots that act as the "dragon head" operations to lead development in the rest of the regional economy? Pastoral region governments, because of adverse past experiences or simply because they have insufficient funds, are seeking external sources of finance rather than their own funds to invest in these "dragon-head" projects.

Some other parts of China, such as Shan-

dong Province, have pursued development more at an individual or disaggregated level by encouraging specialisation among individual household whether it be in areas such as cattle fattening, cattle dealing or cattle slaughtering. Such small-scale specialisation has led to a more diverse rural economy and it is an alternative to the large-scale, top-down, approaches to rural development typified by the "dragon head" concept. Of course, economic and social conditions in the densely populated and agriculturally intensive Shandong Province differ from those in the pastoral region. However, as mentioned in the previous section, specialisation already occurs in the pastoral areas in terms of household fattening units. Encouraging that small-scale specialisation to accommodate the production and marketing systems outlined earlier, would seem desirable.

The effective functioning of a decentralised and disaggregated industry based upon a very large number of specialised small-scale production units rather than a few monolithic "dragon head" enterprises, requires an efficient and reliable market information system. Investing in improved public market information systems and the provision of marketing services may not be as concrete or spectacular as constructing large-scale abattoirs or saleyards. Nevertheless, these investments may be much better options for local governments in terms of their overall impact on regional development.

1) This not only relates to economies of throughput and size in the physical operation of the plant, but also economies in co-ordinating cattle assembly and beef marketing and distribution.
2) Analysis carried out as part of the ACIAR/MLA funded research project revealed that so-called "Joint-Venture, Premium Market (JVPM)" abattoirs can return a profit of around Rmb750 per head slaughtered or Rmb3,720 per tonne of beef. However, this requires that 30% of the carcass beef can be sold into a premium market at an average price of Rmb50 per kg compared with a price of Rmb14 per kg in the mass undifferentiated market (Brown *et al.* [2]). If all the beef is sold into the undifferentiated mass market, then this group of abattoirs incurs losses of Rmb811 per head slaughtered. The level of capacity utilisation can also affect the profitability of the abattoirs, although not to the same extent as either the price of the beef sold or the cost of live cattle bought in.

6. Concluding Remarks

The issues addressed in this paper have been illustrated by reference mainly to semi-pastoral areas that are geographically located close to, and are relatively well connected with, agricultural areas. In this sense, they are at the interface between pastoral and agricultural China. As a result, some of the options outlined above may not necessarily be available or suitable in all parts of China's pastoral region. Nevertheless, the semi-pastoral areas represent a relatively large part of this region. They are also the areas with the highest population densities and they tend to have the most degraded pastures.

The recent emergence of a major cattle and beef industry in China provides both problems and opportunities for the pastoral region, especially for the semi-pastoral areas. The greatest problem is that official support for the cattle and beef industry, together with the entrenched practices of herders, has increased stock numbers and stocking rates on already degraded pastures. Pasture degradation cycles have intensified to the detriment of both the incomes of herders and longer-term regional development. Current regulatory and natural constraints to increasing herd numbers appear insufficient to halt further pasture degradation. While stricter regulations on the use of both public grazing land and lands privately leased by households should be enshrined in the revised Rangeland Law, such steps alone will not have any significant impact.

The development of new cattle and beef marketing channels and marketing infrastructure could provide opportunities for herders —along with feedlotters, traders and other market participants—to become involved in higher value, more sophisticated cattle operations. These higher value operations will put less pressure on the grasslands. In essence, herders could concentrate more closely on cow-calf operations, with weaners being turned-off before winter to save on household feed supplies and to reduce pressure on pastures in spring. These young feeder cattle could be fattened in local feedlots on an intermediate or long-term feeding regime. Feedlots and fattening households around vibrant market towns could play dominant roles in this regard, although arguments for encouraging

feedlot development in grassland villages could also be made.

But are these recommended systems viable? Do herders and feedlots have incentives to adopt them? Preliminary analysis from the ACIAR/MLA funded research reported in this paper suggests that in some cases, such as long-term feedlotting, the economic incentives (given the input and output prices of the late 1990s) are at best marginal. Therefore, local governments may need to decide whether there are sufficient potential social benefits to justify the costs of providing the necessary additional economic incentives for individual herders and cattle fattening operations to adopt these new systems.

The strategies outlined in this paper offer a set of intermediate or "second-best" approaches aimed at enabling officials to manage the rangelands and regional development in the pastoral region more effectively within the existing set of policy constraints. However, in the longer term, a major new integrated policy approach is needed. Such a policy would not only combine targeted constraints on land use and herd management with incentives for herders to adopt systems that increase the value of the livestock products from the constrained stock numbers (as advocated in this paper). More fundamentally, such a policy would also include broader macro reforms designed to alleviate underlying problems such as human population pressure.

The original Rangeland Law, with its three major pillars, recognised the need for an integrated policy response. Yet much has happened since this Law was originally drafted in the mid-1980s. In particular, the state of the rangelands has deteriorated and the Chinese economy has further commercialised thus generating new market-driven opportunities. Revising China's Rangeland Law and associated policy measures to accommodate these changes and also to overcome realised shortcomings in the original Law, will be a major challenge. It will not be easy to devise a legal framework that makes a meaningful contribution towards resolving the ecological sustainability problems of China's rangelands while, at the same time, addressing the economic sustainability of the herder households that depend upon these rangelands for their livelihood.

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