

**GRASSLAND ANIMAL SYSTEM DEVELOPMENT IN CHINA SINCE  
1949: EXPANDING INTERACTION WITH THE CROPPING AREA**

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# **GRASSLAND ANIMAL SYSTEM DEVELOPMENT IN CHINA SINCE 1949: EXPANDING INTERACTION WITH THE CROPPING AREA**

**Ou Li and James R. Simpson**

## **Abstract**

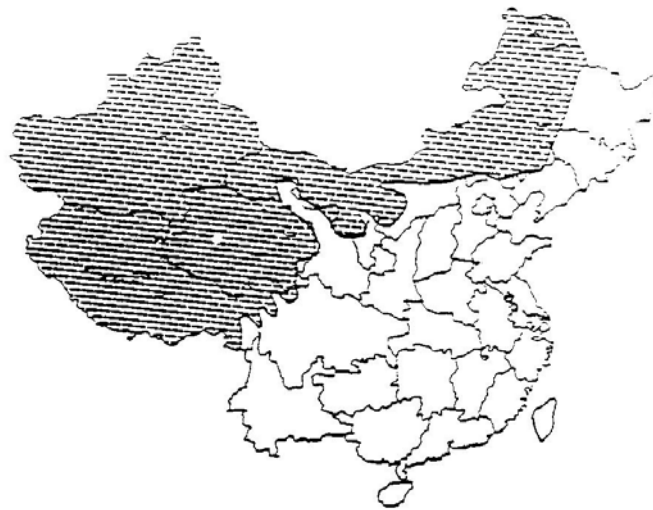
The grassland animal system in Inner Mongolia and other pastoral areas of China, which was transformed over the 4 decades following liberation in 1949 from a nomadic system to a semi-nomadic one, is currently partially sedentary and partially semi-nomadic. An explanation of the transformation process is provided along with the historical cultural setting. Participatory Rural Appraisal (PRA), the same methodology used in an evaluation of the transformation during the early 1990s in the case study site in northeastern Inner Mongolia, is presented in this article. An economic and technical analysis is also reported on about options for structural change in the grasslands over the next quarter century. The analysis involves a shift from an integrated cow/calf and growing-fattening system on the grasslands, to shipping calves from the grasslands to the cropping areas of north central China for growing and fattening. It is concluded that grazing land producers would obtain more net income from selling weaned calves rather than fattened animals. Furthermore, nationally, the country would benefit considerably through reduced use of feedstuffs.

## **Introduction**

China's economy has traditionally been divided into three zones or geo-geographic regions; East, Central and West. There are considerable differences between them in terms of labor productivity, income and other social and economic indicators. The west is the poorest region and has become the focus of most current regional development policy (Yao, 2000). Much of this region, and also the northern part of the Central region—including Inner Mongolia which has recently been designated part of the Western Region by the central government due to its socio-economic features—is grassland. The low agricultural productivity of grasslands and general lack of water and other natural resources is one of the reasons for economic disparity between the three regions. One problem facing planners and development strategists is what to do about the grasslands, and that problem is the focus of the research reported on in this article.

China has one of the largest grassland and pasture areas in the world, covering nearly 2.9 million km<sup>2</sup>. A wide variety of grazing land environments are included, from tiny pastures in the agricultural areas comprising less than one hectare on which a farmer might keep a few sheep or goats, to the roadside communal areas where a producer grazes a half dozen dairy cows or milk goats, up to the vast windswept areas across north China. Equally important are the deserts and rangeland of Western China and the mountainous regions, home to minority ethnic groups and yaks. Roughly half of China is designated as pastoral and grassland, as opposed to agricultural area (Simpson, Cheng and Miyazaki, 1994) (Map 1). The grasslands *per se* are immense, accounting for about 30 percent of the nation's total area. About 2.4 million km<sup>2</sup>, or 85 percent of China's grassland and pastures, are in the temperate zone (Zhu et al

Map 1. Pastoral and agricultural areas of China, 1990



Historically, the major production system in the grasslands has been nomadic animal management, with a small proportion of the population being semi-nomadic. Over time, and especially since China was opened to the outside world in 1978, there has been a major emphasis on settlement of herders into villages or into houses, i.e. an ever increasing semi-nomadic lifestyle in which livestock owners live in houses part of the year.

Curiously, the sedentarization that planners had envisioned of herders living in houses during winter and spring months, and then following their animals the rest of the year, has changed in a substantial number of pastoral areas. What actually has happened is that herders realized the negative impact of the sedentarization on their grassland resources, and thus developed a pattern in which they live in yurts during much of the year, just spending Spring and occasional other times in their houses. Spring is the calving and lambing season, and thus the critical time for good nutrition, shelter and care of young stock. Additionally, this system meets their water problems. They return to their yurts in the middle of June, which by then is summer

pasture, or remain at their sedentary location if they don't have special summer pasture. After going *Aoter* (meaning in Mongolian the short time and fast fattening by frequent moving on pastures with better range conditions), the herders then begin to graze their livestock on autumn pasture. Statistics are not available, but it appears that the majority of livestock in the rangeland areas now fall in this semi-nomadic system.

A critical factor for analysis of grassland production, and pastoral systems in particular, is that they are diverse—and for very good reasons. There is no one solution to the so-called "pastoral problem" of overgrazing and relatively low offtake rates per ha, but there are a number of viable, logical interventions that could result in considerable improvement in productivity (Longworth, Brown and Waldron, 2001). This problem involves a very large region in China. This article is also interregional in scope because the structural changes evaluated are tied to livestock system structural changes in the cropping region as well.

Regional science specialists have numerous research methods at their disposal, and clearly each problem dealt with requires a particular approach and method. A major purpose of this article is to acquaint these specialists with Participatory Rural Appraisal (PRA), an analytical tool with which few are probably familiar. An objective is to demonstrate its use in a regional problem context, particularly as a means to orient longer-term, larger scale research work.

In an earlier article (Li, Ma and Simpson, 1993) we provided a case study of one village in Inner Mongolia which was transformed over the four decades following liberation in 1949, from a nomadic system to a semi-nomadic one. This current article concentrates on that rather small case study site to explain how much of China's semi-nomadic pastoral system operates, and the transformation taking place in both a physical and social context. A related purpose is to provide information on changes that have taken place in the past, impact on the ecosystem, and alternatives for some next steps in economic development of similar low-income areas. This article's regional focus is north-eastern Inner Mongolia and no attempt is made to directly extrapolate our results into a macro level analysis. However, we do believe that our findings provide a basis to promote greater regional productivity of the grasslands, long-term sustainability of the ecosystem, increased incomes to producers and national development. In particular, the findings do have direct implications and relevance for much of China's western region, an area now targeted for economic stimulation

## The Case Site

The case study site for the 1993 article, and the current study carried out in July 2000 is Hurqige *Gacha* (Village), a former production brigade during the commune time between 1958 and 1982.<sup>(1)</sup> It is one of four *Gacha* of Shamai *Sumu* (township), also a former commune located in Dong Ujimqin *Banner* (county), Xilinguole League (prefecture), Inner Mongolia Autonomous Region (Map 2). This *Gacha* of 869 km<sup>2</sup> is on the border between China and the Republic of Mongolia. The average annual rainfall is about 250 mm, and the vegetation is typical Steppe Grassland.

Map 2. Location of the research site



In 1992, at the time of the first study, there were 91 households and 516 people, including Han immigrants who had moved to the *Gacha* in the early 1960s. Actually, they have lived at the banner town since the middle 1980s, but still keep their official registration in this *Gacha*. As of July 2000, there were 103 herder households in the *Gacha*. All were native Mongolian herdsman except for 2 Mongolian immigrants. Besides those households, more than 80 short-time immigrant herders or herder households from a neighboring banner were employed as herdsman to look after the flocks of sheep and goats year-round. Most herder households in this *Gacha* hire such herdsman.

## Case Site Research Methods

The methodologies used in the study reported on in this article are the participatory approach to development study, integrated with sociology and economics. Selected methods of Participatory Rural Appraisal (PRA), such as group and key informant's interviews, mapping of the seasonal nomadic movement, wealth ranking, seasonal calendar, historical profiles on changes in land use patterns, trend analysis for grassland condition, daily routines and activity profiles (especially for women) were used. In addition, Farming Systems Research (FSR), causal diagramming, etc. were also main tools used in the survey. Forty two households were interviewed in the first survey (1992-93), including 39 herdsmen living in the *Gacha*. The remainder were Han immigrants). The results from those detailed surveys were updated in July 2000 by this article's authors using similar techniques although only 25 informants, 10 households, and detailed interviews with village leaders and office officials were conducted.

The rationale for the research methods is that the growing awareness of the failures of conventional development approaches to meeting the needs of resource-poor people has led to the exploration of alternative methodologies for investigating resource management issues; and for planning, implementing and evaluating development activities. Participatory approaches, such as PRA, offer a creative approach to information sharing, and a challenge to prevailing biases and preconceptions about rural people's knowledge. Advocates of participation argue that the production of knowledge and the generation of potential solutions should be developed with those whose livelihood form the subject for research.

The term Participatory Rural Appraisal (PRA) is defined by the World Bank (2001) as a planning approach focusing on shared learning between local people and outsiders to enable development practitioners, government officials, and local people to plan appropriate interventions together. The name is somewhat misleading because PRA is being used in both rural and urban settings, and it is being used not only for project appraisal, but throughout the project cycle. PRA emphasizes participation and learning on the part of the communities visited and this method's trademark is its visual techniques in mapping, ranking and trend analysis used to enable non-literate as well as literate people to participate fully.

Stakeholder analysis is the starting point of most participatory work and/or social assessments. It is used to acquire an understanding of the power relationships, influence and interests of stakeholders involved in the development of a project or policy. Its findings can

provide early and essential information about: who will be affected by the project (positively or negatively); who could influence the project (again, positively or negatively); which individuals, groups, or agencies need to be involved in the project, and how; and whose capacity needs to be built to enable them to participate (World Bank). Based on this analysis, a plan for how to involve each stakeholder group in subsequent stages of the project or policy work is developed.

The methods used in PRA range from field-based visualization, to interviewing and group work. The common theme is the promotion of interactive learning, shared knowledge, and flexible, yet structured analysis. These methods have proven valuable for understanding local perceptions of the functional value of resources, processes of project intervention, and social and institutional relations. The key word, of course, is “participation” which USAID (2001) defines as “the active engagement of partners and customers in sharing ideas, committing time and resources, making decisions, and taking action to bring about a desired development objective.” Participatory approaches can bring together different disciplines, such as agriculture, health, and community development to enable an integrated vision of livelihoods and well-being. Participatory approaches also offer opportunities to mobilize local people for joint action. By participation, a side benefit is that the local rural population can raise their sense of ownership and commitment to the process of development planning, and implementation. In this way programs can produce much more sustainable impacts. This is particularly important to the development of western China during this fast transition period to a market economy in which there is still a strong tradition of the planned economy approach, especially at the local government level.

### **Evolution from the Nomadic Pattern**

The native Mongolian herdsmen in Hurqige *Gacha* had traditionally followed a long-distance nomadic movement pattern as late as 1956 when the *Bage* (a synonym of *Gacha* in Mongolian) was formed and its boundaries fixed. In 1952, a work team was sent by the banner government to the Hurqige area to teach herdsmen to read and write. Herdsmen continued a short-distance seasonal movement within its boundary until 1985, at which time they changed into a semi-nomadic pattern. Accompanying the evolution of the movement pattern were changes in institutions of administration and production.

In 1957, the "collective movement" was introduced into this area. By 1958, all animals had become the property of collectives, which paid the owners for the animals during the

following 25 years. During the commune period, the brigade was responsible for production and financial management as well as development planning. The brigade leaders made arrangements for seasonal use of grazing land, allocation of labor and money for production, selling products and distribution of income among the Accumulation Fund (for investment), Public Welfare Fund and the households. The households got their income based on their Labor Points (Work Score) gained mainly from looking after the animals.

The nomadic movements were frequent in 1960s. The moves were also shorter (about 2-4 km) within each seasonal pasture, usually a total of 6-8 times (or more) each year. Herders stayed in one camp (i.e. physically took down their yurts and moved them) no longer than two months. But, due to the equalitarianism in income distribution and loose management during the Cultural Revolution, they moved less and less, down to 4-5 times every year during the 1970s.

Since 1985 the seasonal movement in Hurqige *Gacha* has changed into a completely semi-nomadic pattern. Several factors have contributed to it, and intervention from the regional and local governments can be traced back to the 1970s. The government considered nomadism as backward and something to be gotten rid of. Originally, they encouraged the herdsmen to build permanent houses and shelters in winter pastures and follow a nomadic mode during the warm grass-growing season. However, due to water resource shortages or limited grazing land, and the critical time for calving and lambing being in the spring, houses and shelters were actually built in the spring pastures in most of the pastoral areas in Inner Mongolia. The case of Hurqige *Gacha* provides a typical representation not only of Inner Mongolia, but also of a substantial portion of the northern grasslands across China. Apart from the general reasons mentioned above, one in particular is that former summer pasture with water resources (about 200 km<sup>2</sup>) was returned to Sunite Pastoral Farm (a commune) in 1986. That farm was forced to move from the national border area in the early 1960s and only returned in the early 1980s to become a new *Gacha* (Bayinaobao *Gacha*) of Shamai *Sumu* in middle of 1980s. What this means is that the herdsmen of Hurqige *Gacha* had to remain all spring, summer and early autumn in their former spring pastures.



In 1985, the herdsmen obtained utilization rights for the grassland after getting back ownership of the animals in 1983. The certificates of use right clarified the area size as well as the boundaries. Beginning in 1987 the households started to build houses, shelters, pens and above ground bunkers for hay storage. By the end of 1992 all the herdsmen had built facilities and also had 35 to 200 ha of fenced pasture in their spring camps. More than 90 percent of them built houses, mainly of brick with tile roofs. There is now 0.5 - 1.5 km between the permanent homes in these spring “camps”.

The herdsmen remain sedentary from the middle of March to the end of August to carry out the spring and summer activities. Then, the men or young couples of the families go *Aoter* by driving the flocks of sheep and goats to the winter pastures for 10 - 20 days for fattening. The cattle remain at the permanent residences. After returning back to their permanent homes they herd their animals 2-4 km from their houses, but not more, otherwise it will be too far from water resources. In late October, when snow is available for water, they move to the autumn pasture and stay there until the end of December when the snow cover becomes too thick for animals to graze. Then, they move to the winter pastures where grass is available.

The new arrangement for animal ownership and grassland utilization is the result of the reform policy. The commune system was dissolved in 1983 and replaced by *Sumu* (for commune), and *Gacha* (for brigade). Village committees took the place of the former brigade committees, and play a greater role in service than in administration. For example, the leaders look for marketing channels for the herdsmen's animal products now that marketing has become decentralized and prices freed. They negotiate the price of hay for herdsmen with some Han immigrants who come back to the *Gacha* during the grass mowing season. The *Duoguilun* (group in Mongolian, an organization existing also during the commune period under the brigade) has been reorganized based on the distribution of herdsmen's homes. Within the group, clipping, washing, AI (artificial insemination), etc. are organized. *Gaote* (which in Mongolian means a pair of herder households staying and moving together to share the task of looking after a flock of sheep and goats) plays a more important role than before. The two households are usually brothers, or father and son. They put their own animals together to form one flock of

sheep and goats, one herd of cattle and another of horses. In this way they can save labor and better utilize infrastructure.

### **Impacts of the Change from a Nomadic to Semi-nomadic pattern**

All herdsmen interviewed in 1992-93 were positive about changes from the shift to a semi-nomadic system. For example, that the sedentary lifestyle had improved living and working conditions, strengthened production stability and provided greater resistance to natural disasters. But, on the other hand, the herdsmen were also aware of some negative impacts. Most herders interviewed in 1992 and 1993 considered that the grassland in Hurqige had deteriorated compared to the 1940s, and it was already worse in the 1970s—the Cultural Revolution period—than in the 1950s. Virtually all the interviewees attributed the reasons for deterioration to the high animal population and over-grazing. Change toward a dryer climate than in the 1950s and 1960s ranked second. A problem found was that animals grazed the pasture in sedentary areas during the entire spring and summer (which totally covers the grass growing season) rather than being moved periodically. Herdsmen said that the grasslands were almost bare in May and June (before the rainy season) in most years.

Most people believed that animal performance, especially resistance to bad natural conditions, had decreased due to reduced exposure to natural hardship and worsened grassland nutrition. They mentioned that the sheep in Mandalatu *Gacha*, where snowfall and cover are always heavier and thicker than in Hurqige, are more tolerate to severe winters. Nevertheless, in general, sedentary life has noticeably reduced animal mortality and increased the stability of animal production. The other important factor has been increased incentive through privatization. The animals belonged to the commune in 1970s, while by 1985 they were privately owned.

The living and working conditions of herdsmen were considered to have greatly improved due to their semi-sedentary life and other infrastructure improvement, especially for women. Most households had tractors which the men drove to fetch water and animal droppings (used for cooking fires) rather than this just being women's work. Wives did not milk cows as

much as before because the cows were on their own, and the crossbred calves needed more milk. In the evening, sheep were often enclosed in pens, which prevented access by wolves so that wives could sleep peacefully with their families rather than getting up during the night to check on their livestock.

Another important impact on attitudes and behavior of herdsman was not directly caused by the nomadic pattern change, but rather by changes in the land tenure system. As a result, herdsman had developed a confidence in their utilization rights for grassland, and no longer worried about new families getting land from the *Gacha*. Ironically, and in contrast to views about degradation of pasture quality, they said they wanted to maintain their assigned pasture in good condition for the upcoming generations. In the previous five years they had spent 15-25 percent of their total expenditures on fencing, building shelters and houses, and developing wells. Rapid increases in animal product price and income in recent years also helped. The result was that total *Gacha* expenditures increased four fold from 1985 through 1992. Nevertheless, all agreed during the 1992-93 interviews that there was still an urgent need to introduce and adopt appropriate technologies in the new semi-nomadic pattern to stop grassland deterioration, and to keep the ecosystem and pastoralism oriented to a sustainable development manner.

### **Case Study Site Interviews in 2000**

The PRA survey carried out in July 2000 not only served as an update on understanding the changes in the institutional setting and nomadic movements in the Mongolian pastoralism areas, and the impacts on the grassland ecosystem and Mongolian herder households' culture and life, but also traced the new changes and challenges the herder households are facing. It was determined that income disparities between households had widened from these in 1992/93. Informants used the number of livestock as the indicator of wealth status. Thirty-six households (about 1/3 in the *Gacha*) had less than 500 livestock. Fifteen of them had even less than 300, a number so low that it results in a difficult life considering the increased annual expenditures in living and production. The informants attributed the growing differences mainly to the capacity of individual herder's planning and management in production, income and expenditure. The stage in a family's life cycle also

contributed to the disparity. Because the grassland is limited, new and young families have less grassland and livestock per capita than other households.

It can be concluded that about 50 percent of herder households in the *Gacha* have the means to significantly improve their grassland and animal system. But, information on the appropriate technological methods and management knowledge/skills were found to be still missing, as they were 7 – 8 years ago. Besides these, it was also found that current grazing pressure was much greater than the proper stocking rate identified in 1985 when grassland use rights were allocated. Considering the proposed fall sales of animals, the grazing pressure was to be reduced. However, it would still be much more than the proper stocking rate, the current one of which should be lower than the one identified in 1985, considering the grassland deterioration since then.

In terms of dealing with grassland deterioration, the herder households have taken measures to change the movement pattern. It was found that herders remain less time at their sedentary locations than in 1992 and thus the grazing pressure on the spring pasture where the sedentary house is located has been reduced. It was also found that although most of the herder households hire labor to look after the flocks of sheep and goats most of the year, they are still busy at other activities that are the most important to their income generation. They themselves look after the flocks of ewes/female goats with lambs and kids in lambing season. They take care of cattle and horses all year round, including calving. They do all of the veterinary prevention for livestock, and harvest products such as cashmere and wool.

It was determined that the senior herders and former *Gacha* leaders were worried about the attitude and behavior changes of the young herders towards labor which might result in loss of Mongolian herders' culture. The Mongolian herders want their children get more education, (and some of them do find jobs outside the grassland area and pastoralism), an attitude that is in contradiction with concern about culture loss. This is quite interesting considering that such cultural transition upheavals are found all over the world in development situations. They are expected to increase as the west of China receives increased development priority.

It was concluded that in terms of research methods, when the methods and tools of PRA are thoughtfully selected and systematically used, the current situation, problems, needs and countermeasures of affected people in the area can be well defined and analyzed within a short time. The changes and differences in space and time among herder households were easily and clearly determined, and it was concluded that from them better research and development planning can be organized. Indeed, PRA is an important and useful tool in regional related

research.

Mongolian herders were found to be aware of the negative impacts of livestock overpopulations on their grassland resources. But, livestock are their only source of income. Considering ever-increasing production and living expenditures, it will be difficult to reduce the number of livestock to the proper stocking rates too sharply and fast. Rather, alternatives should be found to meet additional income generation. Considering all the relevant factors, some off-pastoralism activities might be alternatives to achieve sustainable development of the grassland area and animal systems in the western area (including Inner Mongolia) of China. One of these is now reported on.

## **Structural Changes in Development of Northern China's Beef Industry and Grazing Lands**

A major concern of the Chinese government is how meat and other livestock products can be produced more efficiently. This translates to optimizing the amount of feedstuffs required to produce a given product. Alternatively, it means determining how more products can be produced with a given amount of input. Feedstuffs are the focus of this as they are the major limiting factor preventing transition from subsistence grazing to an integrated livestock production system on China's grasslands. The problem dealt with is evaluation of cattle feedlots as a substitution for grass fattening to slaughter weights.

Livestock production and pastoral systems in China are as varied and complex as the grazing areas are ecologically diverse. For example, a substantial portion of cows in all grassland areas are milked, used for draft and consumed for meat. In the pastoral grazing areas, herdsmen generally own both cattle and sheep. Furthermore, beef in China has traditionally been a by-product of draft animals rather than being a principal output of cattle. About a quarter of China's beef and 40 percent of the lamb and mutton come from the grassland area. However, due to mechanization and consequent reduction in the number of cattle kept for work purposes, greater reliance will inevitably be placed on rangelands as a source of beef cattle.

In 1996-98 there were 98 million head of cattle in China (called "yellow oxen" to differentiate them from buffalo), including single purpose and dual purpose dairy cattle. Results of long-term projections of China's supply and demand of animal feedstuffs shows that per capita consumption of beef will increase from 3.2 kg in 1996-98 to 9.0 kg in 2030 provided the economy continues strong growth (Simpson and Li, 2001). As a result, cattle numbers (not including buffalo) would have to increase to 177 million by 2030. The vast

grasslands will have to play an important role in meeting beef demand from domestic production.

A critical factor for analysis of livestock, and grassland area production systems in China in particular, is that they are diverse—and for very good reasons. There is no one solution to the so-called "pastoral problem" of relatively low offtake rates per hectare as well as overgrazing, but there are a number of viable, logical interventions that could result in considerable improvement in productivity. An unfortunate longer-term impact of overgrazing and the cropping of inappropriate areas is that despite commendable efforts, little scope exists for significant widespread rejuvenation of degraded grasslands due to relatively high cost, although much can be done to *prevent* further problems. In effect, the problem is of such massive proportions and rangeland productivity so low compared with agricultural areas, that massive investment alone is not the answer to greatly expanded red meat production from China's grasslands. These factors, details of the feasibility study and results are found in Simpson and Li (1996). The initial findings based on the PRA in 1992 and reported here were reconfirmed in the 2000 PRA.

There are a number of reasons for the low productivity of cattle in China, some of which can be overcome, while there is little possibility for changing others. Climate and land are factors over which humankind has little control and thus must adapt systems and management to expand output. One way is to shift from a system in which cattle are raised to slaughter weight on grass (sometimes being sold at four to six years of age) to a cow/calf system in which calves are shipped to agricultural areas for fattening at weaning time. In this way the vagaries of climate, which lead to weight loss in the winter or during periods of drought, can at least be partially overcome. Stocking rates can only be reduced if some management mechanism is developed that allows offtake to remain the same level or perhaps even expand when animal numbers are reduced. Therefore, there is need to design and implement systems that can accomplish that goal.

Most range grasses cure well and do not suffer great drops in protein content as happens in tropical and semi-tropical areas. Nevertheless, protein is short for much of the year whether livestock graze, are fed hay, or are provided crop residues. In other words, from the technical side, nutrition coupled with limited production, and most important winter feed, is the most serious constraint to expanded production. But, for a nutrition improvement program to be successful, there must be changes in production systems and in management as a whole.

Four analyses of the model grassland cattle operation were developed. Two systems were evaluated. One was based on the current practice of fattening cattle to slaughter weight on

grass, while the other was a simulation in which weaned calves were shipped to feedlots. Each system was further divided into two parts, one reflecting the current situation and one with considerable improvement in management and technology adoption. Thus, there were four budgets were developed. An objective was to determine if an improved system would be economically viable, if a change to weaning calves was viable and the relation in terms of feedstuffs utilized. It was concluded that the change is viable from the producer's viewpoint.

### **Feedstuffs Utilization**

One of the most dramatic parts of the analysis, and of particular interest for macro level planning, relates to a comparison of feedstuffs use as measured on an energy and protein basis. Results in Table 1 show that while 14,230 Mcal of metabolizable energy (ME) and 738 kg of crude protein (CP) are required per 4-year old male sold at slaughter weight in the current alternative, a feedlot fattened animal from the current alternative cow calf operation needs only 5,670 Mcal of ME and 371 kg of CP. In the improved operation, only 5,410 Mcal of ME and 351 kg of CP are required. In effect, less than half as much ME and CP are required when the feedlot system is introduced. The ME and CP in the grass fattened operation are an accumulation of utilization by the calf as well as the amount attributable to each year of life. Grass fattened cattle in China gain during the summer months but then lose during the winter. The ME and CP are calculated dry matter based requirements for minimal growth. The feedlot ME and CP are based on dry matter based equivalents of feedstuffs consumed (Simpson et al. 1994).

### **Discussion and Conclusions**

The economic and feedstuffs use models discussed clearly indicate that considerable advances can be made in improving the efficiency of China's cattle industry. A shift to a cow/calf orientation would also free up some rangeland for renovation. In addition, a species shift toward cattle and reduction in sheep would greatly help rangeland renovation.

Another conclusion is that feedlots are a viable alternative. However, use of them will take time to develop due to the need for improved transportation and communication systems and knowledge about management. Fed cattle prices historically have not been particularly favorable for feedlot finishing but, as the economy develops and demand grows, prices will improve. Feedlots are being constructed and in the past decade a flourishing feedlot industry has begun to evolve (Smith, 2001).

Development of China's beef industry has to be evaluated from a micro as well as macro viewpoint. The micro, or producer-oriented analysis, indicates that a substantial increase in profitability could be obtained from an improved system, even when fattening on grass. Additionally, shipment of calves to feedlots is more profitable than the present grass fattening oriented system. Naturally, there are considerable differences among producers, part of which is based on management and part on location. Some producers are so isolated that calf production will not be a viable alternative for many years. In other cases, where producers are located near rail lines or major roads, many of them could shift over to a cow/calf system if a viable marketing system were developed. To date, the road, rail, and communication infrastructure has been inadequate to support a major region wide structural shift not only to shipping calves to a feedlot system, but also for substitution of cattle for sheep. But, as the two PRA studies reveal, rapid development of infrastructure is taking place and is sufficiently adequate that some grassland producers could participate. This finding is also verified by the research of Smith (2001).

The analysis indicates that a substantial savings is possible in feedstuffs per kg of meat produced (on a protein and energy basis) by shifting to a cow-calf system in the grasslands. Furthermore, there is an abundance of low quality roughage in farming areas such as rice and other straws as well as stovers such as maize residues, which can, and do, serve as a basis for feeding cattle. The government has a self-sufficiency food policy that is oriented to importation of technology rather than feedstuffs or food. As part of it China has a very large program in farming areas for treatment of low quality roughages with ammonia and urea. (Li, Shang, Guo, and Waldron, 1999). This will expand with demand for higher quality feeds. The government policy, articulated through both tariff and non-tariff means, has stimulated development of the feedlot industry (Longworth Brown and Waldron, 2001). Beef imports and exports are minor and about offset each other.

One impediment to development of a large-scale feedlot industry is knowledge, i.e. a technical problem. In general, capital is not a constraint, especially to villages and cities, which are already major owners of hog and chicken operations. Continual land tenure changes will also be required which will encourage people to migrate from grassland areas to urban settings. The grasslands are overpopulated in the sense that expansion of holdings—and thus greater incomes—through size, scale economics and more sophisticated management requires human depopulation. The last impediment is need for a nationally promoted marketing program that will facilitate sales of calves from grassland areas to crop areas. One innovation being experimented with at China Agricultural University is a contract system in which cow/calf



producers retain ownership of calves through the fattening process and/or a contract system.

Rapid and dramatic changes have taken place on China's grasslands in the past several decades as a very isolated, traditional lifestyle has been transformed to one heavily oriented toward a market economy. The PRA results presented in this article are representative of the changes that have taken place. There are, of course, differences between regions in terms of integration with the market economy and in the degree to which the production system has been transformed from nomadic to semi-nomadic. Nevertheless, the panorama described does accurately portray the sweeping changes that have taken place.

Nationally, massive investments are being made in roads, the rail system and in communication services. It is not unrealistic to expect that within a decade a substantial number of former nomadic pastoralists will have telephones, television sets and indoor plumbing. In addition, rapid development in the economy is bringing about increased demand for meat. As the country mechanizes, the number of draft animals will decrease. Price relationships will develop so that the grasslands will slowly, but surely, be transformed from a production system in which cattle and sheep are raised to slaughter weight on grass, to one primarily oriented to a breeding system in which calves and excess lambs are shipped to farming areas for fattening.

The transformation that has taken place, and will continue to take place, is nothing short of revolutionary. Furthermore, as national infrastructure is developed there will be increased use of the whole plethora of viable production and marketing technologies now available that can easily be adapted to the herdsmen's needs. We do lament the passing of an era, the demise of an entire subculture that spawned the great Genghis Kahn and led to the Yuan Dynasty that ruled China for 97 years, from 1271 to 1368. The trade-off is development of a low cost, efficient supply of beef, lamb, mutton and wool as well as improvement of the ecology at the national level and increased income, leisure time and greater economic security for herdsmen on China's grasslands at the micro level. Not documented in detail here, but particularly striking, were the women's narratives which evolved during the field work, which indicate that few of them would return to those earlier days.

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### Footnotes

- 1) Following are definitions of Mongolian words and names used in this article. *Aoter* (a short period of rapidly fattening animals on good grass), *Banner* (county), *Bage* (synonym for gacha), *Duoguaailun* (a group in Mongolian, an organization also existing

during the commune period under the brigade), *Gaote* (a pair of herder households staying and moving together to share the task of looking after a flock of sheep and goats), *Gacha* (village, called a brigade prior to 1983), *Sumu* (township, called a commune prior to 1983).

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Table 1. Metabolizable energy and crude protein per head sold.

Parameters and results	<u>Grass fattening</u>		<u>Calves to feedlot</u>	
	Current	Improved	Current	Improved
ME/Hd finished to slaughter weight				
Grass finished		13,320		
3-year old males (Mcal)	14,230		5,670	5,410
4-year old males (Mcal)				
Feedlot finished (Mcal)				
CP/Hd finished to slaughter weight				
Grass finished		730		
3-year old males (Kg)	738		371	351
4-year old males (Kg)				
Feedlot finished (Kg)				

Source: Simpson and Ou, 1996.