The Australian Centre for International Agricultural Research (ACIAR) was established in June 1982 by an Act of the Australian Parliament. Its mandate is to help identify agricultural problems in developing countries and to commission collaborative research between Australia and developing country researchers in fields where Australia has a special research competence.

Where trade names are used this constitutes neither endorsement of nor discrimination against any product by the Centre.

ACIAR TECHNICAL REPORTS SERIES

This series of publications contains technical information resulting from ACIAR-supported programs, projects, and workshops (for which proceedings are not being published), reports on Centre-supported fact-finding studies, or reports on other useful topics resulting from ACIAR activities. Publications in the series are distributed internationally to a selected audience.

Longworth, J.W. (ed.) 1993. Economic aspects of raw wool production and marketing in China. ACIAR Technical Reports No. 25, 62p.

ISBN 1 86320 082 7

Technical editing: R. Pini.
Typesetting and layout: Arawang Information Bureau Pty Ltd, Canberra, Australia.
Printed by Goanna Print Pty Ltd, Canberra, Australia.

Economic Aspects of Raw Wool Production and Marketing in China

Editor: John W. Longworth

The papers in this report were presented at a Workshop on Sheep and Wool Research in China, held at Huhehote, Inner Mongolia in June 1992

Australian Centre for International Agricultural Research
Canberra 1993

Contents

Project Objectives and Rationale

Niu Ruofeng*

ACIAR initially established the project 'Economic aspects of raw wool production and marketing in China' (No. 8811) for three years, with a formal starting date of 15 March 1989. After a supportive review in September 1991, the project was extended to 30 June 1993. The collaborating institutions are: the Department of Agriculture, University of Queensland, Australia; the Institute of Agricultural Economics, Chinese Academy of Agricultural Science, Beijing; and the Institute of Rural Development, Chinese Academy of Social Science, Beijing. Fieldwork in China began in August 1989.

Objectives

The major objectives are:

- to identify and, where possible, to quantify the technical, economic, and institutional constraints to the production and marketing of raw wool in China; and
- to establish a strong basis for longer-term collaborative research between Chinese and Australian scholars on wool economics in China.

Project Rationale

The Government of the People's Republic of China places a relatively high priority on the development and management of the nation's raw wool industry. A prosperous wool industry is considered a major factor contributing to the socioeconomic stability of the strategically important pastoral region (Fig. 1). As a result, the Chinese Government is working to apply appropriate technologies and policies to increase the productivity of the wool industry and thereby boost the social and economic development of the pastoral region.

Strategically, the pastoral region is quite significant. A large proportion of China's mineral, fuel, and grassland resources are located there. The region also borders on countries such as Mongolia, Kazakstan, Russia, Afghanistan, and India, that have rapidly increased trade with China in recent years. Further implementation of an 'open door' policy will strengthen this trade and increase the economic and social development of the pastoral region. These developments are especially important since minority nationalities represent a large proportion of the people living in the pastoral region. Greater economic and social development in these remote parts of China will facilitate harmonious relations between the Han people and minority nationalities, the most numerous of which are Mongolian, Tibetan, Uygur, Kazak, Yuguo, Hui, Man, Tajik, and Ewenke.

To assist in maintaining good relations among the numerous nationalities, the Government of the People's Republic has established autonomous zones of residence, which afford a relatively high degree of administrative and cultural autonomy to minority populations. These autonomous zones are established at the administrative level corresponding to the area of a minority population. Therefore, autonomous counties may be established in a non-autonomous prefecture or province, providing the county's minority population is 'significant.' Moreover, the county may consist of spatially separated areas that reflect scattered minority populations. Sunan county in Gansu province, for example, is a Yuguo autonomous county comprising five spatially separate land areas (see Fig. 4 in Chen, this report p. 13). The Chinese Government views autonomous zones as a key element in maintaining social coherence and stability in remote, economically underdeveloped areas. Anxious to contribute to the success of this policy, it places great emphasis on sustaining real economic growth in the region.

Although raw wool production can provide a base for the economic development of the pastoral region, the wool industry faces constraints that challenge not only further development but also efforts to maintain current prosperity. The industry has seen massive socioeconomic change in the last decade. Since the mid-1980s, the national authorities have become increasingly interested in the problems of the pastoral region and the wool industry. ACIAR Project 8811 examines these problems.

As a major commercial industry in China, raw wool production has a short history. One reason for this is that one-third of China described as the pastoral region includes some of the most remote and

* Institute of Agricultural Economics, Chinese Academy of Agricultural Science, Beijing.

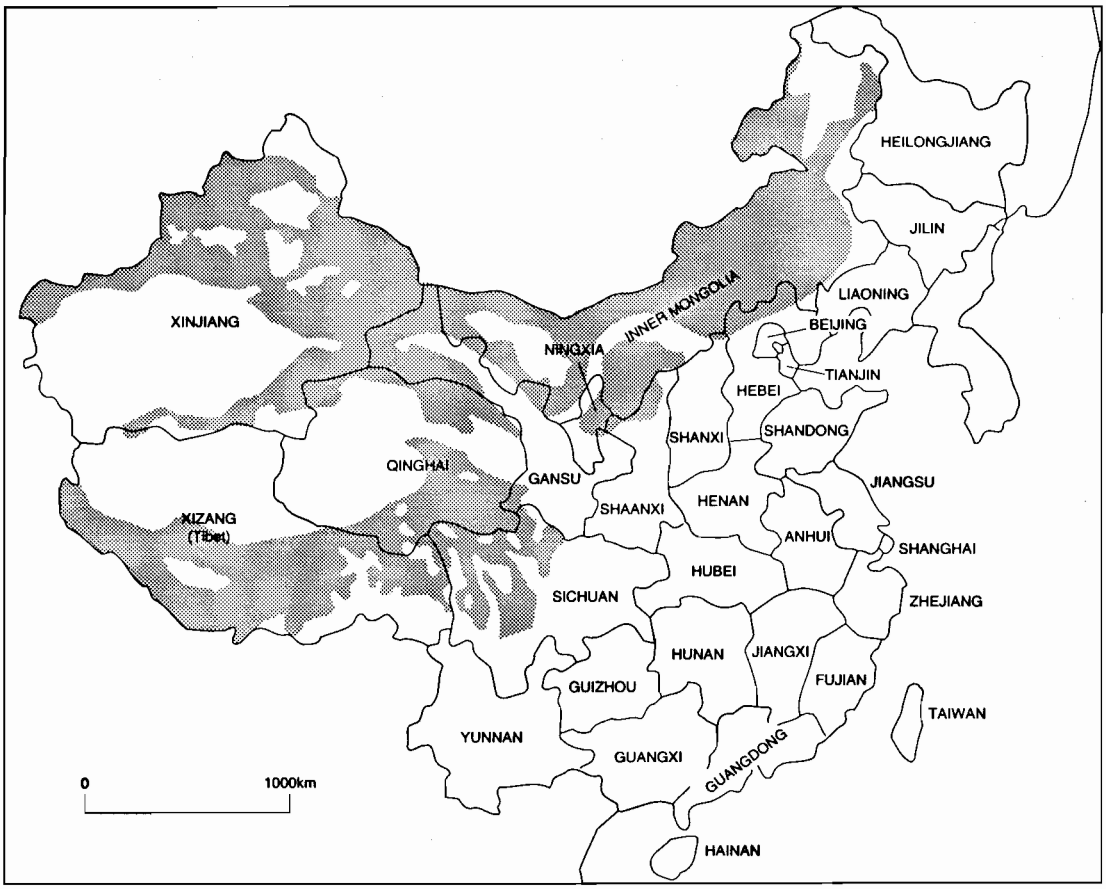

Fig .1. The provinces and (shaded) pastoral region of China

economically least developed parts of the country. In 1989, Inner Mongolia, Gansu, and Xinjiang—three of the most important provincial-level administrative units in the pastoral region—contributed 125 000 t of raw wool or 52% of all wool produced in China. Some 78 000 t of this was fine and improved fine wool (≤ 25 micron fibre diameter; see Longworth 1990), constituting 65% of the national output of this class of wool.

During the first half of the 1980s, the People's Republic of China emerged as a major export destination for Australian wool. In 1979–80, China purchased only 14 000 t of wool from Australia, but this increased to 106 000 t by 1986–87, which represented 11.5% of the total export value of Australian wool. However, Chinese purchases declined sharply from late 1988, and during the 1989–90 financial year, only 3.6% of wool exports by value went to China. Wide fluctuations in Chinese purchases during the 1980s had a destabilising influence on the Australian wool industry. At the same time, the sharp increase in wool imports from Australia contributed to the collapse of Chinese domestic wool prices from 1989. Many obvious and simplistic explanations were circulated to explain fluctuating Chinese demand for Australian wool, yet the real situation in China was not well understood in Australia.

Chinese demand for imported wool is both a derived and a residual demand. It is derived from the demand, both in China and from overseas, for Chinese wool textiles. It is a residual demand because Chinese textile manufacturers are 'encouraged' to use domestically produced raw wool before turning to imports.

Considerable research by the International Wool Secretariat (IWS) and others has been devoted to analysing changes in the domestic market for wool textiles in China. Likewise, the role of China in the world textile market has also attracted the attention of IWS researchers and others. Nevertheless, before the

initiation of ACIAR Project 8811, no serious, detailed research had been undertaken on the supply side of the Chinese wool industry. Even in China, and particularly in Beijing where most important policy decisions are made, little detailed information is available about the rapid changes over the past decade in the pastoral region of China.

For both Chinese and Australian policymakers, therefore, ACIAR Project 8811 is filling an information gap. For the Chinese Government, the project is providing important data and ideas about the constraints facing the raw wool industry in China; and is showing how these limitations on the economic development of the pastoral region can be readdressed and, perhaps, overcome. From the Australian perspective, the project is contributing to the formation of realistic expectations about the future for Australian wool on the Chinese market.

Reference

Longworth, J.W., ed. 1990. The wool industry in China: some Chinese perspectives. Mount Waverley, Victoria, Inkata Press, 105 p.

Project and Research Methodology

Chen Jiyuan*

ACIAR Project 8811 called for a considerable degree of organisation. While the basic methodology may appear straightforward, the magnitude and diversity of the data-gathering task required close collaboration between the three institutional groups working on the project.

Methodology

Research methodology is concerned with the broad philosophical approach implicit in the research process. Yet, ACIAR Project 8811 cannot easily be described as moulded by a particular research philosophy. The range of issues examined, the number and background of the researchers involved, and the time and space dimensions of the project, all mitigate against any simplistic description of the research process.

Nevertheless, the essence of this research process can be captured schematically (Fig. 1). The three key aspects of the project—namely, normative research, positive research, and policy recommendations are identified and placed in context.

Throughout the project, the research team used well-established normative paradigms or theoretical frameworks to formulate ideas and hypotheses, and to provide a focus for discussion. Normative theories clarified a variety of complex issues including: household distribution of power, food, work, economic rewards; incentive structures created for households by certain property rights and other policy settings; the political and economic marketplaces that exist at village, county, prefectural, provincial, and national levels; the valuation of nonmarket resources; and natural resource management.

At the same time, a positive approach has been used for the fieldwork which has been directed at discovering what is happening. The collection of data and ideas on technical, social, economic, cultural, and geographic phenomena has aimed at getting the facts right.

These normative and positive approaches to research need to be combined in a modelling framework to analyse 'scientifically' the aspects of greatest concern within the project. Irrespective of the model used, whether a formal mathematical model or a conceptual model derived from theory, the final aim is to generate useful policy recommendations, which may range from the micro-technical (e.g., ways to improve the winter management of sheep) to the macro-political (e.g., suggestions relating to national fiscal and population policies). Only when these policy recommendations can be substantiated by a thorough description of 'what is,' 'what ought to be,' and 'why?,' are the project recommendations likely to have credence in either China or Australia.

Research Methods

In principle, the research team adopted extremely conventional methods. However, in practice the research methods developed for the project have a number of unique characteristics. Some aspects of the procedures may prove useful to other researchers undertaking fieldwork in China.

Literature review

As an essential first stage, considerable 'desk research' was conducted in China and Australia before starting field studies. References were carefully selected and organised throughout the project period. The initial phase of documentary research was primarily aimed at generating hypotheses for field testing. In addition, the documentary research indicated the nature of secondary information available and the kind of primary data needed to test the hypotheses.

Relevant English language references were identified by Australian researchers with the help of three databases—CD-ROM from CAB International (Commonwealth Agricultural Bureau, UK); IDRIS from IDRC (International Development Research Centre, Canada); and DIALOG from Lockheed's information service. Initial literature searches were aimed at gathering 'general' information that would serve as an introduction to the Chinese economy. As understanding and knowledge of the research issues increased, reference searches focused on specific relevant aspects of the agricultural economy in China, such as 'pastoral areas' and 'the household responsibility system.'

* Institute of Rural Development, Chinese Academy of Social Sciences, Beijing.

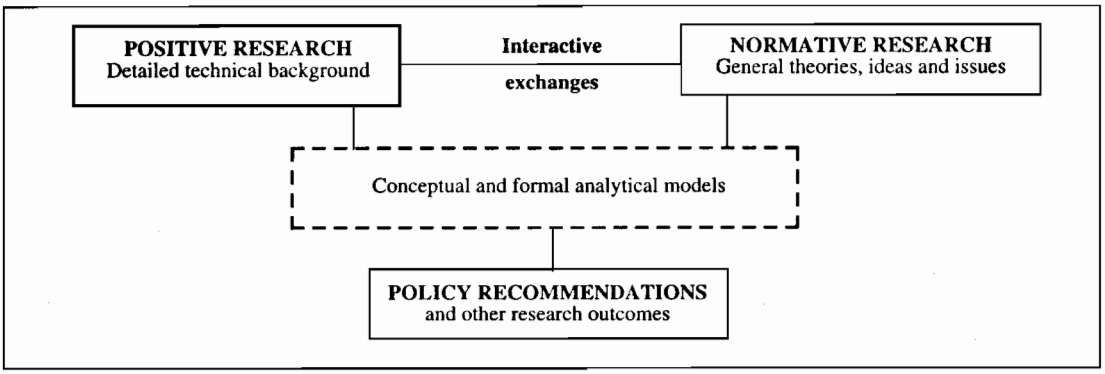

Fig. 1. A methodological framework

Selected books were purchased and copies of published papers collected. At a later stage in the project, Chinese research papers were collected in China and translated into English for inclusion in the document collection.

The primary purpose of the literature search was to assemble a systematically organised set of reference materials for those working on the project. The English language materials are stored at The University of Queensland. Most Chinese language materials are kept at the two collaborating institutes. However, certain key Chinese language data sources and other references are also held at the University of Queensland.

Survey questionnaires

The survey questionnaires represent one of the principal research tools used by the researchers to identify constraints to production, marketing, and processing of wool in China. Separate questionnaires were prepared for household, village, township, county, prefecture, and provincial/autonomous-region administrative levels, as well as for the supply and marketing cooperatives, local wool processors, and the agricultural bank. Using information obtained from the initial literature review, the questionnaires were initially drafted in Australia and subsequently refined before fieldwork commenced in 1989 in collaboration with Chinese project scientists using secondary information available in China. Further revisions were made during fieldwork to incorporate new developments.

Time for fieldwork was limited, and this was one of the major factors influencing the questionnaire design. Given the broad nature of the project and the small secondary information base upon which it could draw, there was a strong temptation to ask numerous questions. Yet, the questionnaires were structured as tightly as possible to allow for maximum information from a minimum number of questions. Questions were kept as simple as possible in concept and terminology to allow for ease of translation and for ready comprehension and comparability of information between respondents. The questionnaires also included a significant number of open-ended questions, thus allowing flexibility for discussing observed subjects of increasing interest, or unforeseen relevance.

Another measure, introduced in 1990, and designed to ease further the problems associated with the lack of time, entailed the division of each of the questionnaires into 'comprehensive' and 'data only' questionnaires. The latter questionnaires were forwarded to the interviewees before the arrival of the project team. The concept of comprehensive and data only questionnaires was generally well received by local officials, many of whom had previously complained in 1989 of difficulties from having insufficient time to assemble the data requested. In addition, the use of data only questionnaires enabled local officials to transcribe the data in their own time and present it to project staff without further need for transcription. This avoided the loss of valuable survey time and minimised translation and transcription errors.

Because the data usually could not be checked once the research team had left the field, comprehensive questionnaires were designed with as many safeguards as possible to avoid misunderstandings and other sources of error. In this respect, the use of dual language questionnaires was of great assistance.

Each English language questionnaire was pretranslated into Chinese. The interviews were then conducted with the aid of interpreters from the collaborating Chinese institutions and the local Animal

Husbandry Bureau. Numerous advantages resulted from using pre-translated formal questionnaires. First, it saved a great deal of time at each interview because the interpreters (not always the same people) did not have to decide how to translate each question. Second, the precise choice of words allowed the Australian researchers to be reasonably confident that the question they intended to ask was actually the one put to the interviewee. Third, the Australian researcher could retain control over the flow of the interview. For example, once a particular question had been answered, the Australian researcher could change the thrust of the interview by asking the Chinese researcher to follow with a specific question referred to by number.

The Chinese language questionnaires also enabled local officials to follow the flow of the interview and to contribute to both the questions and the answers. This 'local official' input sometimes added an overlay to the interview, which needed to be carefully handled. Local knowledge often helped to unravel inconsistencies and other problems that emerged during some interviews.

The comprehensive questionnaires were considered primarily to be a complete check list to ensure that nothing was overlooked at each interview. No interviewee was ever subjected to every question in the relevant questionnaire. Having a comprehensive list of questions that was cross-coded to a Chinese version of the questionnaire enabled the researchers to adopt a flexible and informal approach to most interviews. Interviewees could be encouraged to elaborate on topics of interest to them, even when it disrupted the 'intended' flow of the interview, without the risk of something being overlooked due to the 'apparently' disorganised nature of the interview.

Survey design

The pastoral region of China occupies about one-third of the country. Selecting the most appropriate parts of this vast area in which to conduct fieldwork was an important decision.

For many reasons, it was decided to study the Inner Mongolia autonomous region (IMAR) in 1989 and that fieldwork would concentrate in Chifeng City prefecture (for details on the wool industry in this area, see Longworth 1990). Of the six counties (or banners) in Chifeng City prefecture that are defined as being in the pastoral region, four were selected for investigation in 1989. Two of these, Balinyou and Alukeerqin, can be described as having typical pastoral production systems; one, Wongniute, has semi-pastoral/semi-agricultural production systems; and one, Aohan, is more or less an agricultural area. All four counties are located on the eastern grasslands of IMAR.

For the follow-up in 1990, it was decided that the team should return to the Chifeng City prefecture and visit many of the agencies (but not the households) visited in 1989. In addition, the team spent some time in the capital of IMAR, Huhehote, before travelling on to Gansu province.

In Gansu, two counties were selected for intensive study. Sunan county is typical of the alpine production environment, while Dunhuang is more typical of the semi-desert, irrigated agricultural production systems. These two counties provide sharp and differing contrasts with the grasslands of Chifeng City prefecture in eastern IMAR.

In 1991, the third year of the original project, no new areas were scheduled to be surveyed. However, further follow-up interviews were conducted in Chifeng City prefecture, especially in Balinyou and Alukeerqin counties, and in Huhehote, Lanzhou, and Beijing.

During 1992, interviews were undertaken in Yining (Xinyuan county) and Tacheng prefectures of Xinjiang autonomous region as well as in Beijing, Huhehote, and Lanzhou (Figs 2–5 and see Fig. 1 in Nui, this report p. 6).

The counties were selected for study on the basis of their relative importance as fine wool producing counties and based on the dominant production system in the county. Within each county the townships (or sumus in IMAR) were selected according to their 'representativeness,' and the selection process was double-checked as much as possible to ensure that townships being studied were indeed typical of each county.

Within each township, villages were selected on the basis of average per capita incomes. The aim was to sample villages with the same average per capita incomes as for the township. At the village level, households were examined by flock size, and average, or representative, households were interviewed.

In selecting households to be interviewed, a case study approach was adopted, rather than a properly structured sample survey. For many reasons, including limited resources and the lack of a suitable sampling frame, the research team elected to interview relatively few households, but to question each one in great detail.

While the initial target interviewees were the households, more time was actually devoted to interviewing other relevant units in the field as well as in the prefectural and provincial capitals and in Beijing.

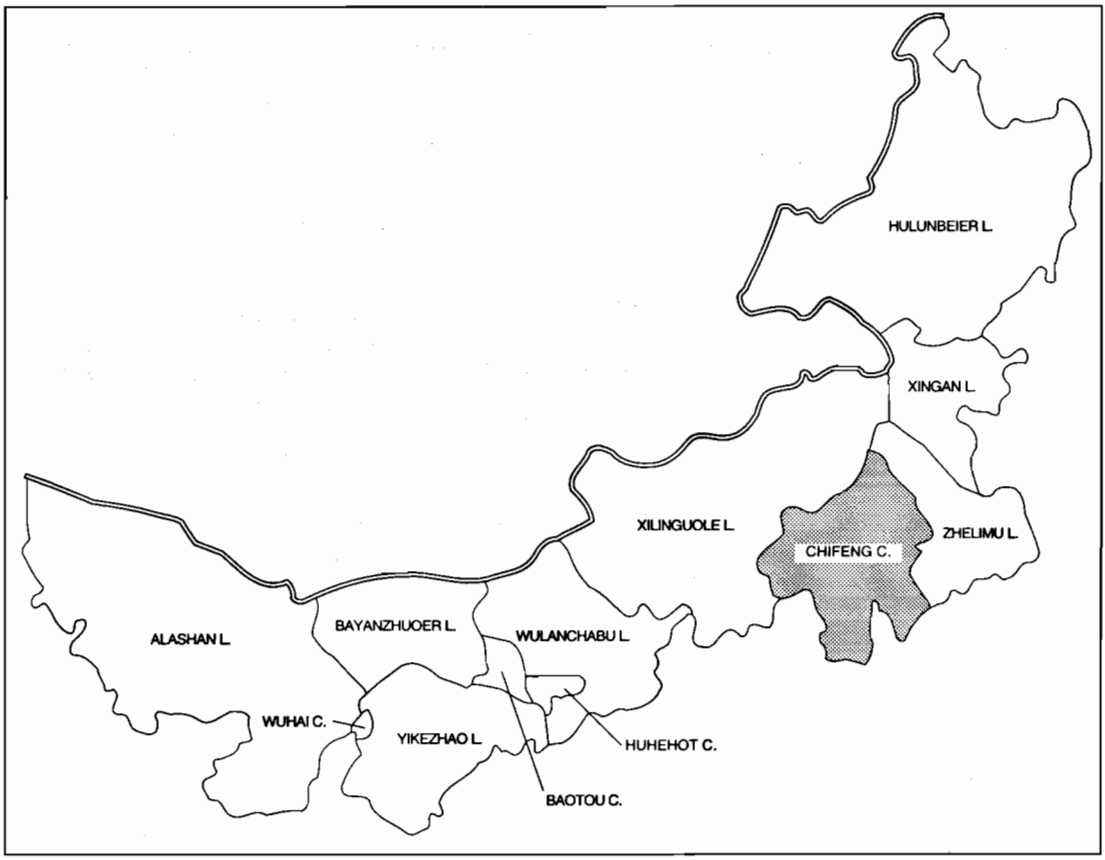

Fig. 2. Chifeng City prefecture and the Inner Mongolian autonomous region

Field reports

In addition to the data collected via the formal questionnaires, the research team adopted a policy of preparing field reports to gather and assemble ideas and information relevant to the project. A field report may be based on a single interview or represent the integration of several interviews and perhaps other written sources as well. The field reports contain factual information along with views and opinions of both the interviewees and interviewer. Some of the material in the field reports has already been incorporated into research papers, and many of the planned publications will draw upon them.

The field reports serve a two-fold role in the research process. They allow fieldwork information to be rapidly communicated between project team members. Moreover, they provide written records of the interviews, which can be assessed and re-assessed as the project progresses. The real meaning and significance of the ideas collected during an interview often emerge later, when the project team has climbed further up the learning curve.

In many instances, the interviewer's ideas and suggestions are expressed in the field reports. While these ideas and suggestions do not necessarily reflect a comprehensive overview of the topic, they nevertheless form a valuable input for the project team and often provide starting points for more comprehensive research.

Field reports also contain, in many cases, the opinions of the interviewees. Recording these primary data is an essential—and sometimes contentious— part of the team research effort, as interpretation may differ between team members and with other professionals. Here especially, the meaning and value of some ideas and information have only emerged much later.

Analytical models

While bearing in mind the institutional, political, and economic environment of China, the research team

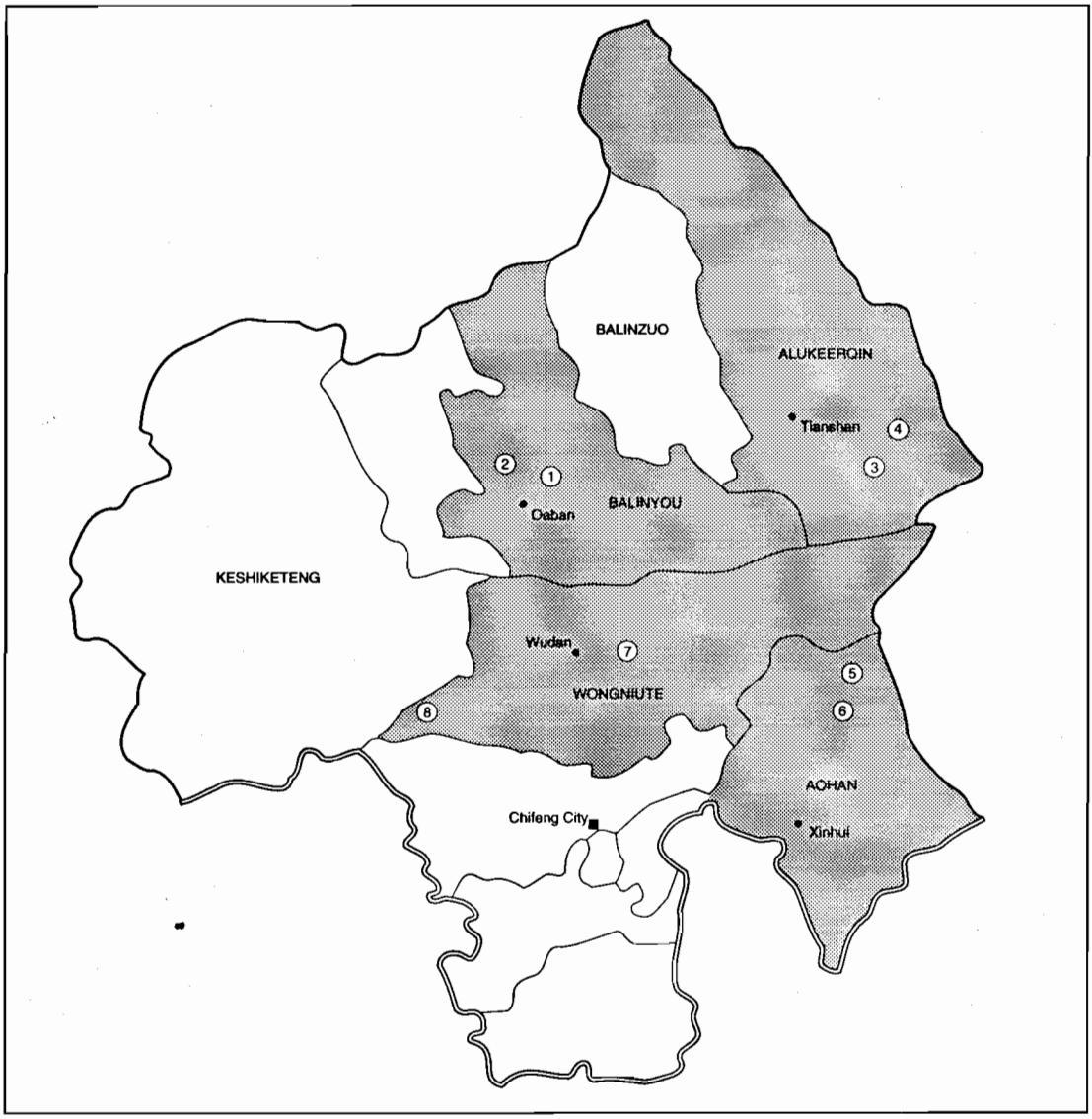

Fig. 3. Pastoral counties (banners) in Chifeng City prefecture and townships (sumus) included in the ACIAR research project. Numbers are research project field survey centres: 1. Bayantala Sumu; 2. Shabutal Sumu; 3. Daoda Sumu; 4. Zagashital Sumu; 5. Changsheng Township; 6. Mutouyingzi Township; 7. Bahantala Sumu; 8. Yangshugoumen Township. ■, prefecture capital; •, county capital; ———, prefectural boundary; ═══, IMAR border.

has conceptualised most problems associated with the Chinese raw wool industry in terms of neo-classical economic theory. Furthermore, economic welfare maximisation (broadly defined) has been assumed to be the overriding policy objective. Subject to the usual caveats about distributional problems, it is assumed that increasing the monetary surplus (profit) of an activity is a necessary, but not sufficient, criterion to improve economic welfare.

Valuing inputs and pricing outputs to reflect their social marginal values in the Chinese economy presents significant problems. All markets in China are distorted by policy constraints and other rigidities. In addition, some policy objectives conflict with the goal

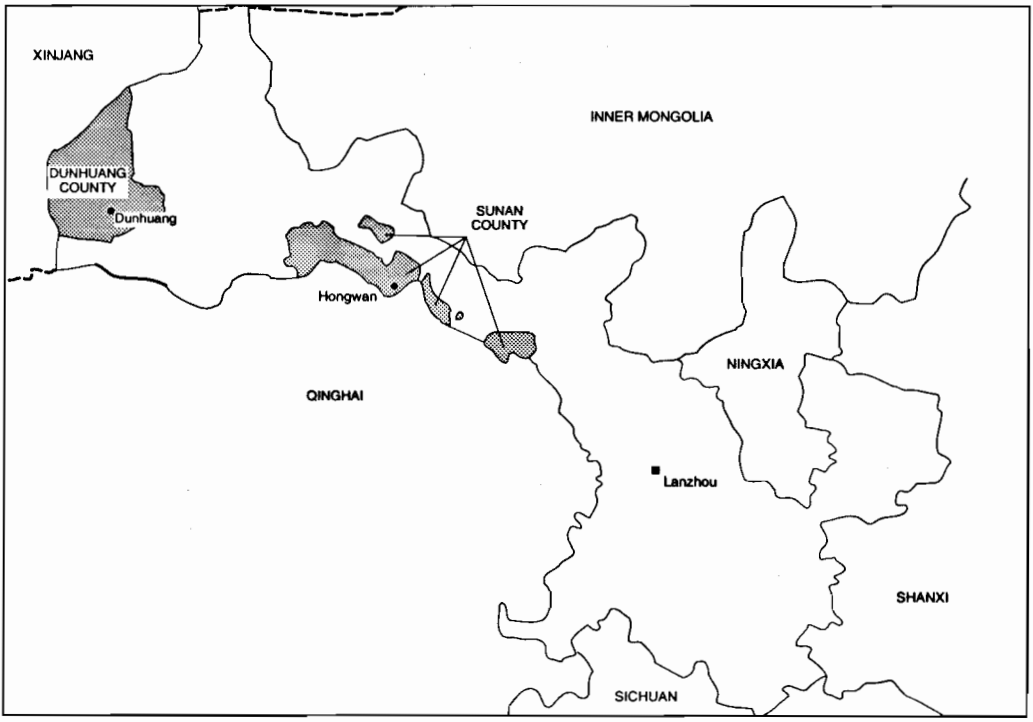

Fig. 4. Location of counties chosen for survey in Gansu Province: ■, provincial capital; •, county capital.

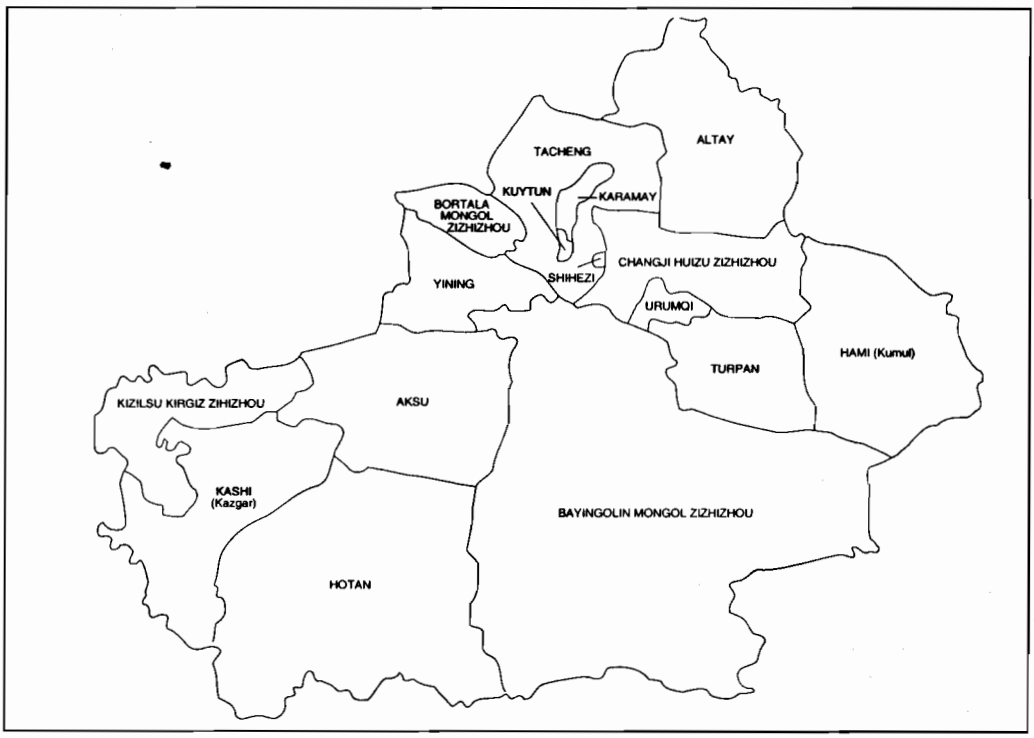

Fig. 5. Xinjiang Uygur autonomous region

of economic welfare maximisation. For these and other reasons, simple neo-classical economic models must be applied with great caution to the Chinese context.

Most analyses prepared by the project team are descriptive, and authors have attempted to explain what is happening in the pastoral region of China. Conclusions and recommendations about how activities ought to be organised to improve economic welfare are based on implied neo-classical assumptions, or sometimes on formally stated neo-classical economic models. The nature of most of the data (limited length and accuracy of economic time-series; non-random samples in the case of cross-sectional data) largely precludes any serious statistical analysis. Even when reliable longer-term economic data series are available, the structural changes in China over the last four decades, and especially since 1978, create obstacles to an econometric approach.

A useful means of 'massaging' the available data is to adopt a linear programming approach. Mathematical modelling offers great advantages for this. The project survey data, especially the household survey information, provide an excellent basis for constructing synthetic activity budgets, defining resource constraints, and so forth. Considerable progress has already been made in constructing linear programming models of the pastoral production systems. These models will be the primary analytical tool in the evaluation of policy options identified by the descriptive-conceptual analysis. Linear programming models can also provide a means of evaluating production systems affected by new technology developed through other ACIAR-funded collaborative projects.

Reference

Longworth, John W., ed. 1990. The wool industry in China: Some Chinese perspectives. Mount Waverly, Victoria, Inkata Press, 105 p.

Some Major Outcomes of the Project

Ross G. Drynan*

THE primary objective of this project is to identify the technical, economic, and institutional constraints to the production and marketing of raw wool in China. The project has concentrated on the production and marketing of fine wool (≤25 micron). Detailed fieldwork has been undertaken in the Inner Mongolia autonomous region (IMAR), Gansu province, and Xinjiang Uygur autonomous region (XUAR).

The research required the first-hand collection of micro-information at all levels of the wool production and marketing chain. Data and ideas generated have been placed in the broader context of the economic development of the pastoral region of China. Although the research has been based on micro-level interviews, much of the research effort has dealt with industrial, regional, and national policy issues. Thus, the value of this project lies in its examination of policies that are the main constraints to development of the raw wool industry in China.

Those constraints are intertwined with the broader issues linked to the problems of achieving sustainable economic development in the pastoral region. In this context, rangeland degradation and desertification are the fundamental issues. Indeed, environmental problems are likely to matter more to China in the long term than the raw wool industry per se. The main factors responsible for the environmental problem impose significant constraints on sustainable development of the pastoral region in general and on the wool industry in particular.

This paper introduces the framework used to explore policy issues and identifies some of the project outcomes and benefits. The list of publications at the end of this chapter identifies the written output of the project.

A Conceptual Framework

The project has identified six broad policy areas that affect the wool industry: (i) application of new technologies; (ii) restrictions on labour and capital; (iii) resettlement and population policies; (iv) landuse practices; (v) assignment of rights and obligations concerning property; and (vi) pricing and marketing arrangements for wool.

Taken together, these six factors explain the widespread degradation of rangeland in the pastoral region of China. At the same time, they explain the rapid economic development that has taken place in pastoral areas since the early 1980s. This project explains these two trends and offers critical recommendations for removing constraints to the raw wool industry and ensuring that the economic development of the last decade is sustainable.

Some Major Outcomes

Unlike the ACIAR-funded technical projects that have focused on particular biological constraints in the Chinese wool industry, the aim of this project has been to develop a comprehensive overview of the conditions in the pastoral region. This overview is summarised diagrammatically in Figure 1 and discussed in relation to each of the six policy factors.

Technology

It is frequently stated that the Chinese wool industry can benefit greatly from the introduction of new technologies, such as new sheep genetic material, new pasture plants, improved parasite control and nutritional improvements. However, introducing new technology without appropriate complementary policy adjustments in the other five areas can be counterproductive.

An example of this could be the introduction of a new technology that assists in overcoming the winter feed deficit. This technology breakthrough would enable greater numbers of sheep to overwinter. Although this would appear to increase productivity, it is clear, as shown in Figure 1, that present incentives generated by policy on property rights and markets would create a negative cycle: an initial short-run increase in sheep numbers, followed by an increase in the animal/land ratio; worsening overgrazing in spring and summer; greater degradation of rangeland; and deteriorating prospects for the future health of the industry. Indeed, to maintain gains from a technology breakthrough on an industry-wide basis, management must adopt a long-term perspective. Because of lags

* University of Sydney (formerly Department of Agriculture, University of Queensland).

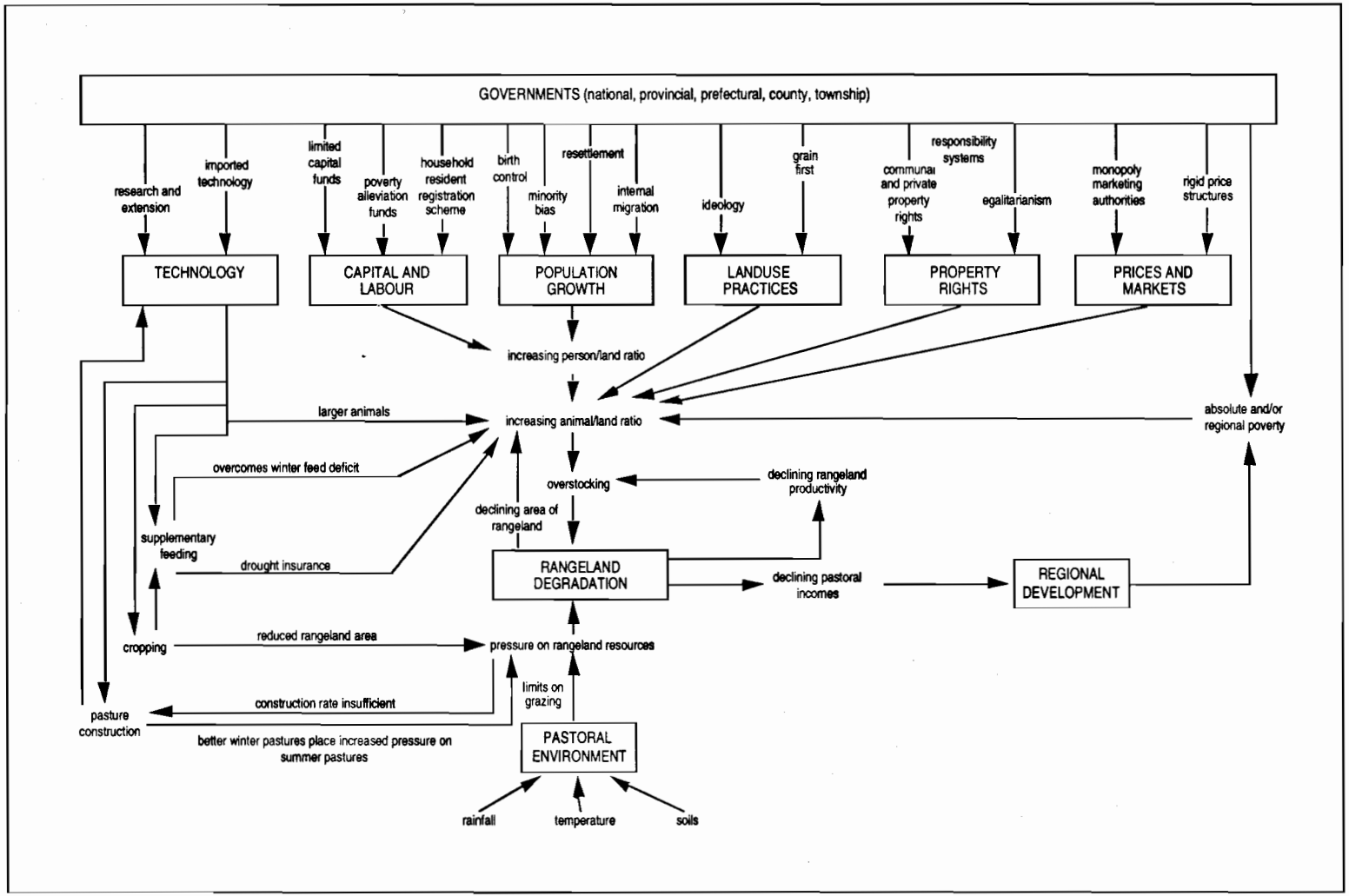

Fig. 1. Interactions between the six major policy areas affecting land degradation, the pastoral industry, society and governments.

in adoption time, predicting the outcome of any new technology may be even more complex than this example. Nonetheless, evidence from fieldwork cautions against the idea that new technology provides a 'quick fix' or is the most important way to achieve progress in the Chinese wool industry.

Capital and labour

Along with the perceived need for new technology, another widely held view states that pastoral areas need a substantial injection of capital, including human capital. This, too, is best seen as an hypothesis to be tested.

In Chifeng City prefecture during the 1980s, a large project sponsored by the International Fund for Agricultural Development (IFAD) injected substantial capital. Official Chinese reviews of this project suggest that, based on a 'before-and-after' analysis, the new capital had a substantial beneficial impact on productivity and household incomes.

However, data collected by the ACIAR project team indicate that the rate of development shows little real difference in comparable areas inside and outside the IFAD project. Furthermore, the long-term sustainability of the development that has occurred remains questionable, whether inside or outside the IFAD project area.

The investigation of the IFAD project also emphasised the importance of the general problems created by the lack of capital and labour markets in China. The impact of constrained factor mobility on the future of the pastoral region has been addressed in another paper (Williamson and McIver 1991).

Population growth

The question of population growth is closely related to arguments about the need for outside investment in the pastoral region and for greater labour mobility.

Massive human migration into the fragile ecosystems of the pastoral region since 1949 can be seen as a fundamental cause of the current widespread environmental degradation. National population policies, including restrictions on labour movement away from the pastoral regions, need to be recognised as major long-term constraints on the development of the wool industry and the pastoral zone (Lin 1990).

Landuse

As the Han people migrated to the pastoral region after 1949, they expanded the area under agriculture at the expense of the best rangeland. In many areas this expansion went too far, creating wasteland. Today, concerted policy measures encourage pasture development and improved landuse. Yet, there is little incentive for households to invest in climatically risky areas, given the uncertainty surrounding future market prices and, even more fundamentally, the uncertainty associated with property rights to land.

Nevertheless, provided the socioeconomic and political uncertainties can be addressed, opportunities may exist for significant changes in landuse that could contribute greatly to the future sustainability of production systems. These and related issues are being investigated by means of a linear programming study of landuse opportunities (Xu, this report).

Property rights

Property rights—the right to use, to transfer, and to share in the fruits of property—are closely associated with the question of appropriate landuse. The issues involved, as with the other factors depicted in Figure 1, must be put in an historical context (Liu et al. 1991; Zhang et al. 1991; Niu and Chen 1992; Zhang, this report).

Property rights have changed frequently and significantly since 1949. Recent reforms, including the introduction of household land contracts, have had both positive and negative effects on the pastoral areas.

One of the weaknesses of the collective system was the inappropriate valuing of human effort. Although society recognised and differentially rewarded labour for the type and quantity of work, no distinction was made for the quality of effort or the productivity of labour. The individual worker, in deciding how much effort to make, was effectively encouraged to place zero value on extra effort, although society would have placed a positive value on that effort.

The household responsibility system, with its rewards for valued output, encourages a more socially desirable level of effort. But significant failures to account for social values in decision-making still occur in the wool industry. In many areas, despite the contracting of pasture lands to individual households, pastures are grazed in common by several households, each of which has individual decision-making power over its stock numbers. Unless the group collectively acts to limit stock, each household will underestimate the social cost of using pasture; and overstocking will result. Grazing in common can be appropriate, but social values will only be properly accounted for if the group collectively holds the right to determine individual stocking rates; or if incentives

(financial or social) to achieve the most appropriate social outcome are given to the households. The financial incentives may involve taxes or fees on stock numbers. Some such fees are in place.

If land is managed by one household, it may tend to value the land resource incorrectly because of a timescale that differs from the rest of society. For example, unless households have confidence in the new institutions of land contracts, their discount rates will likely involve excessive risk premiums. Evidence shows that households will then favour investments that are not subject to such uncertainty (e.g. housing) rather than productive land investment.

A thorough investigation of the changes in property rights and the consequential effects on incentives and the management of resources will be an important output of the project.

Prices and markets

Poorly developed and inefficient marketing systems for raw wool and related products and inputs are also constraints. Given the importance of the market system in conveying signals to households, the supply and marketing cooperatives, county governments, and processors, the project has investigated marketing issues in some depth (Shi 1990; papers by Lin, Zhang, and Longworth, this report).

Wool producers make decisions on the basis of market prices. Because wool prices in China remain largely administratively determined, the project team has concluded that prices for different types and qualities, at different places in China, and at different stages through the marketing chain, do not properly reflect social values. Prices at the household level, for example, offer no incentive for people to place a high value on quality. Consequently, households have positive incentives (and opportunities) to reduce quality by adulterating wool, thereby raising the costs of processing and lowering the product's social value.

Yet, any attempt to increase price differences between wools of different quality, and so reflect social values better, would require a lowering of prices for many wools and hence, reduced income for many households. While such pricing incentives would improve efficiency, they would also result in a loss in equity. The need to consider equity acts as a constraint on the development of the Chinese wool industry.

Institutional constraints to improving wool-marketing channels are significant. As with production technology, novel marketing systems and processing technology should not be treated as a 'quick fix.'

Other Project Outcomes

In addition to the preparation of research publications, this project has generated other significant benefits. There are several measurable or direct benefits:

- collection of Chinese publications on wool production, which have been translated for the first time into English and are now more widely available.
- set of survey questionnaires (in English and Chinese), which may be of value to other socio-economic research projects in China.
- comprehensive set of field reports presenting observations, impressions, ideas, and factual data collected by first-hand interviews and from other sources.
- large project database containing statistical information collected by interview and from secondary sources, complementing the qualitative notes in the field reports.
- substantial computerised bibliography of relevant literature.

There are also several indirect or less measurable benefits from the project that are enormously valuable. The most important of these is the goodwill and professional friendships created within and beyond the collaborating groups. The network established between professional groups in Beijing and in local areas where the project team was active is substantial and of lasting benefit. Moreover, Australian and Chinese researchers working together have acquired valuable general knowledge about each other's countries and cultures—a benefit that will have a long-term impact on the researchers and the organisations for which they work.

Conclusion

The wool industry operates within the larger economic system, which makes it dependent on government decisions about the national economy. For example, the recent large and wasteful expansion of first-stage processing capacity in wool-growing areas has clearly been a response in anticipation of national fiscal reforms. More generally, wrong decisions are taken throughout the wool industry and the economy at large because society as a whole bears the burden of risk rather than the individual enterprises making the decisions.

Fiscal reforms within the wool industry can have an unanticipated impact. Interconnections between the many constraints facing the Chinese wool industry cannot be ignored. Unfortunately, administrative

responsibility and policy development in China are characterised by a rigid vertical compartmentalisation, and the extent to which 'everything really is connected to everything else' is not always recognised, or if recognised, not easily accommodated.

References

Lin, X. 1990. Development of the pastoral areas of Chifeng City prefecture. In: Longworth, J.W., ed., The wool industry in China: some Chinese perspectives. Mount Waverley, Victoria, Inkata Press, 105 p.

Liu, Y., Chen, J., Lin, X., and Du, Y. 1991. Institutional change and economic development: introduction of the household responsibility system in the pasture region of northern China. Paper presented at the XXI International conference of agricultural economists. 22–29 August 1991, Tokyo, Japan.

Niu, R. and Chen, J. 1992. Small farmers in China and their development. Invited paper presented at XXI International Conference of Agricultural Economists. 22–29 August 1991, Tokyo, Japan. In: Stanton, B. and Peters, G., ed., Sustainable agricultural development: the role of international cooperation. Aldershot, United Kingdom, Dartmouth Publishing Company, in press.

Shi, Z. 1990. Wool marketing problems in China. In: The wool industry in China: some Chinese perspectives. Mount Waverely, Victoria, Inkata Press.

Williamson, G.J. and McIver, R. 1991. Implications of constrained factor mobility for sustainable economic development in China's pastoral areas. Paper presented at the XXI International conference of agricultural economists. 22–29 August 1991, Tokyo, Japan.

Zhang, C., Zhou, L., and Xu, Y. 1991. The easily forgotten half of China: towards sustainable economic development in the pastoral region. In: IAE/CAAS, ed. Research on economic and technological development in agriculture. Beijing, Agricultural Publishing House, 151–163. (in Chinese)

Rangeland Degradation in the Pastoral Region of China: Causes and Countermeasures

Liu Yuman*

THE pastoral region in China consists of 120 pastoral counties (banners) and 146 semi-pastoral counties, located mostly in the Inner Mongolia autonomous region (IMAR), Xinjiang Uygur autonomous region (XUAR), Tibetan autonomous region (TAR), and Qinghai province. Some counties are in Hebei, Shanxi, Liaoning, Jilin, Heilongjiang, Sichuan, and Gansu provinces and Ningxia Hui autonomous region (Table 1). Total grassland in the pastoral region amounts to 4127.45 million mu (15 mu = 1 ha). Of this, 3283.85 million mu is useable and 3021.55 million mu is currently in use (Table 2).

Animal husbandry, especially sheep grazing, represents the most important source of income in the pastoral region, supporting about 41.2 million people, many of whom are ethnic minorities. The major animal products are raw wool (46.4% of the country's total production in 1990), beef (24.4% in 1989), sheep and goat meat (27.7% in 1989), and milk (28.3% in 1990).

IMAR and XUAR are the two most important pastoral provinces in the region. Both are major wool producers (especially of fine wool), and together accounted for 108 500 t total raw wool in 1990, or 45.4% of the national total. In the same year, the two provinces contributed 84 100 t of fine and semi-fine wool, or 70.4% of national total. Cattle and goat production in IMAR and XUAR are also significant relative to the national totals. The distribution of animals and production rates for animal products by prefecture in IMAR and XUAR are shown in Tables 3, 4, 5, and 6.

The Success of Rural Reforms

Significant development has occurred in the pastoral regions since the implementation of rural economic reforms. Income distribution is no longer by the old 'big pot' system which was completely dismantled after the introduction of the 'household-production-responsibility' system. Herdsmen who were formerly members of collectives have become relatively independent in their production activities and obtained the rights to use and manage production resources in their own best interests.

As a result, enthusiasm and initiative among herdsmen to develop pasture and raise animal production have increased. Privatisation of collectivised animals has given herdsmen the impetus to increase their animal numbers and this applies to all classes of livestock. Table 7 reveals steady growth in animal populations in the pastoral and semi-pastoral regions of China.

The growth of animal populations over the 1981–90 period led to remarkable increases in the output of animal products, such as wool, beef, milk, and sheep and goat meat (Table 8). These increases occurred largely because of improved management after privatisation. Herdsmen take their responsibility seriously for all kinds of production activities—such as animal tending, feeding, watering, dipping, drenching, shearing, lambing, calving and breeding—that were not performed well in the commune era. In addition, herdsmen have become aware of the importance of animal improvement. In view of the pasture degradation that has occured, herdsmen are beginning to appreciate that animal quality is more important than sheer stock numbers. Hence, local breeds have been improved, especially in the case of sheep, with the introduction of improved breeds from overseas and from within China. In IMAR for instance, the percentage of improved sheep increased from 36.7% in 1980 to 66.9% in 1990. This indicates an increasing eagerness and demand for good quality animal breeds among herdsmen.

As the 'pasture-land-contract' system was introduced, herdsmen were given more incentive to invest in pasture development. This was especially the case in counties where local governments reinforced household rights to develop, use, and manage pasture land over a long period. Thus, whoever uses, manages and develops pasture lands is entitled to enjoy the benefits of these activities, while intergenerational inheritance and subcontracting the land is also permitted. As a result, the total number of pastures planted and total fencing in the pastoral areas of Inner Mongolia and Xinjiang, have increased steadily from 1981–90 (Table 9).

* Institute of Rural Development, Chinese Academy of Social Science, Beijing

Table 1. The location of pastoral and semi-pastoral counties (banners) in China

Province	Total counties	Pastoral	Semi-pastoral
Hebei	6	0	6
Shanxi	1	0	1
IMAR	54	33	21
Liaoning	6	0	6
Jilin	10	1	9
Heilongjiang	15	7	8
Sichuan	48	10	38
TAR	37	13	24
Gansu	19	7	12
Qinghai	30	26	4
Ningxia	3	1	2
XUAR	37	22	15
Total	266	120	146

Source: Statistics of ethnic minorities of China 1949–1990. Statistical Press of China, Beijing, 1991.

Table 2. Grassland area by province (million mu[a])

Province	Total area	Useable area	Area in use
Hebei	24.9	23.0	19.8
IMAR	1211.2	952.9	836.6
Liaoning	16.4	16.4	16.4
Jilin	28.2	20.7	20.7
Heilongjiang	28.8	25.7	25.4
Sichuan	245.5	213.4	204.2
TAR	1016.2	705.0	584.6
Gansu	135.0	118.8	106.0
Qinghai	542.9	471.0	471.0
Ningxia	19.5	16.9	16.9
XUAR	858.9	720.1	720.1
Total	4127.5	3283.9	3021.6

[a] 15 mu = 1 ha.

Source: Statistics of ethnic minorities of China 1949–1990. Statistical Press of China, Beijing, 1991.

The Feed Supply Crisis

Over- or undergrazing of pasture will greatly reduce both economic and ecological efficiencies. To achieve maximum economic and ecological returns, the optimal balance between feed supply and animal numbers must be maintained.

However, over the past few decades, the guiding principle for assessing the development of livestock production in China has been simply to count the number of livestock. At the same time, the 'big pot' principle (or common grazing) has been adopted for pasture management. Together, these two practices have placed intensifying pressure on pastures; as animal populations have expanded, the grassland has become increasingly overgrazed and degraded.

Table 3. Animal inventory of IMAR by prefectures, 1990 ('000 head)

Prefecture	Cattle	Sheep	Goats
Huhehote	46.3	327.4	97.1
Baotou	24.5	519.5	297.3
Wuhai	0.3	10.8	19.5
Chifeng	672.7	2451.8	1421.2
Hulunbeier	576.2	1319.1	251.1
Xingan	424.2	1061.5	258.7
Zhelimu	818.9	1363.1	667.8
Xilinguole	912.6	5367.4	1449.5
Wulanchabu	292.1	3400.8	650.4
Yikezhao	45.7	2230.2	2169.9
Bayanzhuoer	29.4	2240.2	1430.0
Alashan	9.8	457.3	778.0
Total	3 852.8	20 749.0	9 490.3

Source: Statistical yearbook of IMAR, 1991. Statistical Press of China, Beijing, 1991.

At present, degraded grassland in the pastoral regions totals 1.3 billion mu, or one-third of the useable grassland. Pasture productivity has decreased from 30–50% since the 1950s. According to the project survey conducted in IMAR in 1990, degraded grassland amounts to around 375.5 million mu, or about 39.4% of the total.

Of the degraded area, 177.54 million mu are lightly degraded, 132.64 million mu are moderately degraded, and 65.37 million mu are heavily degraded. Furthermore, grassland degradation in China is accelerating and is occurring at a rate of about 10 million mu each year. For example, in Balinyou county (IMAR) the average annual rate of grassland degradation was about 79 000 mu from 1958–63, and 115 000 mu from 1964–79. From 1980–89, the rate of degradation jumped to 215 000 mu annually, and total degraded grasslands in Balinyou county nearly doubled from 2.86 million mu to almost 5 million mu. Average pasture productivity is declining at the rate of 2.1 kg per mu annually in Balinyou county.

Analysis of Animal–Pasture Imbalance

Overstocking, one of the most serious problems facing China's pastoral industry, is common throughout the pastoral region. Detailed data for the whole

Table 4. Production of beef, meat (sheep and goats), and wool in IMAR by prefecture, 1990 (tonnes)

Prefecture	Beef	Meat	Raw wool production		
			Total	Fine	Semi-fine
Huhehote	460	1 707	722	160	309
Baotou City	676	3 136	1 153	86	552
Wuhai City	3	173	18	0	0
Chifeng City	15 564	13 671	9 521	7 328	826
Hulunbeier	14 194	7 323	2 517	970	368
Xingan	5 564	4 183	2 308	1 494	51
Zhelimu	18 572	5 773	4 982	3 646	0
Xilinguole	24 849	34 897	12 253	8 282	241
Wulanchabu	4 149	18 241	10 950	4 499	4 874
Yikezhao	820	18 094	7 731	3 308	2 736
Bayanzhuoer	516	17 009	6 323	2 613	2 296
Alashan	516	3 570	725	1	0
Total	85 535	127 777	59 203	32 387	12 253

Source: Statistical yearbook of IMAR. Statistical Press of China, Beijing, 1991.

country that would clearly demonstrate the seriousness of the problem are difficult to obtain. However, data available in the IMAR, where grassland degradation has taken place in every prefecture, illustrate the severity of the situation (Table 10). Except for Hulunbeier, Xilinguole, and Wuhai prefectures which appear to have a surplus of grass, all the prefectures have insufficient supply for the current number of grazing animals. Chifeng, one of the most seriously overstocked prefectures, has seen its useable pasture area per sheep equivalent drop from 26.3 mu to 5.7 mu since the 1950s. Currently, the herbage supply can meet only 60% of estimated animal needs. The causes of the animal–pasture imbalance are many and complicated, but can

Table 5. Animal inventory in XUAR by prefecture, 1990 ('000 head)

Prefecture	Cattle	Sheep	Goats
Wulumuji City	44.6	336.7	112.2
Kelamayi City	3.9	34.7	6.0
Tulufan	28.0	706.1	111.5
Hami	55.0	569.4	305.4
Changji	144.0	1702.3	283.6
Yili	664.2	3257.3	147.9
Tacheng	253.7	2107.9	419.3
Aletai	380.0	1492.4	331.5
Buoertala	62.9	726.9	57.1
Bayinguoleng	175.4	1616.3	412.4
Akesu	386.6	2010.8	1025.5
Kezilesukeerkezi	133.2	756.6	359.8
Kashi	680.8	3368.0	527.8
Hetian	198.4	2598.0	196.3
Production troops	165.2	2530.4	199.0
Total	3 382.2	23 813.8	4 494.3

Source: Statistical yearbook of XUAR. Statistical Press of China, Beijing, 1991.

Table 6. Production of beef, meat (sheep and goats), and wool in XUAR by prefecture, 1990 (tonnes)

Prefecture	Beef	Meat	Raw wool[a]
Wulumuji City	1450	3209	807.6
Kelamayi City	102	248	46.3
Tulufan	1006	4521	1060.4
Hami	679	3130	1231.5
Changji	3451	10702	4169.9
Yili	15431	20199	9255.4
Tacheng	4869	12351	5237.8
Aletai	10872	16828	2834.2
Buoertala	1696	3915	1650.1
Bayinguoleng	2876	10347	2464.0
Akesu	4541	11898	2995.6
Kezilesukeerkezi	3363	6304	1221.0
Kashi	11885	22333	3131.4
Hetian	4037	17084	2352.3
Production troops	4564	14468	7752.0
Total	70822	157537	46218.5

[a] Wool production figures for 1990 are not available; data are from 1987.

Source: Statistical yearbook of XUAR. Statistical Press of China, Beijing, 1991.

largely be attributed to the growth of the animal population, inadequate pasture development, and population pressure.

Growth in animal population

The animal population in the IMAR, which has been increasing continuously since the 1950s (Table 7), has now exceeded its pasture carrying capacity. Indeed, the problem of overstocking began in the late 1950s in some parts of the pastoral region and gradually worsened so that by 1978, it was widespread. During that period, pasture industry workers from herdsmen to government officials used production targets based on animal numbers. Herdsmen were encouraged to raise as many animals as possible, and in turn, animal numbers were increased without regard to the environmental consequences. Eventually, the ecology of the pastoral environment was damaged to a large extent.

Although increasing importance has been attached to ecological protection since 1979, the animal population is not being well controlled, and continued animal population growth has worsened the animal–pasture imbalance. Introduction of the production responsibility system has not turned the situation around.

Formerly, two so-called 'big pots' were customarily shared in the pastoral regions. Herdsmen shared both an 'animal pot' and a 'pasture pot.' In the early 1980s the responsibility system for animals was implemented which led eventually to the sale of collective-owned animals. Thereafter, the shared 'animal pot' completely disappeared, and herdsmen took individual responsibility. However, the responsibility system for pastures was not introduced in most

Table 7. Animal inventory in pastoral and semi-pastoral regions of China

Year	Large animals[a]		Small animals[a]	
	'000 head	%[b]	'000 head	%[b]
1949	1014.2	16.9	1902.3	44.9
1952	1226.9	16.0	2461.5	39.8
1957	1462.7	17.6	3623.1	36.8
1965	1802.9	21.4	5591.1	40.2
1978	2166.0	23.1	6220.5	36.6
1979	2270.6	24.0	6882.1	37.8
1980	2358.0	24.7	7085.6	37.8
1981	2495.5	25.6	7623.2	40.6
1982	2703.8	26.7	7498.0	41.2
1983	2549.2	24.6	7019.7	42.0
1984	2624.5	24.2	7054.4	44.5
1985	2763.3	24.3	7245.4	46.5
1986	2781.0	23.4	7124.8	42.9
1987	2795.6	22.9	7311.4	40.5
1988	2817.0	22.5	7714.4	38.3
1989	2780.5	21.7	7744.4	36.6
1990	2810.8	21.6	7819.9	37.2

[a] large animals: cattle, buffalo, yaks, horses, donkeys, mules, camels; small animals: sheep and goats.

[b] percentage of the national total.

Source: Statistics of ethnic minorities of China 1949–1990. Statistical Press of China, Beijing, 1991.

Table 8. Total outputs of major animal products in pastoral regions of China ('000 tonnes)

Year	Raw wool	Beef	Milk	Sheep and goat meat
1981	83	106	450	184
1982	100	119	516	194
1983	101	139	513	224
1984	87	131	591	185
1985	102	n.a.[a]	n.a.	n.a.
1986	101	n.a.	n.a.	n.a.
1987	104	211	953	242
1988	99	218	1037	222
1989	125	261	1111	266
1990	117	n.a.	1343	n.a.

[a] n.a. = not available.

Source: Statistics of ethnic minorities of China 1949–1990. Statistical Press of China, Beijing, 1991.

Table 9. Pasture development and fencing in pastoral–semi-pastoral counties of IMAR and XUAR ('000 ha)

Year	Inner Mongolia		Xinjiang	
	Planted area	Fenced area	Planted area	Fenced area
1981	185	1458	n.a.[a]	n.a.
1982	261	1515	175	n.a.
1983	n.a.	n.a.	n.a.	n.a.
1984	497	n.a.	260	337
1985	n.a.	1591	n.a.	391
1986	552	1759	400	442
1987	706	2041	n.a.	490
1988	1089	2489	533	533
1989	1110	2714	609	619
1990	1292	3202	667	667

[a] n.a. = not available.

Source: Statistics of ethnic minorities of China 1949–1990. Statistical Press of China, Beijing, 1991.

counties until several years later. The delayed introduction of responsibility systems has meant that private owners grazed their animals on commonly held land in areas throughout the pastoral regions, where at the same time herdsmen were encouraged to increase their flocks.

Moreover, the introduction of the responsibility system for pastures remains incomplete. For example, in Chifeng prefecture of the IMAR, where a field survey was conducted from 1989–92, only the fenced pasture and land for hay cutting had been contracted to individuals. Though some of the grazing land is contracted to each individual household, most of it is still commonly used, and landuse rights are given to a group of households. The 'pasture pot' is still widely used in Chifeng prefecture, and it is believed to be widely used in most parts of the pastoral region. Inevitably, most herdsmen will seek to take advantage of this by increasing their flocks. Therefore, the problem of the 'pasture pot' shared by all animals has only been partly solved.

The lack of alternative income sources also results in animal population increases. Unlike some rural areas in China, the pastoral regions have poorly developed nonagricultural industries, and herdsmen have few opportunities for supplementing their subsistence. Thus, the income generated by animal production forms a large part of the total income for each family, and to improve their standard of living, herdsmen have to increase their flocks.

Pasture development

Pasture development—which includes planting and improving, aerial seeding, and fencing—is much too slow to cope with the increase in the animal population. Upgrading pasture productivity increases the supply of herbage to animals. For sustainable growth, pasture development should always occur before any increase in animal population.

Unfortunately, pasture development was neglected until the 1970s when it began to receive attention in most pastoral regions. However, the years of neglect resulted in dramatically distorted ratios between pasture productivity and stock numbers, and between pasture inputs and outputs.

In recent years, however, the rate of pasture development has been increasing annually. At present the total developed pasture area is about 182.34 million mu (excluding Tibet, where data are unavailable). Of this, 'total planted area reserved' amounts to about 40.7 million mu, 'total improved area reserved' is about 50.05 million mu, 'total aerial-seeded area reserved' is about 12.17 million mu, and the 'total fenced area reserved' is about 79.42 million mu (Table 11).

Table 10. Degradation and overstocking in IMAR by prefecture

Prefecture	Grassland area ('000 mu[a])	Degraded area ('000mu)	Stock balance ('000 sheep equivalents)
Hulunbeier	16 947.1	3 145.6	+1 102.4
Xingan	4 551.1	1 138.1	– 4.7
Zhelimu	6 854.2	3 621.4	– 104.5
Chifeng	8 240.2	4 398.0	– 370.8
Xilinguole	29 279.4	10 928.7	+21.6
Wulanchabu	8 467.9	3 962.6	– 351.3
Huhehote	268.6	136.9	– 28.8
Baotou	750.8	378.8	– 30.8
Bayannaoer	8 012.7	2 800.6	– 125.7
Yikezhao	8 298.1	4 622.7	– 177.2
Wuhai	234.4	120.0	+0.2
Alashan	26 302.3	2 341.8	– 31.9

[a] 15 mu = 1 ha.

Source: Pasture resources of IMAR. The People's Press of IMAR, Huhehote, 1990.

Despite these efforts, pasture development is not keeping up with the rate of pasture degradation. According to the project field survey, the ratios between pasture development and degradation are 1:2.6 and 1:3 in Balinyou and Alukeergin counties (both in IMAR), respectively. Lack of capital hinders further development. Total investment in the pastoral regions since the establishment of the People's Republic of China is about 4.6 billion yuan, which amounts to an annual investment rate of 0.03 yuan per mu—an insignificant rate relative to the land's output value of around one yuan per mu annually.

Population pressure

Population growth in the pastoral regions generally outpaces the national average and this puts increasing pressure on the land. From 1982–90, China's average annual growth was 1.48%, while minority groups in the pastoral regions grew from 1.91–14.1% during the same period (Table 12). To add to the growing pressure, significant migration (precise data are unavailable) into the region from other farming areas has occurred since the 1950s. This growth translates into reduced useable pasture per capita. In IMAR, for instance, useable pasture has decreased from 3623 mu per capita in 1949 to 503 mu in 1992.

Clearly, population pressure has led to the animal–

pasture imbalance. Overstocking simply reflects the high levels of human population. In fact, human overpopulation of the pastoral region is the key issue in the development of the Chinese pastoral industry.

Policy Recommendations

Unsustainably high population growth and a chronic shortage of capital to invest in pasture development are the main causes of animal–pasture imbalance. To redress this imbalance, a new approach must take into account the problems of overpopulation, overstocking, and environmental degradation.

Human population control

The rate of population growth in the pastoral region must be slowed. Every level of government must take steps to implement the family planning program, to educate and inform herdsmen, and to discourage migration into the region.

The presence of nonagricultural industries is vital, and all levels of government need to take positive steps to promote this kind of development, by increasing funds or using part of the special fund for pasture development.

Accelerated pasture development

Pasture development and appropriate management are fundamental to the sustainable growth of an animal production system. The future benefits of such a system relate directly to the scale of pasture development undertaken now.

Table 12. Population growth in pastoral regions of China ('000)

Minority group	1982	1990	Annual growth rate (%)
Mongol	3 417	4 807	4.36
Zangzu	3 874	4 593	2.15
Uygur	5 963	7 214	2.41
Kazak	908	1 112	2.56
Daur	94	121	3.24
Ewenki	19	26	3.92
Yugur	11	12	1.91
Oroqen	4	7	6.74
Hezhe	1.5	4	14.12
China: total population	1 008 175	113 363	1.48

Source: Statistics of ethnic minorities of China 1949–1990. Statistical Press of China, Beijing, 1991.

The pastureland contract system should be further implemented. Where all requirements for implementation are satisfied, grazing land should be contracted to individual households. Where requirements for individual household allocations are not satisfied, grazing land should be contracted to joint households or to production groups, instead of using the 'big pot' grazing system. Continuous efforts should be made to satisfy all requirements for the implementation of the household production responsibility system in regard to pastures.

The 'user pays' system has been implemented successfully in a number of counties in IMAR and could usefully be expanded to other pastoral areas. It is an

Table 11. Pasture development in the pastoral regions of China by province, 1990 ('000 mu[a])

Province	Planted area reserved	Improved area reserved	Aerial seeded area reserved	Fenced area reserved
Hebei	232.2	33.5	28.0	161.0
IMAR	1 983.0	2 495.8	777.7	4 804.8
Liaoning	187.3	46.9	16.8	14.4
Jilin	141.2	57.0	33.5	48.3
Heilongjiang	247.0	214.2	76.9	372.2
Sichuan	49.1	248.8	4.1	183.0
TAR	n.a.[b]	n.a.	n.a.	n.a.
Gansu	41.6	148.3	n.a.	258.5
Qinghai	194.0	147.0	27.0	1 095.3
Ningxia	40.0	114.0	3.0	4.3
XUAR	1 000.0	1 500.0	250.0	1 000.0
Total	4 070.6	5 005.4	1 216.9	7 975.4

[a] 15 mu = 1 ha.

[b] n.a. = not available.

effective way of raising funds for pasture development.

To encourage herdsmen to reinvest some of their income in pasture development, a long-term pasture-leasing system should be established in a small number of counties with good natural, economic, and social conditions. As an advanced form of the 'user pays' system, the leases could run for 50–100 years and be transferable from one generation to the next.

A soft loan fund for pasture development should be organised with the participation of all levels of government. Low interest or interest free loans would encourage individuals to use the fund for pasture development. Importantly, this approach would allow the government to work directly with individuals to develop pasture.

Current pasture development efforts typically entail simple enclosure, which allows pasture productivity to recover to the pre-grazed level. To improve pasture productivity, aerial seeding, spot planting, irrigation, and other improvement measures should be gradually applied to enclosed pastures.

Controlled stocking

The emphasis on animal numbers has not only destroyed a huge area of pasture land but also led to a surprising waste of natural resources. It has been claimed that the number of animals dying from starvation and natural disasters since 1949 has almost equalled the number of animals marketed. Stock levels have clearly exceeded the limits of sustainability. If stock levels are continuously increased for short-term gain, the entire pastoral industry will inevitably collapse. Thus, strict control of stock levels is an urgent task. Future development of the animal production system must concentrate on the improvement of pasture productivity. To enlarge animal production, the first step should be to introduce genetically superior animals. Secondly, a supplementary feeding system, especially during winter and spring, should be implemented to improve animal nutrition. And thirdly, day-to-day animal husbandry needs to improve to reduce animal mortalities.

Quantitative Analysis of the Imbalance between Feed Supply and Demand in the Pastoral Industry of the IMAR

Xu Ying*

ANIMAL husbandry has greatly expanded in the IMAR since the Chinese rural reforms of the 1980s. Compared to the average output 1979–81, total beef and mutton output in 1990 was 116.3% greater, or an increase of 8% per year. Total wool output over the corresponding period increased by 47% (4% per year) and total cashmere output increased by 34% (3% per year). Livestock numbers have also increased rapidly, though to varying degrees. Goats increased the most (29.4% from 1980–90), whereas the number of sheep rose 10.1% over the same period. From 1979–90, the rate of increase in animal products and animal population in the IMAR exceeded that for the world as a whole (Table 1).

In recent years, livestock numbers in the IMAR have greatly exceeded the carrying capacity of the rangelands, which has lead to widespread degradation of pastureland (Table 2). Rangeland scientists have become increasingly concerned about the long-term state of the rangelands in the IMAR. Although pastureland is potentially a renewable resource, it is renewable only under given conditions. To highlight the current relationship between livestock and forage grass in the IMAR, this paper presents a quantitative analysis of the imbalance between the two, in hopes of providing useful material for the formulation of policies and strategies aimed at sustainable development of the pastoral areas in China.

Methods

A technical model of seasonal herbage production was developed for four representative prefectures in the IMAR. The model estimates aggregate nutrition and dry matter available for each category of pastureland in each prefecture. Aggregate feed supply derived for each prefecture was then compared with aggregate feed demand of existing levels of livestock, assuming 'standard' feed requirements in the absence of feed stress. Thus, the analysis emphasises the shortfall in the supply of nutrients and dry matter relative to the 'standard' requirements of livestock. Considerable effort was devoted to aggregating large numbers of individual classes of pastureland into broad categories of pastureland. Similarly, for the derivation of nutrient and dry matter demand, considerable effort was given to aggregating nutrient demand according to existing livestock population and livestock herd and flock structures with respect to sex, age, breed, and animal type.

Selection of prefectures

Prefectures included in the analysis were selected on the basis of numerous criteria.

Regional features. The IMAR consists of large pastoral areas, complex geographical conditions, and varied rangeland ecology. However, it can be classified into three distinct regional areas: east, semi-meadow steppe land; central, arid and semi-arid land; and west, Gobi Desert land. Ecological conditions and rangeland productivity of the three regions differ. Hulunbeier prefecture typifies the eastern zone, Xilinguole prefecture the central zone, and Bayannuoer prefecture the western zone. In addition, Chifeng City prefecture is a survey base point of this project, and it was therefore also included in the prefectures selected for research.

Pastoral features. There are 12 prefectures in the IMAR. The four selected prefectures are of key importance in pastoral animal production throughout the IMAR. They exhibit all of the pastoral types separately identified in the IMAR with 91% of the sub-types, and 53% of the rangeland classes. Additionally, the selected prefectures are also representative of the livestock population and account for 54.8% of the sheep and 53.5% of the sheep equivalents in the IMAR (Table 3).

Production system features. Pastoral production in the IMAR can be divided into two types: pastoral and semi-pastoral areas. There are two pastoral areas and two semi-pastoral areas in the four selected prefectures.

* Institute of Agricultural Economics, Chinese Academy of Agricultural Science, Beijing

Livestock requirements

The nutritional requirements of livestock assumed in the analysis are for average body weights and vary according to the species, age, and sex of the animal (Table 4). The composition of livestock herds used to derive nutritional requirements for each of the four prefectures in 1990 appears in Table 5. Additionally,

Table 1. The growth rate of animal husbandry in the IMAR as compared to the world from 1979–90 ('000)

Year	Beef and mutton (t)	Beef (t)	Mutton (t)	Wool (t)	Cattle (head)	Sheep (head)	Goats (head)
World							
1979–81	587 656	44 110	543 546	2 784 079	1 221 536	1 092 480	459 759
1990	732 481	51 152	681 329	3 393 024	1 279 256	1 190 499	557 030
TGR (%)[a]	24.6	16.0	25.35	21.9	4.7	8.97	21.2
IDP (%)[b]	2.2	1.5	2.29	2.0	0.5	0.86	1.9
IMAR							
1979–81	98.6	32	66.6	40.2	3541.6	18 852	7336.7
1990	213.3	85.5	127.8	59.2	3852.8	20 749	9490.3
TGR (%)	116.3	167.2	92.0	47.3	8.8	10.1	29.4
IDP (%)	8.0	10.3	6.73	4.0	0.8	1.0	2.6

[a] TGR — total growth rate from 1980–90
[b] IDP — increase per year
Sources: FAO 1990; IMAR 1991.

Table 2. Rangeland degradation in Chifeng, Hulunbeier, Xilinguole, and Bayannuoer prefectures as compared to the IMAR ('000 mu[a])

Location	Total land	Total pasture	Useable pasture	Total degraded	Lightly degraded	Medium degraded	Heavily degraded
IMAR	1 751 331	1 182 067	953 866	675 552	177 544	132 641	65 366
Chifeng	130 279	82 401	69 620	43 979	14 704	16 559	12 716
Hulunbeier	372 389	169 470	149 706	31 455	17 797	10 777	22 880
Xilinguole	303 870	292 793	264 914	109 286	52 086	44 913	12 286
Bayannuoer	98 327	80 127	69 366	28 006	20 707	6303	995

[a] 15 mu = 1 ha.
Source: Zhang 1990.

Table 3. Livestock and rangeland in the four prefectures in the IMAR in 1990 ('000 head)

	Sheep equivalents	Cattle	Horses	Mules	Donkeys	Camels	Sheep	Goats	Useable rangeland ('000 mu[a])
Four prefectures (FP)	1 374 869	2191	823	209	394	59	11 380	4550	553 608
IMAR 2	2 568 574	3583	1568	553	878	223	20 750	9490	953 866
IMAR/FP (%)	53.5	56.9	52.5	37.7	44.8	26.6	54.8	47.9	58.1

[a] 15 mu = 1 ha.
Sources: IMAR 1991; Zhang 1990.

other key parameters are presented, such as percentage of death, survival rates for lambs, and the percentage of animals sold.

A liveweight of 40 kg is assumed for adult sheep in Chifeng and Hulunbeier prefectures. For the remaining two prefectures, adult sheep are marginally

Table 4. Seasonal dry matter, protein, and energy requirements for livestock in the IMAR.

	Dry matter (kg/day)		Protein (g DCP[a]/day)		Energy (Mcal/day)	
	Warm	**Cold**	**Warm**	**Cold**	**Warm**	**Cold**
Sheep						
Fine and improved						
ram	2.3	2.5	175.0	190.0	5.6	6.2
dam	1.8	2.2	75.0	104.0	3.6	4.2
1–2 years old	1.4	1.5	66.0	57.0	2.6	2.2
spring lamb	1.2	0.7	63.0	68.0	2.3	1.8
winter lamb	1.0	0.8	58.0	61.0	2.1	1.8
wether	1.9	2.1	75.0	82.0	3.4	3.7
Local						
ram	1.8	2.0	140.0	152.0	4.5	5.0
dam	1.4	1.8	60.0	83.2	2.9	3.4
1–2 yearsold	1.1	1.2	52.8	45.6	2.1	1.8
spring lamb	1.0	0.6	50.4	54.4	1.8	1.4
winter lamb	0.8	0.6	46.4	48.8	1.7	1.5
wether	1.5	1.7	60.0	65.6	2.7	3.0
Goats						
Fine and improved						
male	1.8	2.0	140.0	152.0	4.5	5.0
female	1.4	1.8	60.0	83.2	2.9	3.4
1–2 years old	1.1	1.2	52.8	65.6	2.1	2.2
spring young goat	1.0	0.6	50.4	54.4	1.8	1.4
winter young goat	0.8	0.6	46.4	48.8	1.7	1.5
castrated male	1.5	1.7	60.0	65.6	2.7	3.0
Local						
male	1.7	1.8	126.0	136.8	4.0	4.5
female	1.3	1.6	54.0	74.9	2.6	3.0
1–2 years old	1.0	1.1	47.5	59.0	1.9	2.0
spring young goat	0.9	0.5	45.4	49.0	1.7	1.3
winter young goat	0.7	0.6	41.8	43.9	1.5	1.3
castrated male	1.4	1.5	54.0	59.0	2.4	2.7
Large animals						
Cattle						
bull	13.0	14.3	550.0	605.0		
cow	8.5	9.0	380.0	437.0		
1–2 years old	7.0	7.5	320.0	352.0		
calf	1.0	3.6	60.0	220.0		
steer	8.5	8.8	350.0	385.0		
Draught						
oxen	10.0	11.5	440.0	484.0		
horse	5.3	5.7	330.0	363.0		
donkey/mule	3.2	3.5	260.0	286.0		

[a] DCP = Dry concentrated protein.

Source: List of chemical composition and nutritional values of Chinese forage plants, edited by Kong Qingfu and Bai Yunlong, Institute of Pastureland, Chinese Academy of Agricultural Sciences.

smaller, and the dry matter requirements (Table 4) were adjusted downwards by 10%. The proportion of male and female animals in the four prefectures was based on the proportion for the whole IMAR in 1990; 1:30 for cattle, 1:25 for sheep, and 1:22 for goats.

Feed supply

Yields from different types or classes of rangeland were determined according to results of a survey by the Institute of Inner Mongolian Survey and Design in 1985. Use of these results in the following analysis rests on the assumption that the ecological environment has not changed to the extent that it has markedly affected the yield of rangeland between 1985–90.

Nutrition supply was determined as follows: (i) the composition of grass species for each class of pastureland was derived from the survey results of the IMAR Rangeland Resources; (ii) the supply of nutrition for each class was taken from the list of chemical composition and nutrition values of Chinese forage plants, edited by Kong Qingfu and Bai Yunlong, Institute of Pastureland, Chinese Academy of Agricultural Sciences; and (iii) the supply of nutrition for each subtype was determined using averages weighted according to the area of each class of pastureland and calculated on the premise that useful pasture species accounted for at least 60% of total grasses. An average to slightly higher than average nutritional value was used during the growing season, reflecting the practice of grazing on both sides of the peak period for grass nutrition. Available digestible nutrients for each class of pastureland were determined according to the average rates of digestible matter for sheep. The average level of digestible matter for goats and cattle is assumed to be similar to that of sheep.

Marked seasonal differences in pasture growth are found to occur throughout the IMAR. These differences correspond to the considerable differences in latitude and climate. Broadly speaking, the climate in the IMAR can be divided into a warm season stretching for 135 to 195 days, and a cold season that lasts from 170 to 230 days. Variation in the length of seasons is found both within and across prefectures. For example, in Aohan county in Chifeng prefecture, the warm and cold seasons are 195 and 170 days respectively. However, in Balinyou county, which is located further north, the warm and cold seasons last for 160 and 205 days respectively. To simplify the analysis, an average value for seasonal variation was selected —namely, 160 days for the warm season and 205 days for the cold season. Seasonal dry matter production

Table 5. Livestock parameters for the four prefectures in 1990

Item	Livestock ('000 head)	Fine and improved (%)	Breeding dams (%)	Survival rate (%)	Death rate (%)	Off-take rate (%)	Useable life of breeding stock (years)
Chifeng							
sheep	2451.8	89.1	51.4	65.4	4.9	35.8	7
goats	1421.2	29.3	49.7	66.8	4.0	30.0	7
cattle	672.7	40.4	36.4	47.5	4.7	23.7	8
Hulunbeier							
sheep	1319.1	39.3	56.3	71.4	6.1	37.2	7
goats	251.1	3.2	48.4	79.1	6.3	32.4	7
cattle	576.2	52.8	40.9	64.5	4.1	22.6	8
Xilinguole							
sheep	5367.4	54.8	52.2	84.0	4.5	37.0	7
goats	1449.5	0.5	46.6	76.0	3.0	26.0	7
cattle	912.6	11.6	39.5	58.5	4.9	20.9	8
Bayannuoer							
sheep	2240.2	63.7	54.3	73.9	3.6	34.7	7
goats	1430.0	45.9	51.5	62.5	3.4	27.5	7
cattle	29.4	10.2	34.0	45.7	1.8	25.3	8

Source: IMAR 1991.

and nutrition value for different rangeland classes in Chifeng City prefecture are presented in Table 6. Aggregate seasonal variation in dry matter production and nutrition was determined using data on the proportion of warm and cold season rangeland in Chifeng City prefecture from the National Grasslands Survey.

Average yields for artificial and improved pastures at the prefectural level were not available. Survey data of artificial and improved pastures are only scattered. Moreover, there is considerable variation in these data. The degree of variation is clearly evident when using the data to calculate the average yield for each prefecture. Consequently, in the absence of reliable survey data, selected experimental data and test data at particular sites were used to obtain average yields for artificial and improved pastures. Differences in the natural conditions between eastern and western regions were accounted for by weighing the average yields. Yields varied by around 20% between the two regions. The nutritional quality of artificial and improved pastures was determined according to the species and/or the composition of the species found in the pastures. The nutritional values determined are presented in Table 7.

Data on the feeding of concentrates to cattle, sheep, and other herbivores are not available. Consequently it was necessary to calculate the values by deducting estimates of consumption for pigs and fowls from data for total annual consumption of concentrates in the IMAR. The standard used to calculate consumption by pigs and chickens was 200 kg of concentrate per pig and 10 kg per fowl. Estimates of concentrate consumption for each of the four prefectures in 1990 are presented in Table 8.

Table 6. Area, yield, and quality of each sub-type of rangeland in Chifeng City prefecture

Type of rangeland	Area ('000 mu[a])	Warm season yield (kg/mu)	Cold season yield (kg/mu	Warm season protein (g/kg)	Cold season protein (g/kg	Warm season energy (Mcal/kg)	Cold season energy (Mcal/kg)
IA plain and hill meadow steppe	1416	87.7	47.3	41.4	33.1	2.5	2.2
IB upland meadow steppe	14 778	67.2	46.6	49.6	27.8	2.4	2.2
IIA plain and hill rangeland	23 269	38.0	22.8	56.6	26.1	2.4	2.1
IIB upland typical rangeland	4524	44.0	30.2	52.3	27.6	2.4	2.0
IIC typical sandy rangeland	18 277	35.0	22.6	53.4	29.7	2.4	2.2
VIB upland meadow	1287	67.8	43.8	49.3	26.7	2.3	2.1
VIIA floodland meadow	1411	78.6	54.8	56.3	28.1	2.4	2.2
VIIB lowland moor meadow	1311	53.5	41.7	53.3	34.4	2.5	2.3
VIIC lowland salt meadow	2223	49.2	34.9	49.3	28.0	2.3	2.2
VIII grass moor	764	44.4	43.3	48.1	27.4	2.4	2.1
IX subsidiary pastureland	359	33.0	21.4	47.9	30.9	2.3	2.4
IA.IIB	46.9	30.8	48.1	28.0	2.3	2.1	n.a.[b]
Total	69 620						

[a] 15 mu = 1 ha.

[b] n.a. = not available.

Source: Inner Mongolia pastureland resources: Chemical composition and nutrition values of Chinese forage plants.

Results

The shortfall in the supply of dry matter and protein relative to the requirements of the nonstressed standard of grazing livestock was most evident in Chifeng and Bayannuoer prefectures, where dry matter supply was found to satisfy only 65% and 62% of standard livestock requirements. Dry concentrated protein (DCP) was found to be in particularly short supply, satisfying only around 52% and 75% of normal requirements during the cold season. Notably, dry matter and protein were also found to be in short supply during the warm season (Tables 9 and 10).

The imbalance between feed supply and demand was most evident during the cold season. In Chifeng City prefecture, the supply of dry matter, protein, and energy was sufficient only to meet 65.5%, 52.2%, and 71.7% of normal requirements. These shortages explain the vicious circle of sheep becoming strong in summer, fat in autumn, thin in winter, and weak in spring.

The lack of coordination between feed supply and demand often results from low quality rather than quantity of forage. For example, in Chifeng City prefecture, the quantity of forage production was found to be short of requirements by 35% during the cold season, whereas the quantity of DCP required fell short by almost 50%. This result is even more disturbing given the fact that 8% of protein requirements are derived from concentrates rather than pastures. The situation is even more acute in Bayannuoer prefecture, where only around 30% of protein requirements are sourced form pastures. These results clearly highlight the importance of nonrangeland sources of feed for livestock in IMAR.

Table 7. Area, yield, and quality of rangeland, by pasture and feed types

Type of rangeland	Area ('000 mu[a])	Warm season yield (kg/mu)	Cold season yield (kg/mu)	Warm season protein (g/kg)	Cold season protein (g/kg)	Warm season energy (Mcal/kg)	Cold season energy (Mcal/kg)
Artificial pasture	1 316	220	176	121.1	68.8	2.5	2.1
Improved pasture	778	140	112	97.7	47.2	2.5	2.3
Aerial sown pasture	1 111	120	96	86.8	44.0	2.4	2.2
Fenced pasture	7 827	100	80	60.9	27.0	2.4	2.2
Total	11 032						
Straw (t)	731				164.0		23.9
Forage crops (t)	165				997.0		7.9
Total	896						
Maize (t)	44				68.8		3.8
Beancake (t)	5				375.1		3.5
By-product (t)	31				110.0		2.9
Total	79						

[a] 15 mu = 1 ha.

Source: List of chemical composition and nutrition values of Chinese forage plants. Fodder nutrition values for Heilongjiang province, by the Institute of Animal Husbandry of Heilongjiang Province.

Table 8 Estimated concentrate consumption (includes grain, bran, and beancake) for the four prefectures for 1990 ('000 kg)

Prefecture	Total	Pigs and fowl	Cattle and sheep	Level of dependence on concentrates (%)
Chifeng	264 397	185 078	79 319	30
Hulunbeier	215 872	82 030	133 841	62
Xilinguole	16 967	15 758	3939	20
Bayannuoer	360 600	15 392	245 208	68

Source: IMAR 1991.

Table 9. Pastureland supply and demand in Chifeng City prefecture in 1990

	Warm season grass	Cold season grass	Protein (DCP[a])	Protein (DCP)	Warm season energy (DE[b])	Cold season energy (DE)
	('000 t)				'000 Mcal	
Total supply	2 453	2 022	121	80	6 026	5 134
Total demand	2 645	3 085	133	152	6 515	7 160
	(%)					
Total supply/ total demand	92.8	65.5	91.2	52.2	92.5	71.7
Total rangeland/ total demand	51.0	29.7	54.5	19.9	49.9	28.0
Total improved pastures/total demand	24.8	21.3	30.8	22.2	26.0	21.2
Total hay/ total demand	20.0	11.8	5.9	5.2	16.6	15.1
Total grain/ total demand	0	0	n.a.[c]	8.0	0	7.3
Total supply	100.0	100.0	100.0	100.0	100.0	100.0
Total rangeland	54.9	45.3	50.7	32.4	54.0	39.5
Total improved pasture	26.8	32.5	33.8	42.5	28.1	29.9
Total hay	18.3	22.2	6.5	9.9	17.9	21.3
Total grain	0	0	0	15.3	0	10.3

[a] DCP = dry concentrated protein. [b] DE = digestible energy. [c] n.a. = not available.

Table 10. Pastureland supply and demand in Bayannuoer prefecture in 1990

	Warm season grass	Cold season grass	Protein (DCP[a])	Protein (DCP)	Warm season energy (DE[b])	Cold season energy (DE)
	('000 t)				'000 Mcal	
Total supply	1 123	940	55	58	2 631	2 927
Total demand	1 209	1 506	60	76	2 710	3 330
	(%)					
Total supply/ total demand	92.9	62.4	91.0	75.6	97.1	87.9
Total rangeland/ total demand	59.7	33.0	62.6	15.8	57.3	29.9
Total improved pastures/total demand	6.8	8.2	12.6	7.8	7.4	8.3
Total hay/ total demand	26.4	12.9	7.6	9.0	23.1	28.2
Total grain/ total demand	0	0	0	49.5	0	29.1
Total supply	100.0	100.0	100.0	100.0	100.0	100.0
Total rangeland	64.3	52.9	68.8	20.8	59.0	34.0
Total improved pasture	7.3	13.1	13.9	10.3	7.8	9.5
Total hay	28.4	34.0	10.5	9.9	29.8	26.8
Total grain	0	0	6.9	59.0	3.7	29.8

[a] DCP = dry concentrated protein. [b] DE = digestible energy. [c] n.a. = not available.

Table 11. Pastureland supply and demand in Xilinguole prefecture in 1990

	Warm season grass	Cold season grass	Protein (DCP[a])	Protein (DCP)	Warm season energy (DE[b])	Cold season energy (DE)
	('000 t)				'000 Mcal	
Total supply	4 750	4 864	233	147	9 391	10 195
Total demand	3 575	4 086	171	212	8 160	9 499
	(%)					
Total supply/ total demand	124.5	119.0	136.5	69.4	115.1	107.3
Total rangeland/ total demand	124.5	85.7	136.5	69.4	115.1	74.9
Total improved pastures/total demand	0	30.8	0	17.5	0	29.8
Total hay/ total demand	0	2.5	0	0.9	0	2.7
Total grain/ total demand	0	0	0	0.1	0	0.1
Total supply	100.0	100.0	100.0	100.0	100.0	100.0
Total rangeland	100.0	72.0	0	72.2	0	69.7
Total improved pasture	0	25.9	0	25.3	0	27.7
Total hay	0	2.1	0	1.3	0	2.5
Total grain	0	0	0	1.2	0	0.1

[a] DCP = dry concentrated protein. [b] DE = digestible energy. [c] n.a. = not available.

For Xilinguole, the analysis indicated a balance of pastureland supply and demand (Table 11). Protein was the only nutrient found to be in short supply. This shortage however was modest in relation to Chifeng and Bayannuoer prefectures.

Results for Hulunbeier prefecture indicate a surplus of dry matter and nutrition during both the cold and warm seasons. For example, dry matter was found to be 4.3 times livestock requirements during the warm season. These results indicate that Hulunbeier prefecture is able to increase its level of total sheep equivalents by 1660 in the warm season (a 260% increase over 1990) and 680 sheep equivalents during the cold season (an increase of 130% over 1990). Results for Hulunbeier prefecture are presented in Table 12.

Recommendations

The IMAR is a large and diverse part of northern China, and this makes it difficult to apply uniform policy recommendations for correcting imbalances between pastureland supply and demand. However, based on the analysis presented here, a number of broad recommendations can be made:

1. Herdsmen should be encouraged to reduce livestock numbers through the development of an efficient pastoral industry. The development of a sheep meat industry should be encouraged, and the proportion of fertile, breeding ewes should be increased. These measures would enable higher stocking rates during the warm season and lower stocking rates during the cold season.
2. The rate of pasture development should be increased to achieve higher levels of nutrient supply throughout the IMAR. Particular attention needs to be paid to the difficulties experienced by herdsmen in undertaking new pasture improvement projects.
3. Animal improvement projects should be accelerated.
4. Artificial and improved pasture fodder must be cut and stored with greater efficiency to reduce the loss of nutrients and dry matter.
5. Industrial development must be encouraged in pastoral and semi-pastoral areas to create alternative employment opportunities that can relieve some of the population pressures contributing to overstocking and rangeland degradation.

Table 12. Pastureland supply and demand in Hulunbeier prefecture in 1990

	Warm season grass	Cold season grass	Protein (DCP[a])	Protein (DCP)	Warm season energy (DE[b])	Cold season energy (DE)
	('000 t)				'000 Mcal	
Total supply	6 165	4 741	383	151	13 300	10 348
Total demand	1 430	1 739	715	90	3 584	3 348
	(%)					
Total supply/ total demand	431.2	272.6	535.6	168.1	371.1	240.0
Total rangeland/ total demand	418.6	248.4	519.4	138.7	366.2	204.1
Total improved pastures/total demand	4.6	8.9	8.0	7.6	4.9	8.2
Total hay/ total demand	13.4	7.7	3.0	5.2	7.8	14.9
Total grain/ total demand	0	0	5.3	20.9	3.3	13.4
Total supply	100.0	100.0	100.0	100.0	100.0	100.0
Total rangeland	97.1	91.1	97.0	82.5	95.7	85.8
Total improved pasture	1.1	3.3	1.5	4.8	1.3	3.5
Total hay	1.9	5.6	0.6	3.1	2.1	6.3
Total grain	0	0	1.0	10.0	0.9	4.5

[a] DCP = dry concentrated protein. [b] DE = digestible energy. [c] n.a. = not available.

6. Levels of pastureland dry matter and nutrients need to be analysed so that herdsmen can concentrate their livestock in areas with a surplus while devoting development efforts to areas with a deficit.

References

FAO (Food and Agriculture Organization) 1990. Production yearbook. Rome, FAO.

IMAR (Inner Mongolian Agricultural Region) 1991. IMAR yearbook. Huhehote, Chinese Statistical Press. (In Chinese).

Zhang, Z., ed. 1990. Inner Mongolian rangeland resources. Rangeland Research Institute, Chinese Academy of Agricultural Sciences.

Wool Marketing in China: a System in Transition

John W. Longworth*

THERE has been a growing recognition in China that the traditional wool-marketing system is a major constraint to the modernisation of the wool industry. While in part this reflects the general swing away from the centrally planned production quota and fixed price distribution system for agricultural commodities (An 1989; Ash 1988; Sicular 1988), it also reflects some special features associated with wool marketing (Shi 1990).

This chapter provides a broad background to the Chinese wool industry and examines the role of supply and marketing cooperatives in relation to the marketing of wool. One of the key aspects of any marketing system is the way prices are determined. Therefore the question of price determination is examined in some detail, especially for the Inner Mongolia autonomous region since 1984. Finally, several innovations that could improve the functioning of the Chinese wool market are discussed.

Background

Wool, broadly defined, is produced in many provinces and autonomous regions of China. However, the most important producing areas are the Inner Mongolian autonomous region (IMAR), which produced 59 701 t or 25% of the greasy wool grown in China in 1991, Xinjiang Uygur autonomous region (XUAR), which produced 21%, Shandong (9%), Qinghai (7%), Gansu (6%), Hebei (5%), and Heilongjiang (5%). All of the other provinces and autonomous regions produced less than 10 000 t in 1991.

However, fine wool and improved fine wool (which is defined in China as wool with an average fibre diameter of 25 microns or less) is primarily grown in IMAR (30%), XUAR (26%), Shandong (10%), and Jilin (7%). All other provinces or autonomous regions produced less than 5000 t of fine and improved fine wool in 1991 (Table 1).

Wool production systems and average flock size vary a great deal both within and between provinces. The introduction of the 'household-production-responsibility' system in the early 1980s created an enormous number of individual wool-producing and selling households. There is also a significant number of wool-growing state farms, especially in XUAR and IMAR, and the wool clips they can sell are usually much larger than those of individual households. Furthermore, the state farm clips are usually of better quality and more carefully prepared for market.

After the establishment of the People's Republic of China (PRC) in 1949, wool remained a free market commodity until 1956 when it became a category II commodity. Commodities in category II were subject to the central government plan, and the National Price Bureau was responsible for setting the state prices. Specific quotas were set for these commodities and procured by the state at state prices. Excess production was usually sold to the state procurement agency at negotiated prices, in practice usually also at the quota price.

Wool remained a category II commodity until 1985 when the central government suspended the classification for wool and announced it would allow provincial governments to set state purchase prices and/or to develop a free market for wool in the areas under their jurisdiction. At the same time the central government advised the governments of the four western provinces of IMAR, XUAR, Gansu, and Qinghai, to develop their wool textile industries by integrating them more closely with the wool production sector in their province. This was the so-called 'self-produce, self-sell, self-process' policy, which is still in place.

The Role of the Supply and Marketing Cooperatives

When the central government designated wool as a category II commodity in 1956, it appointed the network of Supply and Marketing Cooperatives (SMC) as the official state procurement agency. That is, the SMCs were responsible for purchasing and collecting the state production quota on behalf of the state and, in most parts of China, for purchasing all over-quota wool.

Grass roots SMCs are organised at the township (or sumu) level. The township is the lowest formal level of government in China. It corresponds to the commune in the 1957–78 period. In the IMAR, a town-

* Department of Agriculture, University of Queensland.

Table 1. Distribution of wool production in selected provinces and autonomous regions of China, 1991

Province or autonomous region	Fine wool and improved fine wool		Semi-fine wool and improved semi-fine wool		Total all wool[a]	
	Amount of greasy wool	Proportion of national total	Amount of greasy wool	Proportion of national total	Amount of greasy wool	Proportion of national total
	(t)	(%)	(t)	(%)	(t)	(%)
Hebei	4881	4.5	2616	4.7	11 941	5.0
IMAR	32 672	30.1	12 077	21.6	59 701	24.9
Liaoning	3480	3.2	2052	3.7	7196	3.0
Jilin	7847	7.2	1273	2.3	9124	3.8
Heilongjiang	4281	3.9	6389	11.4	10 766	4.5
Shandong	10 476	9.6	6660	11.9	21 574	9.0
Tibet	20	–	1154	2.1	8064	3.4
Gansu	4477	4.1	1318	2.4	15 001	6.3
Qinghai	323	0.3	6319	11.3	17 736	7.4
XUAR	28 534	26.3	11 740	21.0	49 578	20.7
Sub-total	96 991	89.3	51 598	92.4	210 681	87.9
Grand total for all China	108 613	100.0	55 839	100.0	239 609	100.0

[a] In addition to fine and semi-fine wool, there is a considerable amount of coarse wool (primarily used for making carpets) grown in China.

ship is called a sumu when it embraces a significant Mongolian population, and pastoral industries are the dominant economic activity (for more on relevant Chinese administrative structures, see Longworth 1990, 3–5). Besides acting as the state purchasing authority for certain farm outputs such as wool, SMCs also operate like a general store, selling processed food (powdered milk, biscuits, cakes, and other goods), alcohol, clothing, household tools, consumer durables (radios, fans, televisions), and farm inputs, such as fertilisers and pesticides. However, the SMCs are not permitted to sell certain farm inputs, such as most seeds, which are sold by special seed companies with a state monopoly, or petrol and oils, to which state fuel companies have sole rights. The SMCs are also not permitted to purchase grains or meats from farmers since there are special state monopolies established under the Ministry of Commerce to purchase these commodities.

A township SMC will have a small branch shop/purchasing depot in most villages administered by the township government. The SMCs are arranged in a heirarchical or pyramid structure with the town SMCs forming the base and the All China Union of SMCs the apex. Between these two levels in ascending order of responsibility are the county-level SMCs, prefectural SMCs and provincial SMCs.

Originally the SMCs were established as genuine cooperatives in the first half of the 1950s. However, after 1956 and especially during the 1960s, they were absorbed into the state bureaucracy, initially in parallel with the Ministry of Commerce and eventually integrated within it. During the 1980s, there was renewed interest in having an independent, farmer-controlled, agribusiness cooperative movement in China (An 1989). Some provinces, such as Gansu, have encouraged the SMC to break away from the state bureaucracy and become more independent. Nevertheless in most provinces, and even in Gansu, the SMC and its associated companies, such as the Animal By-Products or Native Goods Companies (which trade in wool on behalf of the SMC), remain an arm of the state under the control of the Ministry of Commerce. This relationship became especially important in 1989 when the SMC began to accumulate large stocks of wool. Since then, the state has been forced to subsidise the holding of wool stocks by the SMC. Township SMCs were also provided with special loans through the agricultural bank so that they could keep purchasing wool from the farmers in 1989, 1990, and 1991 despite having large amounts of capital tied up in their wool stockpile.

As Lin discusses in the following chapter, SMCs have traditionally collected a 27% marketing margin

on raw wool. That is, the purchase price paid to the farmers is increased by 27% to determine the price the textile mills must pay. Of this mark up, 17% is shared between SMCs at the township, county, and prefectural levels, while 10% is a wool product tax collected by the SMC on behalf of the county governments. As the officially sanctioned marketing margin is a percentage of the state purchase price paid to farmers, the SMCs and county governments stood to benefit greatly when the prices of wool soared during 1985–88; an inevitable consequence of the SMC monopoly on wool buying.

Lin points out the obstacles this fixed 27% mark up has created for reforming the wool-marketing system. The so-called 'wool wars' resulted largely from the SMC and county government fear of losing control over this institutionalised marketing margin when the wool market was 'freed-up' in 1985. Other authors appear to have not recognised this critical reason for the 'wool wars' (see for example, Watson et al. 1989).

Pricing

Historically, wool has not been a major commodity in China. By present day standards, all of the wool grown traditionally in China would have been very coarse. Since the 1950s, attention has focused on breeding for finer wool. Before 1956 wool was traded in a completely free market and prices were not subject to any form of government control. In the pastoral areas, wool was sold by the nomadic herdsmen when they gathered together once or twice each year for trading, celebrations, and games. (These occasions were called 'Nadam Fairs.') Prices were unstable and unpredictable, and inefficient in the sense that they did not reflect any overall interaction of total market supply and total market demand. Communications (over both time and space) between the small, isolated Nadamur markets were poorly developed.

From 1956 to 1984, the state, in principle, completely controlled the marketing of all wool. As a category II commodity, the state established the purchase price for the quota amount (which was usually also the price paid by the SMC for over-quota wool). These administratively determined prices were set without much reference to costs of production or the welfare of wool growers. The primary objective was to provide the textile mills with the raw material at a price that enabled the end products to be made available to (mainly urban) consumers as cheaply as possible. Consequently, the prices paid for wool remained low and stable between 1956 and 1978, and the differentials between grades were extremely modest. For example, there was no difference between the prices paid for fine wool and semi-fine wool despite the considerable differences in quality. Fine wool measures 25 microns or less in average fibre diameter, and the average fibre diameter of semi-fine wool measures 25.1–42 microns (see Table 4).

With administratively determined prices and state planning of production, quality characteristics become completely neglected, since they are not related to the preferences of buyers. Consequently, sellers have no incentives to allocate resources and effort to improving the quality of their product.

It was not until the 1980s that the allocative role of prices gained official attention in the PRC. Previously, prices had been used simply as a means of distributing income in the centrally planned economy. However, with the emergence of free markets in China, the allocative role of prices is becoming more important.

With free markets, prices signal how resources should be allocated (prices serve as a means of communication between buyers and sellers) and provide the major determinant of income for the owners of the resources. When market-determined prices generate politically unacceptable changes in the distribution of income between producers (groups of resources owners) or between producers and consumers, governments of all political persuasions come under great pressure to modify the market outcomes. One policy approach interferes with the free market to generate more politically appropriate prices. Another policy response leaves the free market alone and addresses the unsatisfactory income-distribution outcomes directly. After more than half a century of focusing on the former approach, the governments of Western, developed nations now seem to be shifting the emphasis to the second approach.

In general terms, the pricing reforms of the 1980s demonstrate that the Chinese Government wants to take advantage of the efficiency gains that free markets and prices can offer in relation to the allocation of resources. However, the potentially unacceptable implications for the distribution of income impose major constraints on how far and how fast the Chinese Government is prepared to move in the direction of free markets.

Problems associated with wool pricing appear particularly intractable. Whereas premiums for finer, better quality wool would, in the long term, encourage farmers to produce more of the 'right' kind of wool from the viewpoint of the textile mills (and ultimately

the final consumers), in the short term, premiums could only be achieved by substantially reducing the prices paid for semi-fine and coarse wool. At present most of the finer, better quality wool is produced by state farms and better-off farmers with larger flocks. Furthermore, the production of better wool is concentrated in a few counties (or wool production bases) within the pastoral region. Consequently, numerous groups, including the overwhelming majority of sheep farmers, of SMCs purchasing wool, and of county governments (which depend on the 10% wool product tax for fiscal revenue), would strongly oppose a wool-pricing system with appropriate quality premiums and discounts.

This is a major political obstacle to the development of a more appropriate pattern of prices for wool of different types and grades in China. In fact, it is probably the underlying reason why the free wool-market experiment, which began in 1985, was so vigorously opposed and why there is so much resistance to the further development of wool auctions. A properly functioning free market system would automatically generate the appropriate premiums and discounts for the various types of wool.

Raw Wool Pricing in the IMAR since 1984

In the IMAR, the Provincial Price Bureau sets the official state purchasing prices under the general guidance of the National Price Bureau and in consultation with the prefectural-level textile mills[1], the IMAR Bureau of Textiles, the IMAR Bureau of Animal Husbandry, and other interested groups. These prices for 1984 are presented in Table 2.

Despite the 1985 central government decision to allow provinces to open their wool markets if they wished, the government of the IMAR did not allow prefectural governments to open their wool markets until 1986. Consequently the official state prices, at least in theory, were the purchase prices paid to all farmers by the SMCs in the IMAR in 1985. These official 1985 prices were set by the Provincial Price Bureau as being the same as those for 1984 (Table 2), plus 20%. In 1986, 1987, and 1988, the provincial government permitted the prefectural government to allow free trading in raw wool. At the same time the Provincial Price Bureau continued to set official state prices, which were supposed to apply where local governments did not permit a free market. For 1986 these

[1] The textile mills in Huhehote are owned and operated by the prefectural-level city government. There are no provincial-level state-owned textile factories in the IMAR.

Table 2. Official state purchase prices for raw wool in the IMAR, 1984

Type of wool		Price per kilogram (greasy) (yuan)
Special grade		5.28
Fine and semi-fine wool	– grade I	4.86
	– grade II	4.56
Improved fine and semi-fine wool	– grade I	4.26
	– grade II	3.88
Coarse wool		3.20

official purchasing prices were increased to 25% above 1984 levels. In 1987, the Provincial Price Bureau established official prices at 35% above the 1984 level. In 1988 the IMAR government aimed to stabilise wool prices at their 1987 level. But the so-called 'wool wars' were raging, and a large number of buyers were active in the market. Consequently, wool prices in some areas more than doubled 1984 levels.

During 1985–88, in areas where the market remained officially closed, purchase prices paid to farmers by the SMC varied widely from one prefecture to another (and even between counties in the same prefecture), despite fixed prices set by the IMAR Price Bureau. There were two main reasons for the wide variations.

First, some prefectures (and counties) wanted to encourage wool production and were not concerned about the cost of the raw material to the textile mills. Prefectural (and county) price bureaus in these areas tried to set the official purchase prices as high as possible. In other areas, local governments (prefectural and/or county) owned and operated textile factories and were keen to keep raw wool prices down to increase factory profits.

Second, the emergence of a 'black market' for wool in officially closed areas, with many units and individuals competing with the SMC for the available wool, also contributed to the growing regional variation in official raw wool prices. This 'private' illegal competition was especially important in counties (and prefectures) adjoining provinces such as Liaoning where a vigorous free market in wool had developed from 1985 onwards.

Where prefectures opened their wool markets, SMCs faced even more vigorous competition for the available wool from other government units and pri-

vate dealers. The rush to buy and deal in raw wool pushed prices up sharply in 1987 and 1988. For example, in June and July 1987 the average price per kg of raw (greasy) wool in the IMAR was 9.80–10 yuan but this rose to 14–16 yuan/kg in June and July of 1988. The market became very disorderly with farmers and wool dealers adulterating wool because buyers were often not experienced and would buy almost any kind of wool.

The wool-buying season in China begins in June and is most active in June and July, the months of maximum shearing. Traditionally, official state prices for wool are announced just before the buying season commences—that is, normally in May or early June.

By mid 1989 the market conditions for raw wool were much less buoyant than at the beginning of the 1988 season, which had been the peak of the 1980s wool boom. The strong deflationary monetary and fiscal policies implemented by the central government from September 1988 had severely dampened demand for finished textile goods, for textile fabrics and yarns, and consequently for textile raw materials like wool. Political events in China in May 1989, which culminated in the June 4 upheaval in Beijing, also affected the demand for raw wool. In fact, the 'private' wool buyers and dealers, who had been very active in 1987 and 1988, had virtually disappeared by the time the 1989 wool-buying season opened in June.

Consequently, the provincial government of the IMAR decided to close the wool market in all prefectures for the 1989 and subsequent seasons. Once again the township SMCs became the only organisation permitted to buy wool from farmers in the IMAR.

In recognition of the depressed market, the IMAR Price Bureau, on behalf of the provincial government, changed the way the official purchasing prices for the IMAR would be established for 1989. They announced sets of maximum and minimum (reserve) prices, rather than a single set of fixed prices (Table 3).

Although prices paid to farmers by the township SMCs are officially supposed to be the same throughout the wool-buying year, after 1985 many township SMCs began to vary their prices during the season to compete with 'private' buyers. In the 1985 to 1988 seasons, most farmers who stored their wool after shearing were able to obtain higher prices later in the season. However, as the market became progressively depressed during the 1989 season, the reverse was true. Due to the build up of stocks at the end of 1989 and into 1990, SMCs stopped buying raw wool and many farmers who had initially withheld their clips from the market in the second half of 1989 could not sell their wool.

Despite the deteriorating market, the IMAR Price Bureau set maximum official prices in 1990 at the same level as in 1989 (Table 3). Furthermore, it actually raised the minimum (reserve) prices for all types by 27% relative to 1989. As Lin discusses in the following chapter, this kind of official pricing policy effectively priced domestic raw wool out of the textile fibre market in China in 1989 and 1990.

Marketing Innovations

In recent years a number of experiments have been started to evaluate some important marketing innovations. Four of these innovations are direct selling to processors; selling on the basis of clean-scoured yield and industrial grade; sale by auction; and the introduction of county-level, first-stage processing.

Direct selling

As Lin explains in the next chapter, and as others have pointed out, the traditional SMC-controlled mar-

Table 3. Maximum and minimum prices for various types of wool established by the IMAR Price Bureau for the 1989 wool-purchasing season

Type of wool		Maximum price yuan/kg (greasy)	Minimum price (reserve) yuan/kg (greasy)
Special grade		10.88	6.86
Fine and semi-fine wool	– grade I	10.00	6.32
	– grade II	9.40	5.92
Improved fine and semi-fine wool	– grade I	8.78	5.54
	– grade II	7.98	3.04
Coarse wool		8.18	3.20

Source: No. 3 Woollen Mill, Huhehote, 1990 (personal communication).

keting chain from producers to processors is inefficient and too expensive. Of course, the long-term solution is to allow other agencies to compete with the SMC in a free market. However, even if in the short term the SMC is to retain its absolute monopoly in wool marketing, a number of important changes could be introduced.

One of these modest reforms would be to eliminate the role of the prefectural SMC in wool marketing by allowing the textile mills to buy directly from county SMCs. Indeed, in some areas there may be considerable advantages in allowing the mills to buy directly from the township SMCs—eliminating both the prefectural and the county SMCs from the marketing chain.

Another important change would be to allow state farms (both ordinary state farms that produce wool and the special state sheep stud farms) to sell their wool directly to processors. This has been the situation in the IMAR since the 1990 wool-selling season. In this case, the mills must negotiate purchases through the provincial stud farm company under the IMAR Animal Husbandry Bureau rather than through the SMC network. The state farms in the IMAR are said to supply the best wool and mills pay a premium of up to 10% to obtain it. Most of the wool purchased from state farms is said to be fine wool, grade I and II. About 10% of the raw wool requirements of the mills in Huhehote can be purchased from the state farms with the remaining 90% coming from the prefectural SMCs. Most of the wool supplied by the SMCs is fine wool grade II or improved fine wool grade I.

Large national or provincial state sheep stud farms, such as Huang Cheng in Gansu and Gongnaisi in XUAR, have had the right to sell their wool directly to mills since the mid-1980s. But in general, lower level state farms in most provinces other than the IMAR must market their wool through the SMC. It is often the local government and not the provincial government that enforces this regulation. For example, while the Gansu provincial government has declared a free market for wool in Gansu, Sunan county in Gansu requires the state farms there (except for the Huang Cheng stud farm) to sell wool to the SMC and for it to be processed through the county scouring plant.

Apart from reducing the marketing margin, direct selling has a number of other advantages (as Lin explains in the following chapter). These include improving the producers 'awareness of the processors' requirements and facilitating the channelling of technical advice and possibly investment capital from the mills to the producers.

Selling by clean weight and industrial grade

There is growing support in China for the introduction of a wool-purchasing system that would enable growers to be paid on a clean yield or clean-scoured basis.

At present the township SMCs purchase raw wool from farmers on a greasy weight basis according to the National Wool-Grading Standard (Appendix A). The technician or wool buyer at the SMC purchasing station determines the weight of the wool offered for sale by the farmer after shaking out the loose sand, twigs, leaves, and other debris. This person also determines the grade and hence the price the farmer will receive. Many of the purchasing stations collect only small amounts of wool each year and the purchasing agent cannot be expected to be especially skilled in wool grading. Any grading system to be applied at this stage in the current marketing chain must be extremely simple (or nearly useless from the viewpoint of the processors).

While precise data are not available, apparently most of the wool now purchased directly from state farms in the IMAR by processors like the No. 1 Top-making Mill in Huhehote is bought on a clean-scoured basis. While it was technically illegal for ordinary households outside a state farm to sell their wool to a state farm until the market was declared open in 1992, better quality wool growers who live near a state farm apparently now have an opportunity to use this unofficial marketing channel to obtain better returns than selling their wool to the township SMCs.

Other provinces have also experimented with selling on a clean yield basis. For example, the Gansu Textile Industry Buying and Marketing Bureau, together with the Gansu Quality Management Bureau (Fibre Inspection Division), the Gansu Price Bureau, the provincial SMC, and the Light Industry and Textile Industry Department of the provincial government all agreed to conduct a series of experiments in two counties in 1990. These counties were Huang Cheng county[2], which is east of the Yellow River and grows mainly coarse wool, and Sandan county, which produces both fine and coarse wools. Testing equipment to measure clean yields (which was estimated to cost only about 2000 yuan per set) was to be located in the county SMC. If these experiments proved successful, the Gansu authorities planned to expand the

[2] This county is not located anywhere near the well-known fine wool study with the same name.

objective measurement of wool at the county-level SMC to 10 counties in 1991 and to all counties producing more than 50 t of wool in 1992.

Although measuring the clean yield before setting the price for a lot of wool is a major step forward, it would be even more useful if the wool were properly graded before the yield was measured. It is interesting that some of the major state sheep studs, such as Gongnaisi in Xinjiang, are already selling their clips directly to processors not only on a clean-scoured basis but also on the basis of the Industrial Wool-Sorting Standard (Appendix B).

Some idea of the differences between the National Wool-Grading Standard currently used by the SMCs and the industrial sorting system used by the textile mills can be obtained from Table 4. This table presents the average results achieved in 1989 by the Topmaking Mill in Huhehote when wool purchased from the SMC on the basis of the National Wool-Grading Standards was re-sorted into industrial types. The degree of heterogeneity in the roughly graded SMC-prepared wool is too great for it to be made into good quality tops. Consequently, domestic wool destined to be made into tops needs to be re-sorted prior to scouring. It is virtually impossible to re-sort the wool appropriately after scouring.[3]

While it would be completely impracticable to expect that wool could be graded according to the Industrial Wool-Sorting Standard at most purchasing stations, the importance of good grading before scouring suggests that wool needs to be graded into industrial types (or at least into grades that are much closer to the requirements of the processors) before the clean yield is measured and before the purchase price is finally determined. This could be done at the township SMC in major wool growing areas and at the county SMC in other areas. That is, the native goods companies that handle wool for the county SMC and above need to become bulk-handling and re-sorting agencies similar to the private firms that undertake this role for wool growers with small clips in Australia.

Wool auctions

This innovation is especially important because its successful implementation will stimulate the development and adoption of other long-overdue reforms to the Chinese wool market. Zhang explores these issues in considerable detail later in this volume.

[3] This point will be emphasised in a later section in connection with the development of county-level scouring plants.

One point not mentioned by Zhang is the important role a 'public' auction can play, where the premiums and discounts that processors are prepared to pay in competitive bidding establish the relative value for the various types of wool. The absence of such a mechanism is a significant gap in the present marketing system. Currently, it is virtually impossible to determine how much more processors can afford to pay for good quality fine wool compared to poorer grades. Consequently, in a given production environment it is impossible to decide on the relative profitability of, for example, fine wool versus improved fine wool.

Until some progress is achieved in establishing realistic premiums and discounts in the wool market, it will be difficult for policymakers and producers alike to decide what type of wool can be grown best, and where. Thus, the useful potential of an auction system for 'discovering' the true value of the various kinds of wool should not be underestimated.

First-stage processing at the producing areas

Many aspects of this innovation are well past the experimental stage. There are now a large number of scouring plants located in wool-producing counties in China. The reasons for this development and the problems associated with these plants have been explored in considerable depth in Brown and Longworth (1992) and will not be discussed in detail here.

Perhaps the most important point to make here is that these local scouring plants have the potential to retard severely the development of the Chinese domestic raw wool industry. Once improperly graded wool has been poorly scoured, it can become virtually useless to most textile mills, certainly to top-making and worsted fabric-making factories. Hence, local scouring plants could have serious deleterious effects on the future of the wool industry in China unless their technical capacities, both to grade the greasy wool appropriately before it is washed, and to operate the scouring process correctly, are up-graded significantly in the near future.

Conclusions

While some feel that the long-term future of the sheep and wool industry in China depends on technical and biological improvements, such as better parasite control, nutrition, and breeds of sheep, the incentives for producers to adopt these new technologies will ultimately depend on the attractiveness

Table 4. Re-sorting of wool from national standard grades to industrial types

Industrial types[a]	Raw wool National Standard Grade								
	Special fine wool	Fine wool		Improved fine wool		Improved semi-fine wool		Semi-fine wool	
		grade I	grade II	grade I	grade II	grade I	grade II	grade I	grade II
	(percentages by weight on a clean-scoured basis)								
70s	8.86	0.22							
66s	67.21	48.22	52.83						
64s	4.35	33.64	12.91	15.74	0.36	3.64	0.34	28.66	51.17
Sort I	5.24	2.42	11.51	37.42	7.06	33.49	4.59	7.39	17.60
Sort II	0.54	0.21	1.09	12.95	10.20	22.69	10.78	1.80	2.96
Sort III	0.18	0.05	0.43	5.77	9.55	10.07	14.60	0.59	0.90
Sort IV(A)	0.35	0.04	0.38	4.13	18.63	7.21	25.29	0.57	1.19
Mixed sort wool not white	0.83	0.03	1.05	3.68	6.62	4.01	5.96	1.63	3.31
Mixed sort with vegetable matter fault	4.55	4.72	4.49	6.12	1.32	6.11	7.04	4.10	4.34
Short wool	4.49	1.45			1.60			3.96	3.96
Edge wool		1.08	5.80	8.96	4.64	6.03	1.32		
Cotted		0.03	0.45	0.33	4.80	0.08	1.07	0.05	0.05
Mite affected		0.01	0.05	0.03	0.08	0.02		0.16	0.18
Stained yellow wool		0.36	0.03		0.02	0.11	0.08	0.19	0.01
Crutching		0.19		0.14			1.29		0.17
B 64s		1.91	5.31						
Sort IV(B)				0.96		0.42	11.53		0.11
Sort V				1.34	32.26	4.24	14.26	0.48	0.56
58s/56s								46.65	10.72
50s/48s								2.31	0.23
Dust	3.40	4.82	3.67	2.42	2.26	1.88	1.85	1.46	2.54
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.0	100.00

[a] See Appendices A and B for explanation of types of wool.
Source: Topmaking Mill, IMAR (personal communication, 29/5/1990).

of the market for the output. Therefore, it is vital that individuals responsible for the development of the sheep and wool industries in China give at least as much attention to marketing issues as to technical problems.

References

An, Xi-Ji. 1989. The development and improvement of agricultural marketing in China. In: Longworth, J.W., ed., China's rural development miracle: With international comparisons. Brisbane, University of Queensland Press, 18–25.

Ash, R.F. 1988. The evolution of agricultural policy. The China Quarterly, December, 529–55

Brown, C.G. and Longworth, J.W. 1992. Reconciling national economic reforms and local investment decisions: Fiscal decentralisation and first-stage wool processing in northern China. Development Policy Review, forthcoming.

Longworth, John W., ed. 1990. The wool industry in China: Some Chinese perspectives. Mount Waverley, Victoria, Inkata Press, 105 p.

Shi, Zhaolin. 1990. Wool-marketing problems in China. In: Longworth, J.W., ed., The wool industry in China: Some Chinese perspectives. Mount Waverley, Victoria, Inkata Press, 105 p.

Sicular, T. 1988. Agricultural planning and pricing in the post-Mao era. The China Quarterly, December, 671–705.

Watson, A., Findlay, C., and Du, Y. 1989. Who won the wool war? A case study of rural product marketing in China. The China Quarterly, June, 213–241.

Appendix A

The National Wool-Grading Standard*

1. Standard for fine wool and improved fine wool

This standard is used in China for purchasing of fine wool and improved fine wool.

A. Technical requirements for fine wool

Grade	Fineness (count)	Length (cm)	Grease and suint (cm)	Quality features	Quality differential ratio
I	60s and above	6.0–7.9	3.0 and over 3.0	All the wool should be natural white and homogeneous fine wool, uniform in fineness and length of wool staple, normal crimpness, soft-feel, with elasticity even at the tip of the wool. Part of the tip of the staple can be dry or have thin wool, but without withered hair and kemp.	114%
II	60s and above	4.0–5.9	less than Grade I	Has the same quality features as Grade I, but the length and grease and suint are less than Grade I; or the length and grease are the same as Grade I but the fineness and uniformity are less than Grade I, with loose and open staple, sub-normal crimpness, and poor elasticity.	107%

(a) When the quality features and grease and suint of the wool are the same as Grade I, and when the fineness is over 60 count and the length is 8 cm or more, such wool can receive a quality differential ratio of 124%. This wool is packed separately. (Note: This wool is classified as 'special fine wool' during purchasing although formally the grading standard does not specify 'special fine wool' as a separate grade.)

(b) Fine wool of yearling sheep (i.e. at their first shearing) may have withered top of staple, cone-shaped wool tip, poor fineness, poor uniformity in staple length. It is allowed to contain foetal hair. The fineness of the wool produced by young rams is not allowed to be coarser than 58 count.

(c) When grading is in accordance with the staple length, at least 60% of the fine wool should meet this requirement.

(d) In areas where shearing is carried out twice per year, the price should be reduced by 50% for wool that has a length of less than 4 cm. The same applies both to autumn wool and to summer wool. In south-west China, the price of the wool mentioned above should be reduced by 40%. However, the actual price should be set and controlled by the provinces or the autonomous regions.

(e) The fine wool from the head, legs and tail need not be graded and should be packed separately. The price is about 40% of the price of the standard grade.

B. Technical requirements for improved fine wool

Grade I: All the wool should be natural white and basically homogeneous wool with obviously improved features. The staple consists mainly of fine down hair (true fine wool) with little coarse down hair and few heterotypical fibres. The fineness, the uniformity of wool length, crimpness, grease and suint, and apparent morphology are inferior to those of fine wool. The staple is open, with the wool tip at the top. It is allowed to contain a trace quantity of withered hair or kemp. The wool that meets the above quality requirement or the actual specimen should account for 70% or more of the fleece wool or loose wool. The quality differential ratio of this grade is 100%.

* Issued by the State Standards Bureau in 1976 and implemented on trial throughout China since that year). Extracted and translated from Wool standard and inspection, vol. 2, published by the Fibre Inspection Bureau of China, 306–347.

Grade II: This consists of white and heterogeneous wool with or without hair plaits. The finer staple consists of down hair, heterotypical wool and small quantities of coarse wool. There is some crisscross wool, and some withered hair and kemp. The coarser staple consists of down hair, heterotypical wool and coarse wool with more withered hair and kemp. From apparent morphology, it appears to possess the special features of improved fine wool but it also still exhibits some of the morphological features of wool from native breeds of sheep. In comparison with wool from native sheep, the proportion of down hair and heterotypical wool has increased, as also have the grease and suint. The wool that meets the above requirements and matches the appropriate specimen should account for more than 50% of the area of the fleece wool or 30% of the weight of the loose wool. The quality differential ratio of this grade is 91%.

C. It is not permissible to shear the improved fine wool sheep in autumn and summer. If such wool is offered for sale to the State, the price is to be set at 60% of the price for Grade II wool or lower. The actual price is set by the provinces or the autonomous regions.

D. The improved black-and-white wool need not be further graded at all. The whole of the improved black-and-white wool is incorporated into one grade, irrespective of the darkness of the colours or the amount. It should be packed separately and priced at 66% of the standard grade price.

E. The price for wool shorn or pulled from raw sheep-skins is set at 60%-80% of the price for the same category and grade of wool shorn from live sheep. This kind of wool must be packed separately.

F. For each grade of fine wool and improved fine wool, the proportion of mixed grade should not exceed 10%. Mixed grade refers to the mixture between this grade and an upper grade or the lower grade. Mixing the grade by skipping a grade up or down is not permitted. If the proportion of mixed grade is found to exceed 10%, regrading is required before purchase.

G. Boxes of wool specimens of the various grades that are made available to assist with the purchasing of wool should be prepared in accordance with the textual standard for fine wool and improved fine wool. Both the textual standard and the certified specimens are equally authentic. The staple in the last row of the actual specimen should be the lower limit. (For fine wool Grade I, the last staple is the lower limit of 60 count.) The actual specimen has both the national basic standard and local imitation standard.

H. Defective wool

(a) Wool that has been branded with pitch (tar) and paint can seriously affect the quality of wool products. It is very important to persuade farmers not to use pitch or paint to mark sheep for identification purposes. Pitch wool and paint wool should be packed separately. The price is only 60% of that for the same grade. If such wool is found in the normal wool, regrading is needed before selling. It is permissible to shear away the wool tip stained by pitch and paint before shearing. Wool with tips free of pitch and paint should be treated as normal wool.

(b) Yellow-stained wool is priced at only 65% of that for the same wool category and the same grade. Yellow-stained wool that has lost substantial wool strength should be priced on the basis of its wool strength.

(c) Double clip wool, seedy and burry wool, cockleburseedy wool, rigidly cotted wool, and the wool sheared or pulled from tanned sheep-skins should be priced according to the actual condition of the wool. It is up to the provinces or the autonomous regions to set the actual price based on the wool quality.

2. Standard for semi-fine wool and improved semi-fine wool

This standard is used for purchasing of semi-fine wool and improved semi-fine wool.

A. Technical requirements for semi-fine wool

Grade	Fineness (count)	Length (cm)	Grease and suint (cm)	Quality features	Quality differential ratio
I	46s to 58s	7.0–9.9	With grease and suint	All the wool should be natural white and homogeneous semi-fine wool with uniform fineness and wool length. Light and large crimpness, good elasticity, nice lustre, plain wool tip or small sharp wool tip and small hair plait with the shape of plied yarn. Thick hair plait for coarse semi-fine wool, but without withered hair or kemp.	114%
II	Ditto	4.0–6.9	Ditto	Ditto	107%

(a) When the quality features, fineness, grease and suint of the wool are the same as for Grade I, and the staple length is 10 cm or more, such wool can receive a quality ratio of 124%. This wool should be packed separately. (Note: This kind of wool is classified as 'special semi-fine wool' during purchasing although formally the grading standard does not specify 'special semi-fine wool' as a separate grade.)

(b) Purebred homogeneous wool that is stronger than 46 count wool should be graded, for the time being, according to this standard. The semi-fine wool shorn from one-year-old sheep (i.e. the first shearing) has a withered, cone-shaped wool tip. There is little uniformity in wool fineness and staple length. Foetal hair is allowed.

(c) When the semi-fine wool is graded in accordance with the staple length, 60% or more of the wool should meet the stipulations.

(d) In areas in which shearing is carried out twice per year, the purchasing price for wool shorn in autumn and summer with a staple length shorter than 4 cm should be reduced by up to 50%. In south-west China, the price of the same wool should be reduced by up to 40%. The actual price should be set and controlled by the local provinces and autonomous regions.

(e) The semi-fine wool shorn from the head, legs and tail should be packed separately. The price is about 40% of the price of the standard grade.

B. Technical requirements for improved semi-fine wool

Grade I: All the wool should be natural white in colour and basically homogeneous wool with obvious improved features. The staple consists mainly of coarse down hair and heterotypical wool. It is a little inferior in the uniformity of wool fineness and staple length, as well as in crimpness, grease and suint, and apparent morphology. It is allowed to contain small quantities of withered hair and kemp. Wool that meets the above requirement should account for 70% or more of the fleece wool or loose wool. The quality differential ratio of this grade is 100%.

Grade II: This consists of white and heterogeneous wool with improved features. The finer staple consists of coarse down hair, heterotypical wool and some coarse wool. There are some hair plaits at the upper part of the staple, and small quantities of withered hair and kemp. The coarser staple consists of coarse down hair, heterotypical wool and coarse wool with large quantities of withered hair and kemp. There are long hair plaits at the top of the staple. However, in comparison with the wool of native breeds, there is more down hair, and more grease and suint at the base of the staple. Wool that meets the above requirements and matches the appropriate specimen should account for more than 30% of the area of the fleeced wool or the weight of the loose wool. The quality differential ratio of this grade is 91%.

C. It is not permissible to shear the improved semi-fine wool sheep in autumn and summer. If such wool is sold, the price is to be set at 60% of Grade II wool or lower. The actual price is set by the provinces or the autonomous regions.

D. The improved black-and-white wool need not be graded at all. The whole of the improved black-and-white wool is classified into one grade, irrespective of the darkness of the colour or the amount of coloured wool. It should be packed separately and priced at 66% of the standard grade price.

E. The price for wool shorn or pulled from raw sheepskins should be set at 60%-80% of the price for the same category and grade of wool from live sheep. This kind of wool must be packed separately.

F. For each grade of semi-fine wool and improved semi-fine wool, the proportion of mixed grade should not exceed 10%. Mixed grade refers to the mixture between this grade and the upper grade or the lower grade. Mixing the grade by skipping a grade up or down is not permitted. If the proportion of mixed grade is found to exceed 10%, regrading is required before any purchase is made.

G. The actual specimen should be prepared in accordance with the textual standard for semi-fine wool and improved semi-fine wool. Both the textual standard and the actual specimen are equally authentic. The staple in the last row of the actual specimen should be the lower limit. The actual specimen has both the national basic standard and the local imitation standard.

H. Defective wool

The same technical requirements as for improved fine wool.

Appendix B

The Industrial Wool Sorting Standard*

1. The industrial sorting of wool can be divided into two categories according to the physical indicators and apparent morphology of the wool:

- *count-wool,* which is homogeneous wool that can be classified into 70, 66, 64 and 60 counts on the basis of fineness
- *sort-wool,* which includes (a) wool that is predominantly homogeneous and (b) heterogeneous wool that can be classified into Sort I, II, III, IV(A), IV(B) and V on the basis of the content of coarse-cavity wool.

2. Physical indicators

Count-wool

Count	Average fineness (μm)	Fineness discreteness (%)	Rate of coarse cavity wool (%)	Proportion of staple length which contains grease and suint	Classification staple length (cm)
70	18.1–20.0	<24	<0.05	>two-thirds	I >8.0
66	20.1–21.5	<25	<0.10	>two-thirds	II >6.0
64	21.6–23.0	<27	<0.20	>one-half	III >5.0
60	23.1–25.0	<29	<0.30	>one-half	IV >4.0

Note: The rate of coarse-cavity wool in count-wool is that guaranteed under the conditions for enterprises, but no withered hair or kemp is allowed in the 70 and 66 counts. Fineness, discreteness and wool grease serve as reference for the enterprises. Staple length is regarded as the classifying criterion. The proportion of wool that is lower than the lower limit of the staple length of this class should not exceed 15%; of that, the proportion that is lower than the lower limit of the staple length of the next lower class should not exceed 5%. Short wool that is less than 4 cm in staple length will be treated by the enterprises themselves. As for the fineness of commercially cleaned wool used as count-wool, the count should be 0.5 μm finer than the stipulations laid down in each count of the standard.

Sort-wool

Sort	Average fineness (μm)	Rate of coarse-cavity wool (%)
I	<24.0	<1.0
II	<25.0	<2.0
III	<26.0	<3.5
IV(A)	<28.0	<5.0
IV(B)	<30.0	<7.0
V	>30.0	>7.0

Note: The average fineness of sort-wool serves as reference only.

3. Requirements for apparent morphology

70 count: The wool consists of fine down hair. The staple structure is neatly closed, and has an even top, good grease and suint, good lustre, obvious and uniform crimpness, and good uniformity of fineness.

66 count: as for 70 count

64 count: The wool consists of fine down hair with trace quantities of coarse down hair. The staple structure is reasonably closed, and has a generally even top, fair grease and suint, fair lustre, obvious crimpness, and fair uniformity of fineness.

* Issued by the Ministry of Textile Industry in 1979 and implemented in Chinese textile plants since that year. Extracted and translated from Wool Standard and Inspection, Vol. 2, published by the Fibre Inspection Bureau of China, 306–347.

60 count: The wool consists of fine down hair with small quantities of coarse down hair. The staple structure is somewhat loose, and has a small wool tip, grease and suint, lustre, large crimpness, and somewhat uniform fineness.

Sort I: The wool is basically homogeneous, and consists of fine down hair with small quantities of coarse down hair or small quantities of heterotypical wool. It also contains trace quantities of coarse wool and cavity wool with large or unobvious crimpness.

Sort II: The wool consists of down hair and heterotypical wool with small quantities of coarse wool and cavity wool, or sometimes with small hair plaits or unobvious crimpness.

Sort III: The wool consists of down hair and heterotypical wool with a little more coarse wool and more cavity wool, and with thin and long hair plaits.

Sort IV(A): The wool consists of down hair and heterotypical wool with more coarse wool and obvious cavity wool, and sometimes thick and long hair plaits.

Sort IV(B): The wool consists of down hair and heterotypical wool with much more coarse wool and very obvious cavity wool, and sometimes thick and long hair plaits.

Sort V: Wool that falls below the quality requirements of Sort IV(B) but that does not belong to the defective wool category is put into this grade.

Wool that does not possess the obvious characteristics of improved wool in apparent morphology will be treated as the wool produced by native sheep.

4. Wool sorted by the industrial wool sorting standard is not allowed to contain pitch, paint, flax fibre, chemical fibre, cotton or other foreign substances. This requirement should be established as an in-plant examination regulation.

   All the defective wool such as yellow-stained wool, cotted wool, dirty-clot wool, skin-piece wool, seedy and burry wool, scabby wool, pitch wool, paint wool, etc, should be removed from the fleece for separate treatment.

5. Coloured wool should be sorted in accordance with the stipulations laid down in the standard.

6. Actual specimens should be prepared in accordance with the textual standard. Both the textual standard and the actual specimen are equally authentic. The actual specimen standard has both the national basic standard (the original) and local imitation standard (the duplicate). The local imitation standard is used for the raw wool sorting on the basis of quality count and grade. The staple in the last row of the actual specimen should be the lower limit for each count or each grade.

The Outlook for Chinese Wool Production and Marketing: Some Policy Proposals

Lin Xiangjin*

In the second half of 1988, a raw wool surplus accumulated in China. Although the wool textile industry had the capacity to process much more raw wool than was being produced, consumer demand for products made from domestic wool declined sharply.

In 1988, the Supply and Marketing Cooperative (SMC) purchased 146 000 t (greasy wool), which was 66% of the 222 000 t (greasy wool) produced that year. However, it could only sell 130 000 t to textile mills, which left 68 000 t stockpiled at the end of the year (Table 1). In 1989, even though the SMC purchased only 48% or 114 000 t of the 237 000 t of raw wool produced, by the end of the year its stockpile had increased to 118 000 t because it sold only 56% (64 000 t) of the wool it had purchased. Raw wool production increased again in 1990 to 239 000 t and the SMC purchased 138 000 t (58%). However, it sold only 113 000 t and the stockpile climbed further to 143 000 t at year end.

At the end of 1990, the capital value of the stockpile exceeded one billion yuan and the annual interest cost alone was almost 100 million yuan. The financial burden on the SMC was great. Consequently, farmers found it difficult to sell their wool to the SMC (and in most provinces wool purchasing by other units and individuals was prohibited). Farm incomes fell and the expansion and improvement of China's sheep flock was severely checked. In some regions farmers found it financially unattractive to undertake even basic management practices. They could afford to buy neither medicines for their sheep nor hay to feed them through the winter and had to sell large numbers to be slaughtered for meat before winter.

Thus, since 1988, the oversupply of domestic wool relative to demand has imposed heavy social costs on the state and retarded the development of the sheep and wool industry. For this reason, future policies must be developed to ensure that the sheep and wool industry can continue to develop and, thereby, strengthen the national economy.

* Institute of Rural Development, Chinese Academy of Social Science, Beijing

Factors Contributing to Oversupply

High cost

The mixed average purchasing price in 1988 of 10.8 yuan/kg (greasy wool) was the highest average purchase price ever recorded, and more than twice the 1985 price (Table 1). The SMC charges a fixed percentage marketing margin of 27% (which includes a 10% wool tax), so that the mixed average price paid by the textile mills was 13.7 yuan/kg. In addition to the record price that the mills were forced to pay for the greasy wool in 1988, scouring yields had been declining during the 1980s. Thus, prices per kilogram of clean wool increased even faster than the greasy wool prices. Textile mills considered raw wool to have become unbearably expensive in 1988.

For example, one metre of worsted fabric requires 0.4297 kg of net top, and one metre of woollen fabric requires 0.7863 kg of net yarn. Roughly therefore, on average, one metre of wool-based fabric requires 0.608 kg of tops/yarn, which (with a 75% conversion rate) requires 0.8107 kg of clean scoured wool. If the scouring yield is 34%, then 2.3844 kg of raw wool is required to make the average metre of fabric. In 1988 the average cost of this raw material would have been 32.67 yuan. It is estimated that processing costs were about 4 yuan/m and the mill also paid an 18% tax on wool-based fabric. Thus the 'cost of production' per metre would have been about 43.27 yuan. The average wholesale price received for wool fabrics in 1988 was 36.41 yuan/m. Therefore, the mills were losing 6.86 yuan/m of cloth produced. Even if the cost of processing in the mills had been zero instead of 4 yuan/m, the mills would still have operated at a loss of 2.86 yuan/m.

Woollen yarn for hand knitting is a popular product in China. It takes about 144.13 kg of clean wool or 423.92 kg of raw wool to make 100 kg of hand knitting yarn. In 1988, if the mills paid 13.7 yuan/kg on average for raw wool, the cost of the raw material to make 100 kg of knitting yarn was 5807 yuan. The tax on knitting yarn is 18%. Therefore, even if the cost of processing was excluded, the overall cost of the yarn

Table 1. Raw wool production, mixed average prices, Supple and Marketing Cooperative (SMC) purchases and sales, and end-of-year stocks, 1983 to 1990 (all figures for greasy wool)

Year	Raw wool production	Mixed average price paid by SMC for raw wool	SMC		
			Purchases from farmers[a]	Sales to textile industry	End-of-year stocks
	('000 t)	(yuan/kg)	('000 t)		
1983					
1984					
1985	178	5.0			
1986	185	6.0			
1987	201	6.3			
1988	222	10.8	146 (66%)	130	68
1989	237	9.1	114 (48%)	64	118
1990	239		138 (58%)	113	143

[a] Percentages in brackets indicate the proportion of raw wool production purchased by the SMC.
Source: China textile industry statistics yearbook. Statistics yearbook, China.

to the mills would have been 6852 yuan/100 kg. The average wholesale price of woollen yarn for hand knitting in 1988 was 4805 yuan/100 kg. The factories were losing 2047 yuan/100 kg of yarn produced plus the cost of processing.

While the above calculations are based on mixed average prices, average levels of efficiency, and other simplifying assumptions, they demonstrate the magnitude of the problem. Of course, in an attempt to reduce their losses many textile mills sold their products at much higher prices than the official wholesale state price, and consequently retail prices were also pushed up and consumers reacted by cutting back their purchases of wool-based goods.

In 1989, the government reduced the purchase prices for raw wool and raised the wholesale prices for wool-based fabric. The mixed average price paid to farmers for raw wool in 1989 was 9.1 yuan/kg. Textile mills paid 11.6 yuan/kg on average for this greasy wool. The state wholesale price for worsted goods reached 40.70 yuan/m, and 5683 yuan/100 kg for woollen yarn. On the basis of these prices, the mills could operate profitably, but retail prices were pushed even higher and consumer resistance increased so that less volume of wool-based goods was sold. As a result, the mills purchased only about half as much raw wool from the SMC in 1989 as they did in 1988 (Table 1).

The high prices textile mills were forced to pay for raw wool ultimately reduced consumer demand and helped create the domestic raw wool surplus. The two reasons why the wool textile mills faced such high prices for their raw material are outlined below.

'Irrational' pricing system. At present, since wool is a category II agricultural product, the raw wool purchasing policies implemented by local governments reflect the mandatory planning policies of the central government. Under these policies, the state has appointed the SMC as the exclusive buying agency, and other units or agencies are prohibited from buying wool. Additionally, the SMC is required to purchase the planned quantity of wool at the planned purchase price. Planned prices are mandatory, subjective, and fixed. The free market price is decided by the interaction of supply and demand. When governments fix prices, the price may be higher or lower than the underlying market or equilibrium price. If the planned or fixed price is below the equilibrium price, then shortages will develop. This was the situation during the 'wool war' period (1985 to 1987). But, in 1988, 1989, and 1990, the planned price was above the equilibrium price and surpluses resulted.

Excessive marketing margin between farmers and the mills. The 27% mark up that the SMC is permitted to add to the planned purchase price includes a 10% tax. Among the four natural fibres (cotton, silk, wool, and fibre crops), only wool is taxed in this way. Furthermore, meat products (pork, beef, and mutton) are only taxed at 3%. Under the tax regulations passed by the state council in 1984, when a farmer delivers or sells an agricultural, animal, or fish

product subject to a product tax, it is the responsibility of the unit taking delivery or purchasing the product to pay the product tax. For wool, the SMC is responsible for paying the product tax of 10%. Thus, when the planned purchase price paid by the SMC is increased sharply, as between 1985 and 1988, the *total* tax paid per unit of wool also increases sharply, even though the tax *rate* remains constant at 10%.

In addition to the product tax, the SMC applies a fixed 17% mark up to cover the costs of marketing, irrespective of the total purchase price or the real costs of marketing. According to the regulations, the township (sumu) SMC purchases the wool and then ships it to the county SMC, which 'sends' it to the prefectural SMC. In reality, prefectural SMCs do not often handle or see the wool because the county SMC ships it directly to the mills. Nonetheless, the prefectural SMC has the right to sell the wool to the textile mills. Although the precise breakdown varies between provinces, in general the township SMC gets 9%, the county SMC gets 4%, and the prefectural SMC gets 4% of the 17% mark up.

The wool product tax is a primary source of revenue for local governments in the pastoral region. In many counties, the product tax on wool goes to pay the wages of county officials (cadres), workers, and teachers. Since the fiscal reforms in 1980, which introduced greater self-financing, local governments have become hard pressed to balance their budgets. Therefore, modifying wool tax regulations would be a significant change; one which could affect the living standards of local government employees and/or the rate of local government-financed development of regional infrastructure.

The other component of the marketing margin is critically important to the SMC. In recent years in the pastoral region, the SMC has both increased its staff and supported a growing number of retired staff. At the same time, the SMC has faced increases in interest charges and costs of other marketing inputs. Consequently, the SMC organisation is arguing for an increase in the percentage mark up on wool. In fact, senior staff at the provincial level of the SMC in the Inner Mongolian Autonomous Region (IMAR) claim the mark up should be doubled at least to 35% or even 38% of the purchase price paid to farmers.

Two powerful groups—the representatives of local government and the SMC—argue that the present system has great social benefit and seek to maintain or even increase the margin between the farmer price and the price mills must pay. Farmers can sell their wool, the tax is collected by the state, and the wages of cadres and workers are paid. Therefore, it will not be easy to reduce the current marketing margin. Nevertheless, the stockpiling of unsold wool in the hands of the SMC during the period 1988–90 greatly reduced the attractiveness of the present arrangements.

Declining 'market share'

In response to the high cost of wool in 1988 and 1989, many textile mills have modified their production. They are using much more chemical fibre and less wool. This has occurred in two ways. Wool/synthetic blends have become much richer in synthetics, and many wool textile spindles are now making pure synthetic fabrics and yarns.

In 1985, a total of 224 000 t of fibre materials were used in the production of wool-based products (Table 2). Of this material, 78% (or 175 000 t) was wool. In 1990, the total amount of fibre material used in the production of wool-based products had fallen to 200 000 t of which wool only represented 58%. The substitution of synthetics for wool in blended products has been increasing since 1988 (Table 2). Most of the substitution has been in acrylic fibres, although the use of polyester fibres in combination with wool increased suddenly in 1990 (Table 3).

In 1988 and 1989, the total consumption of chemical fibres by the wool textile industry was 200 000 t and 211 000 t respectively. This is almost three times the amount of chemical fibres blended with wool in these years (Table 2). Thus, almost two-thirds of the productive capacity of the wool-making mills was used to process chemical fibres into purely synthetic fabrics in 1988 and 1989.

Table 2. Raw materials used to make wool-based products, 1985–90

Year	Total	Domestic and imported wool[a]		Chemical fibre	
		Quantity	Share of total	Quantity	Share of total
	('000 t)	('000 t)	(%)	('000 t)	(%)
1985	224	175	78.1	49	21.9
1986	228	163	71.9	64	28.1
1987	252	188	74.6	64	25.4
1988	244	186	76.2	58	23.8
1989	215	146	67.9	69	32.1
1990	200	115	58.0	85	42.0

[a] Domestic wool is clean wool. Imported wool is raw (greasy) wool and wool top.

Source: China textile industry statistics yearbook.

Table 3. Amounts ('000 t) of different chemical fibres blended with wool, 1985–90

Year	Total	Polyester	Acrylic	Polyamide
1985	49	5	39	5
1986	64	6	51	5
1987	64	7	50	6
1988	58	7	45	5
1989	69	7	55	5
1990	85	13	65	5

Source: China textile industry statistics yearbook.

Although the number of spindles in the wool textile industry almost doubled between 1985 and 1990, from 1.3 million to 2.7 million, wool consumption by the wool textile industry declined from 175 000 t in 1985 to 115 000 t in 1990 (Table 2). This move away from wool has serious implications for wool producers.

At the request of the central government, provincial governments in Xinjiang, Qinghai, Gansu, and Inner Mongolia must adopt a policy of producing, processing, and marketing their own wool. However, the technical efficiency and skill of the processing sectors in these four provinces are lower than in the eastern and coastal provinces. Hence these four provinces produce poor quality fabrics that have been hard to sell on the depressed domestic market. Mills in the four provinces have accumulated fabric and yarn stockpiles and have been reluctant to purchase more raw wool, which also helps to maintain the large SMC stockpiles. At the same time, the wool textile factories in these four provinces have rapidly increased the use of chemical fibres, which cost less, thus enabling factories to sell their output more cheaply and make a profit.

Even though the four western provinces have been allowed to sell their wool outside their own provincial borders, relatively little of it has been sold to mills in eastern and coastal provinces.

Declining quality

There is strong evidence that the quality of wool produced in China declined during the 1980s. This is indicated most strongly by the decline in the falling scouring yield or net wool rate. For example, in the IMAR in the early 1980s, the average clean-scoured yield was about 36%. However, by 1990 this was down to 33%. During the chaotic 'wool war' period (1985 to 1987), many people (not only farmers but also others involved in the marketing chain) adulterated wool with sand and impurities. In some places the net wool rate dropped to 20%.

The primary reason for the falling net wool rate is that the township SMC buys wool on the basis of greasy wool weight. Only impurities that can be shaken out by hand are discarded. Clearly, farmers have an incentive *not* to reduce the contamination of their wool in dusty yards, dirty winter sheds, and so forth. A secondary and related reason for the falling net wool rate is that farmers usually receive no premium for better quality wool. Therefore, higher prices during the second half of the 1980s encouraged farmers to increase the greasy weight of their fleeces without any regard to quality. Since sheep with longer, thicker, greasier wool cut heavier fleeces, farmers were effectively discouraged from breeding sheep that produced finer, better quality wool. The fleeces from these sheep are usually lighter when greasy and are worth less when sold on a greasy weight basis.

The textile mills have observed a more subtle but critical deterioration in the quality of domestic wool. For example, officials from the No. 3 Wool Textile Factory in Lanzhou, the capital of Gansu, claim that whereas 42% of the wool top bought in 1986 had to be downgraded because the average length of the fibres in the top did not meet standard specifications, 85% was downgraded in 1989. The reasons for the decline in the quality of the top are complex and related both to the declining nutritional intake of the sheep, especially during the dry 1988–89 production season, and to damage done to the wool during scouring in the new but low-grade county scouring plants. These quality problems are widely recognised by the wool textile industry and are a major factor in the declining use of domestic wool.

Availability of imported wool

The wool textile industry regards domestic wool as expensive and of doubtful quality. Furthermore, the central government policy to encourage the four western provinces (Xinjiang, Qinghai, Gansu and IMAR) to produce, process, and market their own wool effectively restricts the access of eastern and coastal mills to domestic stocks of fine wool. Consequently, these large eastern mills have become increasingly dependent on imported wool. The mills in the four western provinces have also increased consumption of imported wool to produce the higher grade fabrics that can compete on the export market and that are preferred by Chinese consumers.

How does imported wool affect the consumption of domestic wool? In 1990 the percentage of domestic wool consumed (that is, the national self-sufficiency rate) increased sharply over the previous four years. In total volume, there was only a modest increase of 9000 t of domestic wool consumed even though imports dropped by 40 000 t. Clearly, in 1990 the wool textile industry chose to use more chemical fibres rather than to substitute domestic wool for imported wool, and consequently wool lost market share to other textile fibres. In 1989, as demand for wool-based fabrics was weakening (and becoming more sensitive to quality), consumption of domestic and imported wool dropped proportionately (Table 4).

One viewpoint in China is that the availability of imported wool has been the major factor causing the current domestic wool surplus problem. However, the data in Table 4 do not seem to support this hypothesis. The large reductions in the amount of imported wool in 1989 and again in 1990 did not solve the domestic surplus problem. Domestic wool needs to become more competitive. It is the total amount of domestic wool consumed by the textile industry that is important—not the national self-sufficiency rate. In fact, it may be advantageous for national wool self-sufficiency to decrease, if at the same time wool increases its share of the textile market in China. This is what happened in the mid-1980s. A strong consumer preference for wool is only possible if quality wool-based goods are readily available.

Therefore, the competitiveness of domestic wool needs to be improved by making better quality available at lower cost to the mills. Unless this can be achieved, the demand for domestic wool will not rise simply because wool imports are reduced. If the mills are 'starved' of imported wool they will switch to chemical fibres, not expensive, low-grade domestic wool.

Table 4. Consumption of wool from various sources by the Chinese wool textile industry, 1985–90

Year	Total consumption	Domestic wool[a]		Imported wool[b]	
		Quantity	Share of total	Quantity	Share of total
	('000 t)	('000 t)	(%)	('000 t)	(%)
1985	175	75	42.9	100	57.1
1986	163	50	30.7	113	69.3
1987	188	67	35.6	121	64.4
1988	186	60	32.2	126	67.8
1989	146	47	32.2	99	67.8
1990	115	56	48.7	59	51.9

[a] Clean basis

[b] Includes raw wool and wool top

Source: China textile industry statistics yearbook.

Collapse of final consumer demand

The wool surplus problem after 1988 was not unique. Most consumer durables, such as fans, radios, household furniture, clothing in general, and other items, have been in surplus since late 1988.

The economy grew very rapidly in the 1980s up to mid-1988. This rapid economic growth led to a 30% per annum inflation rate. In September 1988 the central government introduced a range of macro-economic measures aimed at cooling down the overheated economy. As a result, some data suggest that in 1989 average real incomes in China actually fell by over 6%. This sudden economic downturn had a big impact on consumer spending.

For example, the real value of total retail sales of food commodities fell by over 6% in 1989 relative to 1988, and the real value of apparel sales fell by 12%. It is not surprising, then, that demand for wool-based goods also fell in 1989. In fact, since wool-based clothing is expensive relative to other apparel, one might expect the sales of wool-based apparel to fall much more than clothing in general.

In 1985, the total volume of retail sales of wool-based fabrics was 331 million metres. In 1990, the corresponding figure was 270 million metres or 18% below the 1985 level. Demand for wool yarn for hand knitting declined even more sharply, falling 20% between 1988 and 1990.

The sudden and significant downturn in consumer demand for wool-based goods was only one of the factors precipitating the domestic wool stockpile problem. Improved economic conditions in China began to strengthen consumer spending by 1991, raising consumer demand for wool-based goods once again. However, consumers are becoming more quality conscious. It will be extremely difficult for poor quality, expensive domestic wool to compete with chemical fibres in the cheaper end of the apparel market. Yet, longer-term prospects are extremely favourable for competitively priced, good quality wool in the high quality segments of the apparel market in China. To assure the economic future of the Chinese wool industry, industry leaders must recognise the imperatives to improve the quality of domestic wool.

Making Domestic Wool More Competitive

Domestic raw wool has the twin defects of low quality and high price. In theory, it has two potential competitors, imported wool and chemical fibres. In reality, chemical fibres are the major competitor. It is possible for imported wool and domestic wool to be complementary rather than competitive. Three steps must be taken to improve the position of the domestic wool industry.

Reduce production costs

Fundamentally, the cost of wool production determines the sale price. To reduce the production cost, traditional techniques of producing wool must be improved.

Wool production can be increased in response to higher prices, although there is a limit to how high prices can go. Eventually it is necessary to change the production methods and use new inputs to reduce production costs and improve the returns to farmers. At present, Chinese wool producers operate on a very small scale, using traditional techniques and raising a low percentage of improved breeds. The production rate of flocks is low, and the return on money spent on feed and other inputs is low because production costs are high. The competitiveness of the domestic wool industry cannot be easily improved by reducing production costs because it will be difficult to improve quickly the backward production techniques.

Reduce the marketing margin

The product tax on wool and the excessive charges levied by the SMC place significant constraints on the competitiveness of domestic wool.

In recent years the policy of raising the purchase price of wool to make wool production more profitable for farmers has encouraged farmers to grow more wool. However, the higher purchase price together with the fixed tax rate and constant percentage mark up levied by the SMC have made domestic wool too expensive for the wool textile industry. Increased production in response to the higher purchase price and falling sales to the mills have combined to create a large wool surplus problem.

Unless existing wool-marketing policies and controls are changed to enable the marketing margin to be reduced, the wool industry will find it difficult to develop and become more competitive.

Improve the quality of raw wool

The quality of Chinese raw wool must be raised to approach the Australian level. Without such improvements, it will be impossible to produce quality fabric to meet consumer demand. Competition for a share of the textile market is keen, and only quality fibres available at competitive prices will retain or increase their market share. The importance of improving sheep breeds, reforming sheep-farm management, and improving the health and nutrition of the flock must be stressed. These changes all reduce the costs of growing wool and improve the quality.

Some Policy Proposals

Revoke the product tax on wool

The 10% product tax on raw wool has made domestic wool too costly for the textile industry, and reduced its consumption of raw wool and production of wool-based fabrics and yarns. Fabrics and yarns attract an 18% product tax. Revoking the 10% tax on raw wool will not only help the textile industry overcome the present difficulties but also increase the amount of tax paid on wool-based fabrics and yarns since more of these products will be produced. Overall tax revenues could actually increase.

Currently, the raw wool product tax provides significant revenue for many county governments. Indeed, this is why many county governments did not permit 'private' marketing channels to develop in competition with the SMC during the 'wool war' period (1985–87). Local governments can easily collect the tax from the SMC, but it would be administratively more difficult to enforce the tax if other units/agencies/individuals were allowed to purchase and sell wool. Furthermore, county governments collect the tax from the SMC whether or not it sells the wool to the mills. That is, the county governments are only interested in having the SMC purchase the wool (at the highest possible price). To purchase the wool and to pay the tax to the county governments, the SMC must borrow money from the state through the agricultural bank. If the SMC cannot repay these loans nor even the interest, the state is effectively forced to subsidise the SMC. The real 'loser' under these arrangements is, therefore, the state. The 'winners' are those farmers who can sell to the SMC at the high purchase price and the county governments that collect the 10% product tax calculated on the high purchase price.

Under these circumstances, the product tax on wool creates a number of undesirable effects. Not

only does it discourage textile mills from buying domestic wool but it also greatly inhibits the development of alternative (non-SMC) marketing channels. In addition, it increases the extent of state subsidy to the SMC, which in turn subsidises the county governments.

The wool marketing system would operate more efficiently if the product tax on wool was revoked and the state directly compensated the relevant county governments. Such a change would also facilitate the development of a more efficient and competitive marketing system for wool because local governments would no longer be opposed to freeing up the market. Without the product tax—and with a low-cost marketing system—the marketing margin on raw wool could be substantially reduced. Wool would be much cheaper for the mills without lowering the price to the farmer.

Create a free market for wool

The creation of a free market for wool would involve not only revoking the product tax on wool but also reclassifying wool as a category III product.

Pig meat was reclassified in 1985 as a category III product and is now marketed under free market conditions. Before this, the Food Company of the Department of Commerce had a monopoly over the marketing of pork. The Food Company was extremely dependent on a fixed percentage mark up and repeatedly wanted to increase it to cover rising salaries and other costs. Now, many units, agencies, and pork marketers compete with the Food Company, and these changes have forced it to become much more efficient. Despite this radical change in the way of doing business, Food Company staff have not seen their incomes reduced. In fact, Food Company staff are now encouraging further reforms. The SMC, especially SMC branches in the pastoral region, should follow the example of the Food Company and adopt an independent management approach that takes full responsibility for profits and losses. It should cease being dependent on the state.

Some Chinese agricultural economists believe that if the wool market were liberalised, this may lead to another chaotic 'wool war' similar to the one that occured between 1985 and 1987 when the central government temporarily permitted free trading in wool. In fact, the chaos of the 'wool war' was created by an irrational set of conditions. The wool tax was still in place and many local governments tried (with varying degrees of force and levels of success) to prevent private traders from buying wool within their jurisdictions. In many areas, the SMC also became desperate to retain access to its 17% mark up on wool and began paying increasingly high prices to farmers irrespective of wool quality, adulteration, and other shortcomings. Indeed, when the SMC found it difficult to sell the high priced, poor quality wool, the stockpile crisis ensued.

One of the major advantages of allowing a free market to develop would be to permit mills to buy directly from producers. This would reduce marketing costs and improve communications between mills and producers, enabling farmers to know more about the type of wool required by the factories. Moreover, textile mills might then invest in wool production to improve their sources of supply.

Even at present, some mills are permitted to deal directly with certain state farms. For example, the Gongnaisi sheep farm in Xinjiang has sold its wool directly to the First Wool Textile Factory in Shanxi province since 1979. Gongnaisi wool is graded according to the requirements of the factory, and the price is negotiated on a clean-scoured basis. The returns to the farm have increased because marketing costs are low and the factory has been able to purchase good quality wool. For example, in 1986 the farm produced and sold 105 t of raw wool to the factory. The scouring yield of this wool was 60.5%, which is extraordinarily high for the Chinese wool industry.

With the establishment of a free market for wool, it should be possible to develop an agent marketing system and wool auctions to supplement the direct sales between the larger producing units and the factories. In principle, it should be possible to develop a marketing system similar to the Australian model, although clearly there would need to be major differences in detail.

Encourage the development of price premiums for quality

To raise the quality of domestic wool, farmers must be paid higher prices for higher quality wool. The grading system must be improved to encourage the development of premiums and discounts for good and bad wool. The state must also encourage the objective measurement of wool characteristics important to textile manufacturers.

Enlarge the scale of wool-growing farms

In the future, farmers are likely to receive lower prices for their wool than in the late 1980s. Under

these circumstances, profits will only go up by reducing costs. One might expect to see the emergence of three types of wool-producing households: better-off farmers, marginal units, and households with insufficient income to pay for the necessary expenditures.

The type I farmers will have larger flocks and use advanced production techniques as well as generally having higher levels of management. These farms will have lower production costs (in part because of economies of scale) and will operate profitably even with lower wool prices.

Type II and III wool farms will be smaller-scale producers employing traditional techniques and management. The productivity of these flocks will be lower, and their production costs higher than for type I farms. Policymakers should support type I production units, providing funds and technical and management advice to improve further their productivity and the quality of their wool. At the same time, the authorities should help type II and III farmers, especially the type III, to leave wool production and engage in other enterprises.

Relocation of wool production

At present more than half the sheep in China are located in the pastoral region, and the sheep population there is still increasing despite already being above the carrying capacity of the land. As a result, pastureland is being seriously degraded and wool quality reduced. Too much emphasis has been placed on increasing sheep numbers in the pastoral region without regard to the ecological balance between the grazing animals and the natural pastureland. In many places the number of sheep need to be reduced, if wool quality is to be improved and grazing systems sustained in the long term.

China should adopt the policy of progressively shifting the focal point of wool production from the purely pastoral areas to the mixed agricultural/pastoral areas and to the agricultural areas. In Australia, the wheat–sheep zone, which comprises those areas where sheep are commonly associated with cropping (mainly cereals), accounts for some 45% of the sheep flock. The high rainfall zone covers the sub-coastal and tableland areas of the mainland States and all of Tasmania and accounts for about one-third of the Australian sheep flock. In this zone, wool growing is often associated with other enterprises, such as beef cattle and cropping. In the pastoral zone, which accounts for only 22% of Australia's sheep flock (Department of Primary Industries and Energy 1988), sheep are grazed extensively on natural pasture at low stocking rates. The quality of the Australian wool is high because the sheep are grazed on good pasture.

Development of Chinese Wool Auctions

Zhang Cungen*

THE nascent Chinese wool auction system, which is one part of a much larger effort to reform the raw wool marketing system, has shown great vitality, even though the annual volume of auctioned wool remains small. Understanding the wool-auctioning system can help point the way to further reforms of the raw wool marketing system and hasten the growth of the Chinese wool industry.

Wool auctioning, or the free auction system, is currently the most widely used method in the world for the sale and purchase of wool clips. Growers offer wool for sale through an agent (the broker) at public auction to the highest bidder. The Australian, New Zealand, South African, and United Kingdom clips are disposed of in this way. Between them, these clips make up almost half the world's wool production and account for nearly three-quarters of the wool entering world trade.

Regular auction sales of wool were being held in Australia by the mid-19th century. In the Australian system before the 1970s, brokers marshalled together bales of wool on the show floor. Buyers examined the wool in the bales to assess all characteristics important in processing. In the late 1960s, the objective measurement of certain wool characteristics became feasible and was introduced into the wool-marketing system. This led to the current wool auction concept known as 'sale by sample and certificate.' At present the public wool auction remains the preferred method of selling wool in Australia, and about 80% of the Australian wool clip is sold in this way.

The Chinese wool market is less developed than those of Australia and other major wool-producing countries. For some time in China, raw wool has been a category II commodity, making it part of the planned quota system for marketing agricultural goods and materials, and the wool market has been monopolised by the state. The state has always entrusted the Supply and Marketing Cooperatives (SMC) at the township level to purchase all the raw wool from farmers and herdsmen. Township SMCs then packed the raw wool into soft bales and sent it to the county SMCs where it was classed, repacked into hard bales, and sent to the state processing enterprises designated by the state distribution plan. The provincial SMC took the responsibility for coordinating the purchase and distribution plan for wool within the whole province and for liaising with other wool producing provinces. Some prefectural SMCs possessed warehouses and acted as raw wool transfer stations, but most did not. Nevertheless, all prefectural SMCs collect their share of the management expenses (or linkage fees) paid to the SMC for marketing wool. SMCs have always adopted both the national standards for purchase and sale of raw wool issued by the State Standards Bureau in 1976, and the system of pricing on a greasy wool basis.

Since the 1980s, as part of the general reform of the rural economic system, some changes have been made to the purchase and sale system for agricultural products. In 1985 the state cancelled the compulsory wool quotas for the wool-producing provinces and asked them to implement an open trade in domestic wool, according to the principles of 'self-produce, self-sell, and self-use.' Hence, in principle, the SMC changed from the single purchasing agency into a competitive wool-buying operation. But in practice, few changes were made to the wool-marketing system. To protect their local wool-processing enterprises and obtain more profits and taxes, most of the major wool-producing provinces did not really introduce an open trade in domestic wool during the latter part of the 1980s. However, Xinjiang and Inner Mongolia both declared the wool markets to be 'open' in 1992.

To develop Chinese sheep husbandry, improve wool quality and raise the level of domestic wool self-sufficiency, the Ministry of Agriculture and the Ministry of Textile Industry have continuously established numerous wool production bases in the major wool-producing regions to expand good breeds of sheep, to spread advanced and appropriate techniques of sheep feeding, and to reform the wool-marketing system. These reforms include extending direct trade between growers and processors, introducing a system of pricing wool on a clean wool basis, and experimenting with wool auctioning.

* Institute of Agricultural Economics, Chinese Academy of Agricultural Science, Beijing.

Table 1. Details of all wool auctions held in China before 1992.

Year	Location of auction	Amount of wool involved				Average price paid at auction
		Greasy wool basis		Clean wool basis		
		offered (t)	sold (t)	offered (t)	sold (t)	(yuan/kg clean fine wool)
1987	Urumqi	78.2	78.2	46.3	46.3	34.5
1988	Urumqi	677.0	677.0			n/a
	Huhehote	326.5	326.5			63.1[a]
	Jilin	104.6	104.6			n/a
	Nanjing	385.7	385.7			n/a
	Sub-total	1494.0	1494.0			> 60
1989	Beijing	3124.6	1516.0	1927.8	938.6	39.37 (36.4–43.9)
1990	Urumqi	916.5	511.3	487.2	270.6	31.1
	Huhehote	781.6	437.6	337.9	189.2	31.3
	Sub-total	1698.1	948.9	825.1	459.8	31.2
1991	Qiqihaer	990.0	940.0	416.0	399.0	(22.1–32.0)
	Xi'an	993.0	597.0	491.0	295.0	(n.a.[b]–32.8)
	Huhehote	773.0	591.0	332.0	252.0	(22.9–33.5)
	Sub-total	2756.0	2128.0	1241.0	946.0	ca. 30

[a] This price was paid for 264.1 t greasy wool (equivalent to 146.3 t clean wool), which came from Xinjiang. The overall average prices received at the 1988 sales are not available.

[b] n.a. = not available.

Experimentation with Wool Auctions

By 1991, China had experimented with wool auctions for only five years during which time eleven wool auctions had been held (Table 1).

The first wool auction was in 1987 at Urumqi City, the capital of the Xinjiang Uygur autonomous region. Although this was a small pilot auction offering nearly 80 t of greasy wool, it evoked a strong repercussion throughout the country. Three state farms offered wool for sale, with more than 30 wool-processing enterprises from at least 10 provinces and municipalities buying. Both sides expressed satisfaction with the auction, and all of the wool was sold.

Four wool auctions were held in 1988, the first in Urumqi, and then sequentially, in Huhehote, Jilin, and Nanjing. Nearly 1500 t of greasy wool was auctioned, about 20 times the amount auctioned the previous year. The wool market in 1988 was the most active in recent years. Buyers rushed to purchase the auctioned wool, and growers obtained the best prices ever paid for wool in China.

In September 1989, the Ministry of Agriculture and the Ministry of Textile Industry jointly organised the First National Exhibition of Sheep and Goat Breeds, Wool and Cashmere and Their Products, and put on a large-scale wool auction in Beijing. The auction offered more than 3124 t of greasy wool (nearly 1928 t on a clean wool basis) from over 20 state farms or enterprises, such as the Animal Husbandry, Industry, and Commerce Company, and from 11 provinces and autonomous regions. Of this offering, 1516 t of raw wool (938 t on a clean wool basis) was purchased by 26 wool-processing enterprises from 17 provinces and municipalities. Most of the remainder was considered irregular due to incomplete skirting and other factors, but it was nevertheless sold during the exhibition by negotiation between sellers and buyers. Under conditions of national tight money, a weak wool market, and growing stocks of raw wool and wool products, the Beijing auction paid only about two-thirds of the prices paid the previous year. Nonetheless, this wool auction was generally considered to have been very successful.

Two wool auctions were held in Urumqi and Huhehote in 1990. The total amount of raw wool offered for auction was more than 1698 t (equivalent to 825 t clean), of which nearly 949 t of raw wool was sold at auction (trade clearance rate was 55.9%). The rest was sold according to the reserve prices through the direct trade between growers and processors. The prices paid at auction represented a 20% decrease compared with 1989.

In August–September 1991, wool auctions were held in Qiqihaer (within Heilongjiang province), Xi'an (capital of Shaanxi province; raw wool from Xinjiang), and Huhehote. The total raw wool offered was 2756 t (1241 t of clean wool), of which 2128 t (or 946 t of clean wool) was sold at auction. The trade clearance rate reached 77.2%, a substantial increase over 1990. The prices paid at the auction were generally about equal to 1990.

The Auction System: a Needed Reform

The wool market in China has not yet matured sufficiently to implement country-wide, public wool auctions. In the past five years, the successful, small-scale implementation of the auction system within numerous wool production bases has been a significant breakthrough in reforming the raw wool marketing system. Such changes are in keeping with the overall direction of current economic reforms in China, and they can protect the interests of wool growers and processors alike. The wool auction system has enjoyed growing public interest and attention from economists for a number of reasons.

First, the wool auction system encourages better clip classing and preparation; it focuses attention on pricing on a clean wool basis and allows for the introduction of objective measurement of wool quality. This can help reform some long-standing problems in the wool marketing system, such as forcing wool grades and prices up or down, adulterating wool with foreign matter, and being unable to match good quality wool with good price and good use. Therefore, experimentation with the wool auction system has become an important measure for promoting the development of wool production bases, improving wool quality, and accelerating the modernisation of wool production and management.

Second, the wool auction system may reduce some marketing costs, since shared gains can mobilise greater productivity both from growers and from processing enterprises. Generally speaking, under the traditional marketing system, SMCs collect 17% of the purchase price to cover their linkage operations between growers and processors. The costs of managing the auctions are only 1–2%. Therefore, growers can easily obtain prices above the state-recommended levels, while processors will pay less than they do for wool purchased from the SMCs.

Third, experimentation with the wool auction system may enable both the growers and the processors to meet together to enhance mutual understanding and share market information. The growers can become better informed about the processing requirements for wool types and quality and prepare better plans for breed improvement or take steps to raise the quality of their flocks and wool. The processors may directly choose the wool they need, and this will avoid a waste of raw material, reduce production costs, and improve the competitive potential of their products.

Despite the importance of experimentation with the wool auction system, the auction concept has met with resistance and various problems. The chief resistance, of course, comes from the major beneficiaries of the current system and the departmental and regional interest groups who operate it. However, the traditional wool-marketing system has become an unarguable constraint to the development of the Chinese wool industry. Because a new auction-based wool-marketing system and all the necessary mechanisms for it to operate are not yet fully established, it is necessary to create some essential conditions for the development of the wool auction system.

Quality Standards for Auctioned Wool

In the past five years, considerable effort has been devoted to testing the wool auction system. 'Work Regulations for Wool Auction,' draft regulations designed to solicit opinions were drawn up by the Ministry of Textile Industry, The Ministry of Agriculture, and other relevant departments in 1989. The Working Group of Wool Auction Reformation Pilots was formally set up in April 1990. This working group produced a revised edition of the above regulations in May 1990. In March 1991, the regulations were further revised, enlarged, and renamed 'Quality Standards of Auctioned Wool—Work Regulations for Wool Auction' (an edition for trial implementation). The contents of this new edition are listed in Table 2.

These standards are considered to be a great improvement over the National Wool-Grading Standards, issued by the State Standards Bureau in 1976

and now in use for raw wool marketing. The formulation of 'Quality Standards of Auctioned Wool' provides a scientific basis on which wool can be auctioned. For a further improvement in standards, professionals able to implement the classing of flocks, wool grading and general clip preparation at shearing time must be trained. Moreover, these professionals will need an understanding of objective measurement, sale by sample, and pricing of wool on a clean wool basis according to the 'Quality Standards of Auctioned Wool.'

Table 2. Contents of 'Quality standards of auctioned wool —work regulations for wool auction'.

A. Quality standards (see Table 3)
B. Presale clip preparation
C. Appraisal of conditioned weight
D. Objective measurement (scouring yield, fibre diameter, staple length, and vegetable matter)
E. Packing, marking, store, and transport
F. Work regulations for auction
   1. Register of qualification (for attending auction)
   2. Form of auction
   3. Determination of prices
   4. Method of payment
   5. Check-and-accept
   6. Arbitration of claims
   7. Others
G. Glossary
   Attachment
   Illustration

Recommendations

1. Reform of the raw wool marketing system must be accelerated, further opening the wool market and expanding the scale of wool auctions. SMCs are still the major channel of raw wool marketing; however, they could reasonably be required to reduce some of their linkage activities and take part in the wool auctions. Some township SMCs, for example in Wushen county, Inner Mongolia, have already participated in wool auctions. Although few township SMCs would be able to participate directly in wool auctions, virtually all county SMCs should. They could use their network of collection/purchasing points dispersed over the county to purchase more raw wool and to obtain higher returns by undertaking more or better clip preparation. At the same time, a variety of companies (such as the Animal Husbandry, Industry, and Commerce Company) must be developed by individual growers and township services, and allowed to take part in wool auctions. The state should draw up policies and regulations to develop a unified management and macro-level control system for the production, sale, and processing of wool as well as to coordinate the interests of wool growers, operators, processors, and consumers.
2. The 'Quality Standards of Auctioned Wool' must be continuously improved. The new standards are a great step ahead compared to the National Wool-Grading Standards, yet they are only a synthesis of the administrative and technical regulations drawn up by some departments. New standards, which are not yet in full keeping with the international wool standards, might be revised and divided into two regulations with different functions. One set could be the technical regulations entitled, 'Quality Standards of Auctioned Wool,' issued by the State Technical Supervision Bureau (the former State Standards Bureau) and implemented by the State Fibre Inspection Bureau and its subordinate institutions. The other set of regulations could be the administrative regulation entitled, 'Wool Marketing Act' or 'Wool Auction Act,' issued by the State Council and implemented by the core departments concerned with wool and the relevant local governments.

Table 3. Summary of 'Quality Standards of Auctioned Wool'.

Fine wool	Semi-fine wool	Improved wool
Fineness		
count (μm)	count (μm)	(% of coarse-cavity wool)
70' (18.1–20.0)	58' (25.1–27.0)	I – 1.0
66' (20.1–21.5)	56' (27.1–29.5)	II – 3.5–4.0
64' (21.6–23.0)	50' (29.6–32.5)	III – 6.0–7.0
60' (23.1–25.0)	48' (32.6–35.5)	
	46' (35.6–38.5)	
	44' (38.6–42.0)	
Staple length		
(cm)	(cm)	
A — over 8.0	A — over 10.0	
B — 6.0–7.9	B — 7.0–9.9	
C — 4.0–5.9	C — 4.0–6.9	
D — less 4.0		
Quality grade [according to clip quality and apparent morphology]		
I		I
II		II
III		III

3. The appropriate presale clip preparation, objective measurement, and adherence to the wool quality standards at all auctions are the three essential conditions for successful wool auctions. For this reason, the state should emphasise construction of the necessary infrastructure and technical training of professionals to provide these services. The state may consider establishing some technical colleges for training professionals in wool grading and associated matters.
4. Banking institutions must take part in supporting wool auctions by acting as credit guarantors to facilitate the efficient functioning of wool markets.

Conclusion

In general, the wool auction system has made some progress in China since the first experiments with it in 1987. Greater efforts are necessary to promote its steady development. It is estimated that it will take at least another five years to set up an effective wool auction system in China.

ACIAR Technical Reports

No. 1 ACIAR Grain Storage Research Program: research report 1983-84, 63p., 1985.

No. 2 Pastures in Vanuatu, D. Macfarlane and M. Shelton, 32p., 1986.

No. 3 ACIAR Grain Storage Research Program: research report 1984-85, 85p., 1986.

No. 4 Coconut germplasm in the South Pacific Islands, M.A. Foale, 23p., 1987.

No. 5 South Pacific agriculture: challenges and opportunities for ACIAR and its research partners, G.J. Persley and P. Ferrar, 87p., 1987.

No. 6 ACIAR Grain Storage Reseach Program: research report 1985-86, 96p., 1987.

No. 7 Building on success: agricultural research, technology, and policy for development: report of a symposium held at Canberra, 14 May 1987, J.G. Ryan, 39p., 1987.

No. 8 New technologies for rainfed rice-based farming systems in the Philippines and Sri Lanka: report of a workshop held at Iloilo, Philippines, 20-24 July 1987, 39p., 1988.

No. 9 Gaseous nitrogen loss from urea fertilizers in Asian cropping systems, J.R. Freney, J.R. Simpson, Zhu Zhao-liang and Aziz Bidin, 16p., 1989.

No. 10 Bulk handling of paddy and rice in Malaysia: an economic analysis, G.J. Ryland and K.M. Menz, 32p., 1989.

No. 11 Economic prospects for vanilla in the South Pacific, K.M. Menz and E.M. Fleming, 14p., 1989.

No. 12 Biological control of *Salvinia molesta* in Sri Lanka: an assessment of costs and benefits, J.A. Doeleman, 14p., 1989.

No. 13 Rainfed rice production in the Philippines: a combined agronomic economic study of Antique Province, K.M. Menz, 90p., 1989.

No. 14 Transport and storage of fruit and vegetables in Papua New Guinea, K.J. Scott and G. Atkinson, 22p., 1989.

No. 15 Marketing perspectives on a potential Pacific spice industry, Grant Vinning, 59p., 1990.

No. 16 Mineral nutrition of food legumes in Thailand with particular reference to micronutrients, R.W. Bell et al., 52p., 1990.

No. 17 Rice production in Sri Lanka, K.M. Menz (ed.) 51p., 1990.

No. 18 Post-flask management of tissue-cultured bananas, Jeff Daniells and Mike Smith, 8p., 1991.

No. 19 The utilisation of remote sensing in the South Pacific, D. van R. Claasen, 59p., 1992.

No. 20 Hybridisation techniques for acacias, Margaret Sedgley, Jane Harbard and Rose-Marie Smith, 11p., 1992.

No. 21 Production of pathogen-tested sweet potato, Peter Beetham and Angela Mason, 47 p., 1992.

No. 22 Plants fed to village ruminants in Indonesia, J.B. Lowry, R.J. Petheram and B. Tangendjaja (ed.), 60p., 1992.

No. 23 Allozyme electrophoretic methods for analysing genetic variation in giant clams (Tridacnidae), J.A.H. Benzie, S.T. Williams and J.M. Macaranas (ed.), 48p., 1993.

No. 24 Tuna baitfish and the pole-and-line industry in Kiribati, N.J.F. Rawlinson, D.A. Milton and S.J.M. Blaber, 92p., 1993.