Strengthening Capability of Risk Management of the Animal Husbandry Sector and Promoting Sustainable Development in the Grazing Area of Qinghai Province

Pastoral Risk Management in Qinghai Province

A Final Report

Consolidated by
Jeremy Swift, Stephan Baas and Yongong Liu

Food and Agricultural Organization-FAO
Rural Institutions and Participation Service

Ministry of Agriculture-MOA
Department of Agriculture and Animal Husbandry-DAAH, Qinghai

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Major acronyms and abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAHB</td>
<td>Agriculture and Animal Husbandry Bureau at prefecture and county level</td>
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<tr>
<td>APV</td>
<td>Agricultural Production Value</td>
</tr>
<tr>
<td>4CM</td>
<td>Four countermeasures for reduction of the pastoral risk implemented in Qinghai, include settlement house for herders, animal sheds for over-winter, fodder planting in the plot, fencing winter pasture</td>
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<tr>
<td>DAAH</td>
<td>Department of Agriculture and Animal Husbandry, Qinghai Province</td>
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<tr>
<td>DEWS</td>
<td>Disaster Early Warning System</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization, United Nations</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>GPS</td>
<td>Geographic Position System</td>
</tr>
<tr>
<td>HH</td>
<td>Herder’s Households</td>
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<tr>
<td>MOA</td>
<td>Ministry of Agriculture</td>
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<tr>
<td>PECC</td>
<td>Pastoral Emergency Coordination Committee</td>
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<tr>
<td>PRM</td>
<td>Pastoral Risk Management</td>
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<tr>
<td>PRA</td>
<td>Participatory Rural Appraisal</td>
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<tr>
<td>RAPS</td>
<td>Resource Assessment for Pastoral Systems</td>
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<tr>
<td>TCP</td>
<td>Technical Cooperation Project funded by FAO</td>
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Unit exchange:

1 USD = 8.2 Chinese Yuan (RMB)
1 ha = 15 Chinese mu
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Chapter 1 - INTRODUCTION AND BACKGROUND

1.1 Introduction

Qinghai province is a typical upland pastoral region of Northwest China. The total area of the province is 720,000 km², accounting for 7.5 percent of the territory of China. The high plateau of Qinghai is covered by mountains with about 80 percent above 3,000 meters asl. Farmland suitable for agriculture in eastern Qinghai makes up only 1.5% of the area of the province. Alpine pasture is the major land resource for the extensive pastoral livestock industry in Huangnan, Guoluo, Yushu, Hainan and Haibei Prefectures. The total pasture area in Qinghai is 36.45 million ha, making up 50.5% of the total area of the province, of which 31.61 million ha is available for grazing.

According to 2004 statistics, the population of Qinghai is 5.38 million, with 55% of Han nationality, and 46% of 33 minority nationalities. The Tibetan population in Qinghai is 1.09 million, accounting for 21% of the total provincial population. The rural population is 3.89 million people, of whom 85 percent are in the cropping area and 15 percent in the pastoral area. Total agricultural production value (APV) is 5,692 million Yuan, of which 3,061 million Yuan (54 percent of total APV) is from the livestock sector.

Qinghai is one of the five largest pastoral regions in China with extensive rangeland resources and a long history of pastoral livelihoods. Livestock production plays a central role in the economy of the province, especially for minority ethnic groups. However, harsh natural conditions and environment limit rangeland productivity. The alpine pastoral ecosystem is now in a fragile condition. Poverty and environmental deterioration are pronounced, and natural disasters (such as severe snow disaster and spring drought) are frequent. They severely jeopardise the livelihoods and production activities of local herders, and at same time undermine the sustainable development of the local economy and threaten the stability of the society. This combination of high exposure to natural disasters, poverty of local herders, steadily increasing pressure from livestock diseases and decline of pastoral productivity, caused by and resulting in poverty and a deteriorating environment, in turn inhibit the herders’ and government’s capacity to prevent risk, and manage and protect the environment.

Family-based pastoral livestock production units in the province are further constrained, and their capacity for disaster prevention is undermined, by several factors:

- A lack of forage production and storage for the cold seasons, i.e. winter and early spring.
- Poor infrastructure: villages and herders cannot afford to invest in infrastructure to improve production or to build up a risk prevention capability.
- Inadequate social services. The technical service capacity of governmental line agencies for livestock and pastoral management is limited, so that the service can not meet the demand of herders for preparedness for, and resilience to, risk. An effective disaster early warning system is not yet established to predict disaster. Lack of animal insurance and credit for small producers makes herder households vulnerable to natural disasters.
- Poor educational level of herders in the high plateau is a constraint to preventing losses during disasters and achieving self-reliance afterwards.
- Poverty and lack of opportunities for economic diversification and income-generating activities in the high plateau are economic constraints on pastoral risk management. The
vicious cycle built between pastoral poverty and frequent natural disaster seriously affects the livelihoods of herders.

- Degradation of vegetation and changes in the ecosystem result in a more fragile environment for livestock production, worsen the situation and creates another vicious cycle. Variable and sometimes insufficient pasture and inadequate management capacities of herder households, hamper the development of livestock production into a more intensive system.

- Management and technical services at provincial, prefecture and county level, especially in townships, are at a low level. The departments concerned lack risk management ability. This leads to a situation where herders usually do not maintain close links with these departments and technical institutions, which further reduces the effectiveness of efforts made by the government in poverty alleviation, risk resistance and disaster mitigation.

As a result of these factors vulnerability steadily worsens, and drastically accelerates due to sudden natural calamities. In recent years, natural disasters have occurred more frequently. Since the 1950s, there have been 14 major snow disasters. Ten were in the 40 years between the 1950s and 1980s, but four occurred in the 1990s alone. This is almost a doubling in frequency during the last decade. Due to these disasters, 22 million head of livestock were lost, and direct economic losses are estimated at RMB 1.1 billion (USD 137.5 million). It is the highest political and economic priority for the North-western Provinces of China to reduce these economic losses.

In order to break the vicious cycle of disaster-poverty-resource degradation, the Chinese Government at various levels has given highest priority to risk management and disaster prevention or reduction as key elements in the national and as well as the Western-Region development strategies or programmes.

However, the concept of pastoral risk management is new in China and the Government lacks experience of how to design and implement comprehensive risk prevention and management plans in pastoral communities. Therefore, the Chinese Government sought FAO’s technical assistance through the TCP programme (project number FAO/TCP/CPR/2902 – ‘Pastoral Risk Management in Qinghai province’) to strengthen the capability for risk management by the relevant departments and institutions, and to strengthen the ability of herders to resist risk in the project area. The product of this work - a package of strategies and techniques for pastoral risk management - will be extended to other areas of China with similar natural conditions and livestock production practices. The risk management strategy and action plan tested by project TC/2902 in the project area can be adopted by other Northwest China Provinces with similar ecosystems.

1.2 The TCP Project

(1) The project objective

The long-term development objective of the TCP project CPR/2902 was to reduce the regular animal losses of pastoral herders in Qinghai due to recurrent natural disasters, and to build up their own capacities to prevent damage from natural calamities. The project should also contribute to the overall improvement of herders’ future livelihoods, reduced environmental degradation and an increased capacity for risk prevention and management at local and provincial levels.
Immediate objectives were:

- To develop a comprehensive pastoral risk management strategy, including annual risk management contingency plans for two counties in Qinghai Province as pilot areas for further replication;
- To develop and field test in selected villages, together with herders, innovative risk management techniques and improved livestock production options to improve rational utilization of the family-based ranches so as to reduce losses when disasters occur.

(2) Project outputs

Specific project outputs were:

**Output 1:** Locally adapted risk assessment methodology designed and tested among local institutions and herding households, and available for replication in other counties after project completion;

**Output 2:** Annual over-winter risk management plans for the pilot villages and counties developed, and consolidated into a pastoral risk management agenda for Qinghai Province available by September 2004; Technical capacities for pastoral risk management and coordination mechanism of township, county and prefecture levels improved;

**Output 3:** Herders' economic co-operative associations for self-assistance established and operational in two pilot villages;

**Output 4:** Improved winter preparation and risk prevention capacities within pilot villages institutionalized and implemented

A: Rangeland improvement measures

B: Increased forage production and storage in herders' households

C: Methods and mechanisms developed for adjustment of herd and flock structures before winter

D: Veterinary stations equipped and staff trained to regularly monitor and treat livestock against parasitic and epidemic diseases

**Output 5:** Risk warning system for herders developed

**Output 6:** Training programme to increase stakeholder capabilities and skills in risk prevention and management

1.3 The Project Pilot Areas

The project counties of Henan and Zeku in Huangnan prefecture are contiguous and lie between 100° 34’ and 102° 15’ N and 33° 04’ and 35° 32’ E. The pilot villages in both counties are of easy access from all-weather roads and less than one hour’s drive in each case from the county towns. The climate is extreme and markedly continental as would be expected at such an altitude in the centre of a continent. Winters are long and harsh and the growing season short. There is no frost-free season: the dates of the first and last killing frosts are variable and frost can occur any day of the year, and ground frosts can occur at any time in summer. The growing season is from May to September. The annual precipitation is relatively high comparing with the more northerly and westerly parts of Qinghai: about 600 millimetres annually in Henan and around
500 mm in Zeku, mainly falling in summer and winter. The average annual temperature in Henan is -1.3 °C – 1.6 °C and that of Zeku -3 °C – 2.8 °C.

The grasslands of the project area are at an altitude of 3,500 – 3,700 metres on gently undulating plains with occasional low hills, typical of much of the southern grasslands of the Qinghai plateau. The vegetation is mainly low-growing with Kobresia and other Cyperaceae. Elymus nutans and Poa sp. are important grasses and many broad-leaved plants of which Ranunculus spp. are very evident. Although pastures are hard grazed, ground cover is generally good to very good. The entire area is above the tree-line.

Both counties entirely depend on a pastoral economy but differ in degree of development and relative wealth. Demonstration villages were selected in each county. Nanqi village in Henan is relatively prosperous, permanent dwellings are in brick and have glazed winter shelters. Jilong in Zeku has winter quarters built in rammed earth and mud-walled pens for winter livestock but no glazed shelters.

By using the tools and methods of participatory rural appraisal-PRA, a socio economic baseline study was carried out in collaboration with the county officials working in grassland management and livestock production in 2004, which lead to the following overall picture.

The herders were formerly fully transhumant and tent-based but now have permanent winter quarters and only live in tents on the summer pastures. Herders in Zeku are Tibetan whereas those of Henan are of distant Mongolian origin, although they are now fully assimilated into Tibetan culture. The level of literacy of older herders is low but, now that they have a fixed base, children receive education. Dairy products and meat are important in herders’ diets and cereals are also widely consumed. Animal products are bartered for household necessities as well as being marketed.

The livestock are mainly yak and sheep of local breeds. Fine-wool sheep were introduced in the collective period but are no longer raised; Oula sheep have been used in breed improvement. Yak are essential to subsistence for dairy production, as a source of down and hair, for meat as well as transport; they are also marketed. Goats and ponies are kept in relatively small numbers. The motorcycle is replacing the pony for personal transport on the grasslands. Stock, especially yak, are very small and it is said that the weight of yak has decreased by about 40 percent in the past thirty years and sheep somewhat less; the reasons for the decrease are not defined and may be due to a combination of nutrition, management and genetics.

The average pasture area for each person in Jilong village is about 7 hectares. With some land in the summer pastures seriously damaged by rodents and black beach soils, herdsmen have insufficient pasture for present stock numbers, which leads them to rent pasture from herders who have moved to nearby Zequ town. The average pasture area for each person in Nanqi village is about 14 hectares with a higher quality than that of Jilong village. The investigations also showed that almost all households in the pilot villages plant some fodder in their sheep pens for supplementary feeding in winter. Average area planted per household is 0.29 ha for Nanqi and 0.33 ha for Jilong.

Before the announcement of the project, no herdsmen’s association had been set up in Jilong, and there was no joint purchase of livestock or fodder. However there was some joint renting of winter pasture. With the approval of the project a herders’ association has been set up, supported by the local authorities in Nanqi village, and 23 households have joined. The association concentrates on the reproduction of Oula sheep, selecting breeding males, fattening lambs, and fattening sheep and yak for sale.
No important livestock epidemic disease have occurred in the pilot areas during recent years.

Following the nation-wide rural reform (the family responsibility system), livestock were distributed to families in the early 1980s and pasture allocation came later. According to the national land tenure policy, the Qinghai government declared in 1993 that the pasture allocation policy would be a long-term part of the livestock household responsibility system. Regulations of the same year required that pasture be allocated to households for at least fifty years. This was a final allocation: when household size or animal numbers change, the allocated pasture stays the same.

In the project area grassland has been allocated under the family responsibility system into family lots for winter-spring pastures and to groups for summer pastures; this limits the scope for mobility and radical adjustments to grazing systems. The allocation of winter-spring pastures is complete in both counties: allocation of summer pastures is complete in Henan and being finalised in Zeku. Winter pasture blocks are individually fenced with link-mesh; the fencing is not stock-proof but is important to herders since it symbolises their permanent grazing rights. According to the Grassland Station the recommended fence is currently zinc plated steel wire. Herders usually use seven wires in their fence. The unit price for fencing in 2004 was 7 RMB/metre.

Herbivorous rodents occur in great numbers on pastures. They consume large quantities of herbage and cause further damage by eating roots and disturbing the surface layer by burrowing. The main species are the plateau pika *Ochotona curzoniae* and the zokor *Myospalax baileyi*. Marmots, *Marmota himalayana*, are also present. Pikas are by far the most numerous; they inhabit open land with short vegetation, live in family groups and can be a cause of soil erosion and pasture degradation (locally called “black beach”). Rodents frequently reach plague proportions and can have a serious effect on winter risk so monitoring is necessary. They are sometimes controlled by poison baits but controlling one species may make way for expansion of another. Pikas are said to be animals of very short grassland but it is not obvious how the close-grazed steppe could be made to grow taller to reduce pika infestation while maintaining livestock production and family incomes. Pikas are the food of foxes and many raptors, however, due to the radical change of the climate and degradation the pasture vegetation, the raptors have almost disappeared in the seriously deteriorated pastoral areas.

More specific community and household basic data on household situation, grassland condition, livestock, fodder, purchased feed, income, household consumption and occurrence of disasters are available in separate consultant reports.

### 1.4 Grazing resource management

**Natural pastures** The grasslands of Henan are mainly alpine meadow and mountain meadow, those of Zeku are mainly alpine meadow. These pastures are dominated by Cyperaceae with *Kobresia* spp. very important and *Kobresia humilis* especially so.

**Water.** The project area is well supplied with water so this should not be a constraint in livestock production nor a serious component of winter risk. There are numerous streams and watercourses throughout the area. The villages visited could reach ground water with shallow wells and extract it with either hand pumps or submersible electrical ones.
(1) Grazing systems

The grazing management system in the project counties is simple. There are usually only two seasonal units of grazing land:

- Autumn-winter-spring pastures are combined and herders’ permanent quarters are built there; these pastures are all allocated to individual families and fenced; the livestock stay on them for eight to nine months of the year. Some herders, in some areas, do have separate autumn pastures; per capita (early 1980s allocation) pasture in Henan is less than 100 mu (around 7 ha).

- Summer pastures which are allocated, or are about to be allocated to family groups and where herders camp and graze their stock for three to four months; summer pastures in the project counties are not noticeably higher than the winter ones and transhumance is more lateral than vertical; the distance between summer and winter pastures is relatively short – ten to twenty kilometres.

Allocation of winter pastures on 50 year leases gives herding families security of tenure so they can invest in housing and infrastructure; this is a vast advantage over several other herding countries which have de-collectivised.¹ Fencing is expensive and much of it does not appear to be very solid or stock-proof, but it is important symbolically since it demarcates a family’s pasture and indicates their grazing rights. Grazing areas were allocated according to family size at the time of de-collectivisation of pasture; this has caused some anomalies and is hard on those who were young bachelors at that time and now have families.

Government policy encourages the protection and reserving of winter grazing but, with fencing, there has been a tendency to let stock graze at will within the three-season enclosure rather than to herd them to specific areas at specific seasons. Better spatial and seasonal distribution of grazing is desirable for efficient pasture use but the means of encouraging herders to tend and direct their stock daily has not been found.

There is a market in grazing and some herders rent pasture, often from former herders who have settled in town; one herder interviewed had rented 300 – 400 mu (20-30 ha) for two months for RMB 1,000.

(2) Grassland management and its problems in pilot villages

In general the grasslands in the project area seem hard grazed but basically in good condition with good ground cover. There is a common degradation problem on the Tibet-Qinghai Plateau known as “black beach” where the natural vegetation has been destroyed leaving a black surface without plants. In the baseline survey 20 families had no black beach and 11 had a total of 3,220 mu. In Jilong village of Zeku county 170 households had 52,207 mu of winter-spring pasture and 40,262 mu of summer pasture; 27,740 mu, some 30 percent of the total, was “black beach” but this is much higher than average.

(3) Grassland monitoring

A grassland monitoring system has been in place for many years and is well established and regularly executed. Monitoring of primary production is by the traditional method of periodic clipping of quadrates, recording fresh and air-dry weight and dividing the harvested material into palatable and unpalatable species. This method gives precise measurements of yield at the

¹ described in Suttie & Reynolds 2003, Transhumant Grazing Systems in Temperate Asia,
sampling sites but it is labour and time-consuming so only a limited number of quadrates can be handled and geographic coverage is sparse.

It is highly desirable that much more rapid techniques of herbage measurement be found to supplement the clipping system, for two purposes: to get better geographic cover so as to have a picture of the overall grassland situation, and to provide a rapid method of estimating the standing biomass at the end of the growing season (mid- to late August) to assist in formulation of the winter risk management plan, and the forecasting of risk.

**1.5 Pastoral Risk and Approaches to Pastoral Risk Management (PRM)**

(1) Pastoral risk

Hazards (destructive natural or human events) in pastoral communities such as those of the Qinghai-Tibetan plateau usually take a different form from hazards in agricultural or urban communities. Examples of such pastoral hazard sequences are:

- drought or snow disaster >> weakened animals>>higher animal death rate>>loss of income>>increased poverty in households for whom animals are main capital stock
- animal disease epidemic>>nobody wants to buy animals>>collapse in livestock prices>>increased poverty in pastoral households which depend on income from animal sales.

The main sources of hazard in pastoral areas include:

- Weather (also important in agricultural communities);
- Animal disease (problem mainly in pastoral communities);
- Predators (eg wolves) and pests (eg rodents) - (problems largely specific to pastoral communities);
- Market instability (special conditions in pastoral communities).

A future hazard of great potential impact is global climate change which will exacerbate other types of hazard.

Pastoral risk management (PRM) is the way pastoralists and government organise and prepare to reduce the impact of hazards. Pastoral risk management programmes set out what individual herders, communities and governments should do:

- every year, to prepare for the inevitable hardships of winter;
- over the medium and long term, to reduce herder vulnerability to severe hazards

Pastoral risk management is a set of four related activities:

- **Risk reduction** is the long term group of activities which reduce vulnerability: for example a land tenure framework that encourages sustainable pasture use, genetic improvement of animals to create better resistance to disease or extreme cold for example, or a livestock insurance scheme.
- Risk planning is the set of activities designed to prepare the herding economy for stress periods such as summer drought and winter snow disaster. Risk planning includes, for example, winter preparation of animals, or better risk forecasting.

- Risk reaction is the set of activities triggered by early warning of an impending hazard, or by the hazard itself.

- Risk related recovery refers to the proactive integration of risk mitigating measures into the recovery processes while households are re-establishing their normal or new livelihood strategies after the event, focussing on opportunities for beneficial change.

The chief actors in PRM are not just government. It is especially important to bring all key stakeholders into the programme through joint planning: involving pastoral communities themselves including experienced herders, community-based organisations, national and international NGOs.

PRM should not be treated as an isolated activity, separated from other government and community programmes. It is especially important to link it to poverty alleviation, and natural resource management.

(2) The Government disaster prevention programme in Qinghai

Qinghai Provincial government has paid particular attention to the problems of herders and especially to the mitigation of winter disasters and has recognised that it is both more efficient and cheaper to reduce the occurrence of disasters rather than to deal with their aftermath. The programme (‘4CM’) has four main points:

- Allocation of winter pastures to households and subsidised fencing;
- Construction of winter shelters for livestock;
- Construction of a permanent dwelling for the herders, who continue, however, to travel to summer pastures using tents;
- Sowing of 5 mu (one third of an hectare) of fodder, for hay.

The implementation of the programme is well advanced but differs in degree between counties, probably reflecting the degree of poverty of their herders. The 4CM interventions are heavily subsidised but herders still have to make some investment. In the project area autumn, winter and spring pastures are all in the same unit and have been allocated. Winter shelters, brick-built with glazed roofs and half-walls are installed throughout Henan but are absent or rare in Zeku: mud-walled sheep pens have been built throughout. The quality of permanent dwellings differs greatly between counties: those in Henan are built in brick and are generally large; in Zeku houses are of rammed earth and often small. The sowing of oats is far behind other interventions but has begun in both districts on a very modest scale: walled sheep pens are small and the target of five mu (a mu = one fifteenth of an hectare and is the common measure of farmland) per household is far from being attained.

Field investigations carried out in the two pilot villages on herders’ attitudes to the four countermeasures programme (4CM), found that the overarching attitude among herders towards the programme was positive in principle, but that full implementation of the 4CM however has not been achieved yet for various reasons.

- Many households in Jilong village had not enrolled in the 4CM programme. They
understood the advantages of 4CM, and would like to join the programme, but did not meet the selection standards, being too poor to pay the necessary share of the total cost. The rate of 4CM enrolment in Nanqi village was around 70 percent.

- All six randomly selected households specifically interviewed on the issue in Jilong village had taken loans from the credit cooperative with yak and sheep as the collateral. The loans were mainly used to buy forage in winter. The implementation and adoption rate of 4CM in Zeku was lower than in Jilong,

(3) Integrating PRM and the existing government programme for disaster prevention: Elements for an enhanced PRM agenda in Qinghai

A successful programme to reduce pastoral risk and vulnerability in Qinghai means to build on and complement the structures and approaches already successfully in place, such as the 4CM, and to create additional new strategies to further enhance the resilience and capacities of herders and herder’s communities for proactive natural risk management. The policies of the provincial government must encourage such strategies.

During implementation the project identified five key components and twelve complementary strategies directly relevant to better addressing pastoral risk and vulnerability in the pilot areas and Qinghai province as a whole. The range of these issues goes beyond the scope of the original TCP design, which had identified during project preparation a more limited number of key issues. As a result the TCP project – due to its limited scope and financial volume – had neither a mandate to advise, nor the resources to conduct pilot research or to intervene on all of them. However, since these strategies are mutually reinforcing, and are all part of the recommended policy agenda for pastoral risk management in Qinghai, they are all introduced and flagged here, even though they will be discussed later on in the report at different levels of depth. The policy agenda is likely to be most successful if it implements all strategy elements in a well integrated way.

Within the agenda three concepts are important:

- *Strategies* are the complexes of linked activities promoted by government and the herders themselves in order to reach economic and social goals;
- *Policies* are the sets of rules and frameworks adopted by government to encourage certain strategies, and discourage others: policies include for example changes to pasture land rules to encourage more conservative grazing;
- *Policy instruments* are the specific means used to implement policies and strategies: policy instruments include for example laws, economic subsidies or new institutions.

The key components and strategies of the recommended PRM agenda are:

I. GRAZING AND PASTURE RESOURCE MANAGEMENT

- Strategy 1  Measuring and monitoring grazing resources
- Strategy 2  Managing grasslands

II. WINTER FEED

- Strategy 3  Feed and fodder production
• Strategy 4  Fodder markets, fodder banks and emergency fodder funds

III. LIVESTOCK PRODUCTION, BREEDING AND HEALTH

• Strategy 5  Animal production and breeding
• Strategy 6  Improvement of animal health

IV. ENCOURAGING HERDER RESILIENCE TO PASTORAL RISK

• Strategy 7  Early warning and rapid reaction system for PRM
• Strategy 8  Improved housing and infrastructure
• Strategy 9  Promoting herder cooperation

V. POLICY AND INSTITUTIONAL FRAMEWORKS FOR PRM

• Strategy 10  Mainstreaming PRM within a reshaped pastoral economy
• Strategy 11  Financing PRM
• Strategy 12  Improving governance for PRM

Section two of this report presents and discusses in-depth the findings and recommendations derived from the project, related to those strategies for which the project had the mandate and resources to work on. Section three presents an integrated policy agenda which establishes, in spite of the need for further investigations on some aspects, guidelines for a comprehensive pastoral risk management strategy for ecosystems and production systems in Qinghai similar to those in Jilong and Zeku counties.
SECTION2:

PROJECT FINDINGS AND TECHNICAL RECOMMENDATIONS FOR THE IMPLEMENTATION OF SELECTED PRM STRATEGY ELEMENTS

Chapter 2 MONITORING AND ASSESSING GRASSLANDS

2.1 Grassland monitoring

Qinghai Province, including Huang Nan Prefecture where project activities were concentrated, has a long history of grassland surveys, most of which were based upon well-established techniques and designed to provide basic information on plant species composition and biomass within typical grassland ecosystems. Earlier surveys tended to focus more on the botanical composition and status of grasslands. With increasing concern over the resource status of the grasslands, more recent surveys have incorporated the assessment of livestock carrying capacity based on simple biomass measurements and standardised livestock forage requirements. More recently, there has been repeated sampling during the herbage growing season to better understand seasonal patterns of biomass accumulation and their inter-year variability.

Surveys to classify and determine the extent of grassland ecotypes were executed by the Ministry of Agriculture during 1984 at county level within each prefecture. In the mid-1990s a new programme, complementing earlier surveys, was implemented in Huang Nan Prefecture to provide basic data on the production and carrying capacity of the grazing lands to support improved grazing management and increase resistance to disasters.

In 2003 the Ministry of Agriculture initiated a modified programme to improve the assessment of livestock carrying capacity. This programme is carried out at 96 sites across the winter grazing lands of the prefecture, and involves a total of 192 quadrat sampling points (incorporating the 150 sampling points of the previous programme). Each location represents about 93,000 mu (6,200 ha) and each sampling point consists of a quadrat of one square metre. Under the new regime three samples, cut to a height of about 1.5 to 2 centimetres, are collected each year during late May, early July and late August or early September. As for the earlier programme, a complimentary set of 192 grazed quadrat sampling points are monitored in the summer grazing land.

Data from these surveys are used to calculate ‘recommended’ stocking loads or ‘carrying capacity’ for the winter grazing lands associated with each township. Stocking load recommendations are provided to herders prior to each winter so that they may make timely adjustments to livestock numbers. The recommended stocking load estimates integrate the fresh weight of the herbage harvested within each quadrat, a standardised livestock herbage consumption rate, period of grazing and grazing land area.

These programmes provide important base information on the nature and dynamics of the pastoral resources within the grasslands and generate coarse indices of livestock support capacity for a particular point in time. The evolution of the surveys from being ‘botanical’ to being used
to manage the pastoral resources and resolve issues of sustainable grassland use shows considerable foresight by both the government and scientists. Such information has proved very useful to the TCP team in compiling land, forage and livestock databases used in developing the pastoral resource and risk assessment techniques proposed for an advanced pastoral risk management strategy.

Further improvements in the scope and detail of pastoral resource information will yield substantial benefits in location relevance and analysis sensitivity. The heterogeneity of land resources and mixes of resources unique to specific villages can be taken into account, resulting in site specific recommendations with a higher level of relevance. Current grassland monitoring and resource assessment programmes are commendable in that they maximise information gathering within the constraints of labour-intensive field techniques, staff resources and funding levels. However if a generational advance in pastoral resource assessment and risk management is to be achieved, then the collection of additional field data will need to be based on more sophisticated and less labour-intensive techniques.

Although current grassland monitoring programmes are designed to represent the main grassland types they do not cover adequately the high level of spatial heterogeneity which exists within the project areas. As a result variations in pastoral resources, especially in productivity, are not reflected in land and forage data sets. Such variations are due to such factors as topography (macro and micro), water table, plant community types, historical use patterns, recent subdivisions and distance from settlements,

Electronic meters, in various forms, have been used to assess standing biomass of pastures since the 1970s. If the electronic meter (the ‘pasture probe’ supplied by the TCP project) is properly calibrated and used under standard conditions it has the potential to be a very useful technique, providing data of the type required by the pastoral resource assessment techniques, the potential for sampling large areas quickly, and will significantly reduce labour requirements in the field.

**Main conclusions on grassland monitoring**
A system of pasture monitoring has been in place in Qinghai for over a decade and has built up sound databases of information on grassland yield and growth patterns. The techniques used are labour-intensive so the number of sites which can be dealt with is limited; this prevents adequate cover of the various pasture types and quick assessment of standing herbage in autumn over a wide area which is required for risk assessment. An electronic pasture probe, used in conjunction with classical sampling, would allow standing herbage to be measured at a great number of sites very quickly. A probe was acquired by the project but arrived too late for training by the international consultant. Instructions for calibrating and using the probe are given in the consultancy report. The areas of the different pasture types and their emplacement are not known; mapping is needed to allow more accurate assessment of grassland yields.

**2.2 Pastoral resource assessment**

**(1) RAPS-Resource Assessment for Pastoral System**
Rapid processing and analysis of monitoring results and their integration with livestock, climate and other parameters is essential if useful information is to be available in real time as is needed by risk forecasters and planners. The project introduced and tested a software system and trained staff in its use. The Resource Assessment for Pastoral Systems (RAPS) has shown great promise in the project area and should be used henceforth as the means of handling data for grassland advisory work and risk forecasting. RAPS should become a mainstream part of such work.
Throughout the province, incorporated into the Bureau’s routine activities, and should not be left as a parallel system to older methodology. ²

Pastoral system modelling using RAPS avoids limitations of the traditional techniques of assessing carrying capacity, and brings the methodology in line with GIS, GPS and remote sensing technologies which are also available to the AHHB. The RAPS model primarily uses metabolisable energy (ME) as the forage-livestock integrator. For each land and forage unit, the main parameters incorporated in the land-forage database are:

- area;
- annual dry matter yield;
- utilization level;
- seasonal patterns of growth and herbage quality (including depreciation);
- herbage production variability both within and between years;
- managerial constraints affecting forage availability and timing of use.

For the livestock component, estimations of forage requirements for each livestock class are based on:

- livestock type, herd or flock composition;
- profiles of live weight change (annual and seasonal);
- changing physiological conditions, relating particularly to pregnancy and lactation;
- allowances for environmental conditions peculiar to the site;
- managerial policies and constraints.

The use of RAPS analyses is not limited to livestock management. It can also be used for many aspects of environmental studies in grassland environments.

The aim of Pastoral Resource Assessment in the context of risk management is to quantify and better understand the complex mix of pastoral resources available to herder groups to support sustainable resource-led management and reduce winter risk. It will: monitor the condition and trend of the grasslands to, among other things, identify as early as possible any trends that might increase winter risk; quantify winter feed requirements and assess the frequency and amount of emergency forage requirements to mitigate the effects of climatically extreme winters; assess the potential impact of risk reduction options listed above and livestock management, and grassland management and forage supply.

Up-to-date information is needed to allow timely warning of possible emergencies and the necessary planning for their avoidance or mitigation. Resource assessment involves the handling and integrating of large quantities of data on grassland and livestock. Suitable computer software to process the data in the form of RAPS has been introduced by the project and staff trained in its use. RAPS is very promising and should be adopted throughout the province but more training will be necessary.

See Figure 1. Components of Integrated Analysis and Assessment and Figure 2. Risk assessment within the context of sustainable pastoral resource management.

² For a detailed description of the RAPS system, see the report of the international consultant on grassland resources assessment.
(2) Training on RAPS

In 2004 a RAPS training course was held at the Huang Nan Prefecture Bureau of Animal Husbandry and Agriculture for local prefecture grassland station staff. It was considered a successful introduction to the scope and application of RAPS. Considerable interest was generated regarding the potential application of RAPS both within the project counties and in
other grassland station programmes. The course highlighted a number of factors critical to the successful outcome of the training:

- RAPS software and guidelines needed to be translated into Chinese;
- a two-day training course was not enough to train local staff to use the software independently;
- training should include Bureau of Animal Husbandry and Agriculture staff at provincial level to ensure that a core of highly qualified grassland and livestock specialists become familiar with the use and potential application of RAPS.

Outputs in 2005 included: updating of the translation into Chinese of the 50 page RAPS User Guideline; translation into Chinese of the RAPS software menus, options, user prompts and text-based results; compilation of training materials based on the above translations; formal training of project staff and other relevant staff of provincial government grassland, pasture and livestock production institutions; provision of informal ongoing training in the use of RAPS to project staff and the national counterparts; analysis of data made available since 2004; updating and expansion of the RAPS benchmark (current status) base variable, land and forage, and livestock databases for each of the four project sites; analyses of the updated RAPS benchmark databases with demonstrations of the application of the databases and interpretation of the results.

Before the second international consultancy in 2005 the RAPS User Guidelines were translated into Chinese by Mr Shi Dejun and Ms Sa Wenjun of the Project Office. The translated document was updated prior to the formal training programme and continually updated thereafter. A draft of the translated user guidelines and initial Chinese versions of RAPS were tested and updated during the training course.

The first training session involved 14 people including two from the Project Office, four from the Prefecture Grassland Station and the remainder from the Provincial Grassland Station and University. The second training session, because of work commitments of the participants, was limited to half a day. With such a short time available, it was decided not undertake any advanced training but to revise the topics covered during the first training session. Revised benchmark databases were used to illustrate the process of development and critical assessment of the databases, the considerations involved and sources of information, and types of output. Interpretation of the results within the context of the identification of critical pastoral resource issues and management decision support were discussed. Senior members of the Project Office and the Bureau of Animal Husbandry and Agriculture attended the second training session. Components and topics of the RAPS training programme are presented in table 1.
Table 1. Components and topics of the RAPS training programme

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<td>Overview of Training Programme</td>
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<th>Background</th>
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<td>Reason for Development</td>
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<td>Complexity of pastoral systems, misleading feeding standards, need to assess many.</td>
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<td>Options and assess range of scenarios, understand relationships between resource.</td>
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<td>Components.</td>
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<td>Farms, development options and complementarity.</td>
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<td>Projects (Bhutan, Ethiopia, Sudan, Xinjiang and Gansu)</td>
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<td>Seasonality</td>
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<td>Dynamics or Variability</td>
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<td>Reflects local environmental conditions</td>
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<td>Livestock Based on International Standards</td>
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<td>Multiple Sources of Data</td>
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<td>Standards (if relevant), field measurements, research, inferred from environmental data. Parameters derived from satellite imagery and remote sensing.</td>
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<td>Easily updated</td>
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<td>Information quality is critical</td>
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<td>Critical Assessment of Output</td>
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(3) RAPS benchmark databases

In 2004 preliminary benchmark databases relating to Henan County, Nanqi village, and Zeku County and Jilong village were compiled. In 2005 the main objective relating to the application of RAPS was to revise and expand the databases to a level at which the current condition of pastoral production at the four sites could be represented realistically. The revision of the benchmark databases involved a factor-wise critical assessment of all the base variable, land and forage and livestock databases. Particular attention was given to the verification of growth and production parameters relating to the local environment and production systems. A range of published scientific papers were drawn upon to refine and localise the parameters. A major
Refinement to the land and forage databases, which was anticipated but not able to be carried out, was the splitting of each seasonal grazing land into sub-units reflecting variations in vegetation communities and livestock use. These improvements are considered high priority as their inclusion would significantly increase the realism and resolution of the databases and therefore the quality of subsequent analyses. Two major issues need to be resolved before such data can be included: the areas of seasonal grazing lands and the integration of seasonal grazing land data with vegetation type and grazing use information. This information needs to be mapped.

There are significant discrepancies between official prefecture statistics on seasonal grazing land areas within each of the project sites, and local information regarding those areas. Much of the discrepancy has arisen because the official information is often out of date and does not reflect the changes in grazing management that have occurred in recent years. Seasonal grazing patterns have become much more dynamic, particularly in relation to the timing of the ‘return’ of livestock from summer to winter grazing areas. These changes have been brought about by the allocation of winter grazing lands and have been facilitated by the fact that differences between the summer and winter grazing lands are more to do with proximity to the permanent winter settlements than differences in vegetation, altitude and weather. That is, the differences are primarily spatial. It is recommended that the seasonal grazing lands and major vegetation types within the project areas be mapped using a GPS as soon as possible and the resultant data entered into the layers of a GIS system. The area information should then be used to modify and expand the RAPS land and forage databases.

The availability of information on herbage yield and availability expressed in kilograms of dry matter per hectare continues to constrain the usefulness of information already collected, particularly from the ongoing grassland surveys. Field measurements that have been traditionally carried out as part of regular programmes are limited in scope and frequency because of shortage of labour and funding, and are expressed in terms of either fresh or air-dried weights of standing herbage for a particular point in time.

The livestock databases representing the current production regimes in each of the four project areas were also critically assessed and updated where substantial information supporting modifications were available. Published seasonal live-weights were used to calibrate the live-weight profiles.

A general description of the pastoral resource characteristics of the four project areas was presented in July 2004. By June 2005 the base variable, land and forage, and livestock databases were considered to be in a ‘usable’ form and therefore could be applied in formal analyses of the current pastoral resource and production regimes. The benchmark databases should be subject to ongoing refinement and improvement. As described above, important improvements to the benchmark databases should only be made once substantial information becomes available.

A number of preliminary analyses have been carried out using the benchmark databases that relate directly or indirectly to the overall pastoral risk assessment and forecasting programme. As described in the RAPS User Guidelines, a series of convergent indicators were used to check the validity of the databases to ensure that they realistically represent the current status of the pastoral production regimes being analysed.
(4) RAPS and risk assessment

The pastoral risk assessment and forecasting programme is designed to give early-warning to herders technicians and administrators of the possibility of serious conditions during forthcoming winter, and particularly relates to the provision of adequate livestock feed supply and shelter. Early-warning forecasts will make it possible for herders and others to engage pre-planned responses. The basic requirements for a practicable pastoral risk assessment and forecasting programme are simplicity, relevance and ease of application at the village level. To maximise the quality of output, the use of multiple convergent indicators of risk is an integral part of design.

Overall, the management of pastoral risk has two categories of mitigation relating to ‘normal’ and ‘abnormal’ conditions:

- The adoption of pastoral resource management and development practices that ensure optimum economic levels of livestock feeding throughout all seasons of normal years.
- The implementation of practical programmes directed at mitigating the impact of irregular and infrequent years of serious forage shortages and climatic hazards.

The overall relationships between the component activities of risk assessment within the context of sustainable pastoral resource management are illustrated in Figure 2.2. RAPS-based assessment of the pastoral systems is fundamental to the formulation of risk assessment procedures. RAPS provides decision support by integrating, quantifying and forecasting the impacts of deviations from the norm of most of the contributing factors.

The main indicators contributing to risk assessment are:

- herder experience and observations on current pastoral resource status and trends;
- grazing land condition and forage availability monitored at strategic points and regular intervals;
- weather monitoring and forecasting, both long term, and immediate to medium-terms;
- assessment of livestock condition;
- the status of land, forage and livestock resource characteristics, production parameters and management features.

Most of the indicators can either be used directly in the subjective assessment of risk or analysed using RAPS software to generate quantified assessments and forecasts. Examples of analyses and outputs that directly or indirectly affect risk management are shown in the grey boxes of the right-hand column of Figure 2. All risk assessment activities contribute to the formulation of the pastoral risk management programme and policy development. It is essential that activities of the pastoral risk assessment and forecasting programme are carried out on a regular, routine and timely basis. Most activities are time-critical within a season to ensure that risk levels for the ensuing winter are identified and quantified as soon as possible. This ensures sufficient opportunity for mitigation measures to be implemented.

A preliminary year-wise schedule of routine pastoral system monitoring and analysis and the integration of the components of risk management is presented in Figure 3. The schedule of activities is self-explanatory and designed specifically to produce timely routine forecasts of the magnitude and extent of winter risk and recommendations for the mitigation of those risks. The coloured activity bars indicate the overall period of a particular activity and not necessarily a continuous full-time commitment. For example the rangeland herbage condition and availability
monitoring activity will be carried out at regular intervals between the beginning of May and the end of August; some monitoring may be required outwith the period shown.
Figure 2. Risk assessment within the context of sustainable pastoral resource management
Figure 3. Preliminary Yearly Schedule of Pastoral Risk Assessment and Management Policy Development Activities
(5) Main conclusions on pastoral resource assessment

RAPS software is promising and effective tool for handling pastoral data and integrating the many grassland, livestock and climatic data to provide information in a suitable form for planning grassland use, providing advice to local authorities and herders as well as assessing and forecasting risk. Preliminary testing in Qinghai over two seasons has provided useful results and shown the advantages of special programmes for analysing and integrating pastoral data. The preliminary analyses have also identified subjects on which more, or more accurate, information is needed. These are noted above and include: mapping of vegetation types; verification of livestock numbers and the need for a greater cover of sampling – which could be attained using an electronic pasture meter. Training courses have been held and the user manual and the software itself have been translated into Chinese. RAPS is a tool for handling and integrating data so it should be integrated into the Bureau’s routine work, preferably Province-wide, not kept as a separate programme. Extension of the use of RAPS will require the training of more staff; there may also be a need for more in depth training of specialist staff who would supervise others.

Chapter 3 - MANAGING GRASSLANDS

3.1 Present grazing management system: winter and summer pasture

The present grazing management system in the project counties is simple. There are usually only two seasonal units of grazing land:

- autumn-winter-spring pastures are combined and herders’ permanent quarters are built there; these are all allocated to individual families and fenced; the livestock stay on them for eight to nine months of the year. Some herders, in some areas, do have separate autumn pastures; per capita (early 1980s allocation) pasture in Henan is less than 100 mu.
- summer pastures which are allocated, or are about to be allocated to family groups and where herders camp and graze their stock for three to four months; summer pastures in the project counties are not noticeably higher than the winter ones and transhumance is more lateral than vertical; the distance between summer and winter pastures is relatively short – ten to twenty kilometres.

3.2 Pastoral Land Tenure and Grazing Management

Pasture land tenure is a central issue to pastoral risk management. Secure tenure reduces risk by enabling herders to manage their grazing activities in a more sustainable way with a degree of certainty to insure the long term use of grassland in the future; insecure tenure leads herders to unplanned and potentially risky moves as they struggle to make the best of what they can find.
The household responsibility system has created new natural resource tenure conditions and greatly increased tenure security for herders. The grassland law formulated in 1985 and amended in 2002 encouraged the development of a more efficient pastoral system, and it has succeeded in many of its objectives. However there are several well-known problems, which include:

- changing household composition over time makes the relationship between number of people and pastoral land area increasingly ill-adapted. As result of the change, per capita grassland holding in both counties varies and results in unequal among households;
- the original allocations of pastures did not always transparently reflect household size and skills;
- pasture leases do not deal adequately with water, where this is scarce;
- the system assumed scientists could calculate accurate stocking rates; however the difficulty in analysing carrying capacity with any degree of precision means that many of these calculations have a doubtful meaning and are not a good guide to policy;
- household pasture leases are for 50 years, and non-rolling (i.e. after 30 years, 20 years remain), creating a cumulative disincentive to lease-holders to invest in pasture improvement or infrastructure.

The winter grasslands in the project area have been fully allocated to households since 1999 on 50 year leases. Household autumn-winter-spring pastures are a single unit and have all been fenced, although in some cases fences between household’s or neighbours’ winter-spring areas are now being removed by the lease-holders to allow a degree of co-ordinated or even common management of winter pastures at a scale larger than the household. Many fences seem to be symbolic markers of property limits, rather than a way to keep animals in or out. Most but not all summer pastures have been allocated to groups, and are not generally fenced.

Under the pasture contract system, there is no provision for emergency, state or community-managed pastures. As a part of the disaster management system detailed below, it may be appropriate to gazette emergency grazing areas and agree and implement appropriate management rules.

Increasing numbers of herders have moved to town and now rent out their pasture to those who stay behind. Individuals, whether they live in towns or the countryside, can build up a large area of rented grazing under their control. In the project area, some herder family groups are accumulating large areas of contiguous winter pasture in this way. They then remove the internal fences in the whole area and manage it as common grazing for their group of households. The fact that this system is evolving through herder initiative alone suggests it has substantial advantages in these circumstances.

(1) Reserved grassland
A few herders have, of their own initiative, enclosed small areas of grassland close to their winter homesteads with wire-mesh and spread sheep manure (most yak dung is used as fuel). These enclosures are protected from about May until they are grazed, usually by ewes, in December – January. The development of the natural vegetation within the enclosures at the time of project fieldwork in 2004 was outstanding; the herbage was 25 – 30 centimetres high and valuable pasture plants such as Poa and Elymus nutans were growing strongly. Outside the fence
the grassland was like a close-mown lawn and these grasses could only be found by very close examination. The Provincial DAAH should encourage more herders to reserve areas of winter grassland and monitor the results.

(2) Reducing and redirecting grazing pressure

The issue of livestock herd size in relation to pasture is complex. Many observers claim that in Qinghai aggregate herds and flocks are now larger than pasture and feed resources can accommodate, although research into this issue by the Qinghai Livestock Development Project was inconclusive. It is unlikely that herders will spontaneously reduce herd sizes, without adequate direct or indirect compensation. At present stocking rates there is general agreement that there is little scope to improve animal productivity by better pasture management alone. Irrigated grassland is not a suitable option for herders in the project area and breaking open grassland to sow pasture is officially discouraged for environmental reasons. Reseeding of severely degraded land may be possible, but not in the short term.

In these circumstances, productivity gains will have to come primarily through a mix of activities, only some of which are directly related to tenure. These include: an extension of the areas of pooled and collectively managed winter-spring grazing, within which there should be a place for small fenced household winter grazing reserves; increased haymaking; and use of supplementary feed including concentrates. If small groups organise to pool and jointly manage their winter-spring pastures, fencing costs would be reduced considerably. One further area where there might be productivity gains from pasture management is in the balance of use between summer and winter pastures, the first being sometimes underused and the latter often overused. Although the movement of herds and flocks between summer and winter areas is a management decision for households, in practice it would be facilitated by a mechanism for herding households to co-ordinate their seasonal moves, of the sort a herders’ association could provide.

Under the pasture contract system, there is no provision for emergency, state or community-managed pastures. As a part of the disaster management system detailed below, any emergency grazing areas should be gazetted and appropriate management rules agreed and implemented.

3.3 Rehabilitation of degraded grasslands

Grassland degradation is perceived as a widespread problem in Qinghai, and throughout much of China’s grazing lands. It was not emphasised within the project area and, since research and demonstration on grassland rehabilitation requires many years, it was not included in the project’s activities: it is mentioned here for completeness and because of its importance in many parts of the province. Degradation is usually brought about by poor grazing management and is often exacerbated by rodent damage, wind and water erosion. One of the more serious types of degradation is the so called ‘black beach’ which occurs at elevations between 3,600 and 4,500 metres in areas that are affected by a combination of human activity and environmental factors.

The TCP did not do its own research on ‘black beach’ soils or on rodents. These sections are based on summaries of the recent scientific research on these issues.
Black beach formation follows a sequence of sedge degradation, rodent burrowing, damage by animal trampling, wind and water erosion, sedge mortality and increased bare ground, root shearing by frost heaving, and continued wind and water erosion.

Much research has been carried out elsewhere in Qinghai on rehabilitation of degraded grassland since the 1970s and effective techniques of reseeding are known. The EU supported Livestock Development Project implemented from 1995 to 1999 has also shown good results in rehabilitating ‘black beach’ in Dari County, Guoluo Prefecture. The most suitable grasses are indigenous ones: *Elymus nutans* and *Elymus breviaristatus*; *Kobresia* has been used successfully but its seed is generally of low germination and the seedlings are slow to establish. Seriously degraded grassland should be enclosed and re-vegetated, moderately degraded grassland should be rehabilitated by reducing the grazing intensity, and livestock grazing should be controlled on lightly degraded grassland. Black beach rehabilitation using these methods has a productive stand life between five and eight years. Maximum yield is reached in two to three years and then decreases. After eight years, stands need to be revisited and re-treated if stand productivity is to be retained. It appears, therefore, that reseeding alone is not enough and fundamental changes in grazing management will be required to avoid recurrence of degradation.

Decisions on grassland rehabilitation will have to be made after economic calculations but where environmental effects are important, as on main catchment areas, the value of the impact of the improved ground cover on runoff and general biodiversity will have to enter the calculation.

### 3.4 Control of rodent damage

Small burrowing herbivores cause considerable damage to grassland in Qinghai. They are generally referred to as rodents although the most important, the plateau pika - *Ochotona curzoniae* – is a lagomorph, the group to which hares and rabbits belong. The zokor, *Myospalax baileyi* is also important and species of lesser importance include are the Daurian pika (*Ochotona daurica*), plateau pine vole (*Pitymys irene*) and Himalayan marmot (*Marmota himalayalayana*).

Pika mainly inhabit the alpine steppe, steppe meadow, alpine meadow and alpine desert steppe at an elevation of 3,100-5,100 m above sea level. In the area of shrub and steppe, they only live on the grassland around the shrub, and never enter the shrub. Pika live in family groups in basin between hills, terrace and piedmont steppe. Pika prefer open habitats and avoid dense shrub or thick vegetation. Pika feed on grass, damage the root, and even damage the primary grass layer and soil layer by burrowing. The damage is proportional to the density of the animals. When the population increases to the carrying capacity, the population increase stops, but damage to the grassland continues.

Rodent infestation is monitored regularly by the Grassland Station; mean data for 2000 – 2004 are given in table 4.

<table>
<thead>
<tr>
<th>County</th>
<th>Area (ha)</th>
<th>Active Burrow (Head/ Burrow)</th>
<th>Total Head</th>
<th>Burrow Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Henan</td>
<td>2,537</td>
<td>352,574 0.536</td>
<td>188,874</td>
<td>0.5357</td>
</tr>
<tr>
<td>Zeku</td>
<td>5,578</td>
<td>2,632,211 0.671</td>
<td>1,766,872</td>
<td>0.67125</td>
</tr>
</tbody>
</table>

Source: Prefecture Grassland Station
On the basis of the rodent data an attempt to calculate their effect was made using RAPS with the following result:

Analyses indicated that pika consume in the order of 10% and 19% of herbage in Henan and Zeku Counties respectively. Therefore competition for herbage between pika and livestock is significant (competition from other rodent types were not included in the analysis). There are many questions about the ecological and managerial influences on rodent populations, especially relating to epidemics. If rodent epidemics are caused by or are exacerbated by current grazing land management practices then rodents have a significant impact on opportunities for pastoral risk management.

Poisoning campaigns have been carried out in many places but there seems, as yet, to be no proven control method for pikas. Similar problems are common throughout Northern China and Brandt’s vole (*Microtus brandti*) is a serious pest in Inner Mongolia.

**Chapter 4 - FEED AND FODDER**

4.1 Fodder production

Sown fodder is a new concept to the herders of the project area. They are being encouraged to grow oats, for hay, in walled sheep pens in summer as part of the Government’s four anti-disaster counter-measures (4CM). Oats are the most suitable fodder and have been widely used in the high altitude area of the province. Naked barley, which is widely grown in agricultural areas, could probably be used but is unlikely to be as productive. The only other forage in demonstration plots is vetch, probably *Vicia sativa*, which has been sown in mixture with oats in some plots. The vetch plants inspected had a few ineffective nodules, and no red nodules were seen. The lack of effective nodulation is not surprising since the seed had not been inoculated, no wild vetch was seen in the local vegetation and sheep pens would in any case be devoid of vegetation. If vetch demonstrations are to be persisted with seed should be inoculated. Commercial inoculant is available in China.

(1) Oats growing by herders

Oats are the only fodder identified as suitable for use in extension work in the project area. The growing season is adequate to produce a hay crop but not long or warm enough for seed production. Seed is produced in the agricultural areas of the province. All fodder oats are hulled forms of *Avena sativa*, although formerly naked forms of *A. sativa* (hexaploid) were common. Provincial research institutions have ongoing programmes for introducing and screening fodder oats. Their recommendations should be followed. The currently recommended cultivars for the conditions of the project area are Lena, Qinghai 444 and Canadian which are the best performing oats for the higher rainfall areas of Qinghai.

Government strategy is to encourage the growing of oats in walled sheep pens; these pens should be highly fertile if sheep are kept in them overnight for an extended period and the wall provides protection against errant stock and strong cold winds. The target figure is one third of an hectare (five *mu*) per household. This is rarely attained and most sheep pens are too small - a little over
Pastoral Risk Management Qinghai

At present the contribution of sown fodder to the overall feed availability in the project area is very small but there is considerable potential to provide more conserved fodder for use in periods of stress. The herders have no experience of cultivation or haymaking and a considerable effort in demonstration and training will be needed before they reach competence. While ploughing of open grassland to sow fodder or ‘improved pasture’ is strictly discouraged for environmental reasons there would be no objection to expanding fodder plots close to the homestead. The EU-funded Qinghai Livestock Development Programme reported that herders in its project area at Guoluo had enthusiastically taken up fodder oats production in sheep pens: over two thousand households were cultivating an average of 3.3 mu each, and achieving yields of 8,543 kg/ha. The practice seemed likely to spread.

(2) The Establishment of household based fodder production

Oats are sown in mid-May so, at the time of fieldwork, they were at the tillering stage. The quality of installation varied greatly from plot to plot. Land preparation had been either manual or by mouldboard plough drawn by a two-wheeled tractor. Two-wheeled tractors have a very large turning circle so are unsuitable for most sheep-pens. Animal drawn implements are not used. There is no tradition of animal traction in herding communities in the project area, although yaks are commonly used as draught animals and for riding. Seedbeds have generally been very rough and the one large ploughed plot inspected seemed to have been sown directly on to un-harrowed ploughed land which gave a very uneven stand with excessively dense ‘rows’ about 60 cm apart and little in between. Many of the hand-dug pens seen were also very rough with uneven stands. Greater care in seed-bed preparation is necessary.

Seed rates recommended locally are high but seed quality is sometimes mediocre. Current recommendations are 15 kg/mu broadcast and 8 kg/mu drilled; increased seed rate does not compensate for poor agronomy but on the grasslands there may be rodent damage. Broadcasting will require training and experience to get seed spread evenly – seed should be cast upwards, not thrown at the sower’s feet; hand-powered rotary seeders are available locally and are much more accurate than broadcasting by inexperienced herders. Some should be acquired by the DAAH for experiment. The walled sheep pens should be fertile if sheep have been kept in them for long enough. In some cases more sheep manure is added; herders have not developed systems for transporting manure.

(3) Seed supply

Seed supply for herder’s needs is assured in quantity and quality since oat seed of known quality and variety is readily available commercially. Qinghai is a major producer of oats in China. The Animal Husbandry Bureau established an oat seed base some time ago in Huangzhong county in a major oat-growing agricultural zone at about 2,600 metres. The base operates under technical advice from the local Grassland Station and is managed by a now private company. Breeders’ seed of recommended varieties is supplied to the Grassland Station by the Qinghai Academy of Agricultural Sciences. The Grassland station produces mother seed (of a range of recommended cultivars) which is sold to the company. The company arranges further bulking by farmers and supervises production; seed is purchased subject to inspection for maturity and purity. The seed is then cleaned and germination-tested before being sold. The area under oat seed in Huangzhong is close to 30,000 mu (2,000 hectares).
(4) Constraints to the expansion of oat growing

The main constraints to expanding oats haymaking in the project area are social and cultural.

- Herders have no tradition of growing crops, even the simplest cereals, nor of haymaking, since the local grasslands are not very suitable for hay.
- They may not be strongly motivated towards manual tasks associated with tillage and haymaking. Their skills with agricultural machinery seem low and even simple farming hand tools are absent from household equipment.
- Local material is lacking. Yak carts are unknown, and animals (and herders) are not trained for ploughing although yak ploughs would be much better suited to small pens than two-wheeled tractors. In the short-grass pastures above the tree-line there are no materials for basketry or cheap ropes and no poles for drying tripods and other haymaking uses.

Technical constraints are very few: oat varieties are screened at provincial level and seed is produced in the agricultural areas (where oat hay is also used) and is available in commercial quantities. The oat crop is already proven in similar ecological conditions and has been grown successfully on a small scale in the project area. Hand tools and machinery for oat growing are the same as those for growing cereals and are readily available in markets throughout the country.

Oat growing is very similar to growing wheat and barley – two of Qinghai’s main crops. Tools for mowing and handling hay, sickles and forks, are likewise available in markets. Weather at haymaking time will probably be a minor constraint since hay is best made after the first killing frost which may be in late September when days are shortening and temperatures falling.

(5) Haymaking

Hay is the most suitable means of conserving fodder under the conditions of the project area. General instructions are available. Site-specific guidelines on oat growing and haymaking are being developed and should be modified in the light of experience. (see training notes in Appendix 1). Drying may be problematic at haymaking time, in early autumn. Silage making would be even more problematic: low temperatures might cause slow fermentation; small silos often lead to high wastage once opened; silage is not an ideal feed for sheep. It is possible to make silage in small plastic bags which overcomes the wastage problem but this is expensive and labour intensive.

Hay should be made at the end of the growing season, in September when the maximum dry matter has accumulated and herders may be returning from the summer pastures. By that time days will be short, temperatures dropping and possibly there will be showers. Conditions for haymaking will not be ideal and there has been deterioration in store. Haymaking will have to be manual; herders may not own haymaking tools but suitable sickles and forks are on sale in the county town and in markets in agricultural areas. Two types of sickle are common: a heavy very curved short bladed type and the more traditional long (50 cm) handled sickle with a very slightly curved blade attached at almost right angles to the shaft; the latter is the main sickle used for cutting cereals and would be suitable for mowing oats for hay.

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4 J. Suttie, *Hay and Straw Conservation for Smallholder and Pastoral Conditions*. FAO, 2000. A copy has been deposited with the project:

Cutting date will be from mid-September when well-grown oats should be at the flowering stage and cut by frost. In haymaking the aim is to reduce the moisture content of the herbage to 15 – 20 percent as rapidly as possible to reduce losses from respiration, enzymatic action and leaching. The present method is to tie the herbage, after a period of wilting, into small bundles and place these to dry on top of the pen walls. The bundles should be turned a few times to ensure even drying but this is not always done. Secondary drying on tripods could improve hay quality but the project area is above the tree-line and far from a source of cheap poles. Oats often appear to be dry before the nodes have dried completely. Moisture content of hay on a few demonstration plots should be checked.

4.2 Fodder Conservation

(1) Household storage of hay and concentrates and fodder banks
The present contribution of hay to risk management is very small indeed; sound data on hay yields is not available but from the area sown it is obvious that not much is produced in relation to need. Haymaking is, however, worth persevering with since it requires few inputs other than herder effort and, if the five mu per family is reached, would make a useful contribution. One third of a hectare, well manured, may produce 1.5 – 2.5 tons of made hay which would make a positive contribution to ewe nutrition. Hay will probably mainly be fed to ewes, possibly mostly to the weaker ones; according to the baseline survey ewe flocks in Nanqi are about 130, in Jilong about 70. With a daily allowance of 500 grams of straw and some concentrates the ewes could be supplemented, assuming two tons of hay, for 30 – 60 days. Hay should be regarded as part of the routine winter feeding programme, not as something which should be stored for later use – second year hay would have deteriorated.

(2) Emergency fodder funds
Under normal conditions central or local government should not hold emergency fodder stocks. Hay is a bulky fodder of relatively low feed value; it is expensive to transport and store and it is not cost-effective to transport it over large distances. Households and local communities should produce and hold private hay reserves if the hay is produced locally. Otherwise, emergency fodder funds should be constituted of higher nutritive value feeds, such as bran and concentrates. Rules for management, release and turnover of government emergency stocks need to be established. Management of such emergency reserves to make them sustainable is complex.

Herders already buy concentrates but quantities declared in the baseline survey vary widely without relation to herd size. Purchased fodder is part of the routine feeding system. Storage methods are probably simple but modern shelters have dry-standing for storing feed and hay.

Buying and storing extra concentrates for winter to form a local fodder bank or reserve should only be encouraged if the autumn pastoral risk forecast is pessimistic about the prospects for the coming winter-spring period. Even well-stored forage deteriorates quite rapidly if not used. Storage by groups would be even more problematical than by households. Concentrates and agro-industrial residues are readily available on the market in Qinghai. The best option for reacting to emergency needs would be to have an emergency cash fund at country headquarters which herders could draw on for loans for advance purchases if the risk forecast signals a severe
risk of shortages in the following three to five months. County-level authorities should be able to call on the same fund to constitute a publicly-managed county level emergency stock. The dangers of this course of action – rapid physical deterioration of such reserves, and ‘routinisation’ (every year becomes a disaster year and the emergency stock becomes a normal part of seasonal feed deficit management by the local authority) – mean it should be approached with great care.

Technical details of hay storage are dealt with in the report of the international consultant on grazing management.

(3) Marketed fodder and hay
According to the Animal Husbandry Bureau of Huangnan Prefecture, hay is not made in marketable quantities in the project herding areas since the grassland is unsuitable for production of natural hay and the amount of oats grown is, at present, very small. Some oat hay is made in the farming areas but prices are high as are transport costs.

Agro-industrial by-products, mainly bran and rape-seed-cake, are readily available and more cost-efficient than hay as purchased feed. These can be purchased in the county town but in recent years have often been supplied to herders by traders from the farming areas. Only a small amount of hay has been sold locally at RMB 1 per kilo; rape cake is RMB 1.4 and bran RMB 1.2 per kilo which makes hay very expensive indeed. Herders who buy feed usually purchase either bran or rape cake; about 500 kg of cake and 1,000 kg of bran is an average yearly purchase by herders of the project villages. Concentrate availability is not a problem for herders who require and can afford them; formulated feeds are available in addition to by-products and cereals. Concentrates are mainly fed to ewes during the critical April-May period. In case of snow events concentrates are used to save stock; a few herders use them to fatten sheep. Yaks are deemed to be hardy enough to survive without supplementary feeding. Losses of 20 – 30 percent live-weight over winter are common.

The baseline survey shows great variations in feed purchase between households and counties. In Henan the average household purchase was 808 kg (range nil – 3,500), with feed per ewe averaging 6.2 kg (range nil – 16.2). In Zeku average household purchase was 763 kg range (400 - 1300) and feed per ewe 12.7 kg (range 4.3 - 26).

Stock were not being fed with hay and concentrate at the time of fieldwork. No feeding equipment (troughs, racks, mangers) was seen so hay and expensive concentrates are probably fed directly off the ground. It may be worth investigating simple feeding equipment to reduce wastage and soiling of feed.

6 1 US $ = RMB 8.2 at the time of writing
Chapter 5  ANIMAL BREEDING AND HEALTH

5.1 Assessment of current animal productivity

Yaks are the main subsistence stock. Sheep are more important for income, although wool prices are now very low. Mutton is important as a revenue source: some are sold direct off grass but nowadays many lambs are sold, in autumn, to farmers in the agricultural areas for fattening. Stock graze year-round although small stock may be sheltered in the worst weather. Stocks are vaccinated against epizootic diseases. The main diseases and parasites mentioned by herders were: hydatid cyst, lamb and calf diarrhoea, abortion (causes unknown), and ticks; internal parasites were not mentioned although they are certainly important. Mating season of yaks is in June-September, pregnancy duration 250 days. Mating season of sheep is September-November. Lambs may not be big enough for sale in the first year but herders aim at this – perhaps a reason for December lambing. Many lambs are sold to the agricultural areas for fattening.

Nearly all the feed comes from grazing and very little conserved fodder or concentrates are used. This means that the stock must be in good condition so as to survive the lean months of winter and spring – which involve severe weight loss. The animals are mostly small; the average weight of both yak and sheep has fallen sharply, almost to half. The reasons for the decline in livestock weight after privatisation of herds are variously attributed to poor breed maintenance and inbreeding, deficient and declining standards of husbandry. Probably all are involved.

Table 5 gives an example of the very serious deteriorating in the weight of yaks in south Qinghai.

<table>
<thead>
<tr>
<th>Age</th>
<th>1981</th>
<th>1998</th>
<th>Decline - kg</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td>13.27</td>
<td>11.74</td>
<td>1.53</td>
<td>11.53</td>
</tr>
<tr>
<td>1 year</td>
<td>122.88</td>
<td>83.01</td>
<td>39.87</td>
<td>32.45</td>
</tr>
<tr>
<td>2 years</td>
<td>183.19</td>
<td>109.68</td>
<td>73.51</td>
<td>40.13</td>
</tr>
<tr>
<td>3 years</td>
<td>241.26</td>
<td>135.23</td>
<td>106.03</td>
<td>44.06</td>
</tr>
<tr>
<td>4 years</td>
<td>253.52</td>
<td>143.89</td>
<td>109.63</td>
<td>43.24</td>
</tr>
<tr>
<td>5 years</td>
<td>300.06</td>
<td>156.42</td>
<td>143.64</td>
<td>47.87</td>
</tr>
</tbody>
</table>


Data from studies on yak weights in the project area during 2004 and 2005 are summarised in Table 6.

<table>
<thead>
<tr>
<th>Age (year)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight</td>
<td>59.88±9</td>
<td>97.85±14.5</td>
<td>167.16±29.8</td>
<td>201.02±44.2</td>
<td>249.92±50.5</td>
<td>270.80±50.8</td>
</tr>
</tbody>
</table>
It is necessary to build up information on stock weights for use in RAPS modelling. Rapid estimation of livestock condition can be done by visual examination and palpation; this will be useful for assessing animal physical condition in autumn. The procedures are described in detail in the report of the national consultant in livestock production. 7

5.2 Improving livestock resilience to risk

Possible animal breeding and health interventions to reduce winter risk include:

- modify the breed so that it is more resilient to extreme conditions;
- improve the health conditions of livestock so as to maximize the conversion of available forage and ensure the animals are in the best possible condition prior to winter;
- minimize exposure to winter conditions through provision of livestock shelters;
- reduce the overall livestock feed requirements through the winter so that per animal feed availability is maximized - this may involve the sale of livestock prior to winter or modification of mating management.

Herders keep local breeds of livestock but, over the past twenty years, the average weight of their animals has apparently dropped dramatically; this may be due to nutrition or breeding. Almost all the feed of livestock comes from grazing so grazing management is in theory the most important means of improving the condition of stock. However there seems to be rather little room for manoeuvre in terms of grazing management. Attention to disease control and good husbandry is necessary. ‘Improved’ yak and sheep varieties have been introduced but their performance is not yet known. Experiments started by the project should be continued since the initial signs are hopeful. The lack of accurate livestock numbers is a constraint on progress and should be remedied by a comprehensive livestock census.

Qinghai province has 36 percent of the total yak population of China, and a substantial part of China’s total sheep population. Yak and Tibetan sheep are therefore the key animals in a pastoral risk management strategy for herders in Qinghai. For generations herders have paid close attention to the breeding of their animals to promote resilience to extreme weather, and they are skilful at this. Future strategy in this field should be to build on herders’ experience by making new types of genetic resource available to them to experiment and adopt.

In terms of body size, meat production and environmental resistance, domestic yak production performance could be considerably improved by crossbreeding with wild yak. Nearly twenty years of research and application into the use of wild yak genes has demonstrated that upgrading domestic yak by cross breeding with wild yak is widely used in all yak rearing areas of China. These techniques provide a simple and practical way to improve the local yak productivity. Most importantly, they are welcomed by herders.

7 Xiaolin Luo, Draft Final Report, Livestock Management System. FAO
Experimental crossing of yak cows with Simmental and Holstein frozen semen started in the late 1980s and achieved notable hybrid vigour, but with an unknown impact on sturdiness and ability to survive extreme winters. This work stopped in 1989.

Experimental crossing of half wild yak bulls with yak cows started again under the TCP project in 2002 in Zeku county, although not yet in Nanqi village. The purpose was to investigate how best to promote resilience to extreme environmental conditions, including especially extremely low winter temperatures and acute feed scarcity. Improvement in body weight in both species was taken as the indicator of greater environmental resilience.

Sheep breed improvement started in the 1960s and 1970s with the introduction of fine wool breeds in response to a strong world wool market and high prices. Decisions about breeds to be selected were taken within the framework of the planned economy, without direct involvement of herders. With the introduction of the household responsibility system, sheep were allocated to herding households and household heads now made decisions about selection. A fall in wool prices resulting from the decline in the wool market in the 1980s provided disincentives to households to continue breeding for wool, and sheep improvement efforts had entirely halted by 1983. From the mid-1980s to the mid-1990s the proportion of improved sheep in the flocks declined rapidly, and by 2005 all traces of the fine wool sheep had disappeared.

Oula sheep are a native breed of Tibetan sheep, selected for their high meat potential. Crossed with Tibetan sheep in other plateau areas, they demonstrate powerful hybrid vigour. Oula sheep were experimentally introduced to the project area from 2002. The crossbreeds with local Tibetan sheep have much high productivity than the pure Tibetans in terms of weight at birth, weaning, one year and adult; in meat productivity, Oula sheep are 30 percent heavier than pure Tibetan sheep. Herders have enthusiastically adopted them.

Twenty households were selected for demonstration in Nanqi village in Henan county, and another ten in Jilong in Zeku county. The criterion for demonstration households was that the infrastructure was good, that the herdsmen had primary education, and access and communications were adequate. The work is described in detail in the technical report on the livestock management system. 8

The work was not far enough advanced by the end of the project for there to be measurable results. Local animal scientists remain convinced that the introduction of improved breeds from other parts of Qinghai, such as semi-wild yak bull and Oula ram, naturally mated with local yak and Tibetan sheep, are key measures for the genetic improvement of local animal under the present grazing system, thus improving the ability of herdsmen to manage risk in the longer term.

The crossbreeding plan is quite complicated, and cannot be implemented by single households. The tasks include how to make breeding plans, castrating yak bulls, measuring the performance of offspring, planning the cull rate for each generation, fixing standards for breeding stock selection, organising all herdsmen to cooperate in the market so as to get the benefits. The work should in future be co-ordinated by local herdsmen’s associations.

Breed improvements by introduction of new breeds are, however for the long term and their effect on risk will have to be monitored. The classic livestock interventions will continue to be the main work of both herders and technicians. The control of contagious diseases (which are a form of risk) must continue. Other interventions must be directed at having stock in good condition in autumn to better withstand the lean, cold season. Parasite control is important to ensure that stock benefit from their grazing. Herders should give full attention to selecting breeding stock (locally) and culling poor performers as well as marketing excess stock before winter. Many herders now have stock shelters at their winter quarters which assist in protecting small-stock from winter cold.

5.3 Veterinary measures for improving the animal health conditions

Veterinary measures play an essential part in winter preparation, especially control of parasites, vaccination, spraying, de-worming and dipping of animals, and establishing drug stocks and methods of administering them.

Contagious diseases are a serious form of risk and they, along with parasites, can weaken stock and make them even more susceptible to serious weather events. The prevention of infectious diseases and the control of parasites is a primary necessity in any livestock production system and also for any programme of risk management. This is well recognised in Qinghai and a strong veterinary service has long been established.

Information on the disease situation in the project counties is lacking since little investigative work has been done there in the past decade. Disease surveillance and monitoring is directed towards the detection of important disease events (such as occurrence of major disease outbreaks) and largely based upon passive acquisition of disease occurrence data - relying upon reports from herder technicians and anecdotal reports from herders.

Studies on parasites were carried out in the two counties during 2002 – 2005. Studies on internal parasites by coproscopy indicated that their incidence, especially intestinal worms, is very serious. Internal parasites include the stomach worm Marshallagia marshalli, trichostrongyles Nematodirus spp., Trichostrongylus spp., nodular worms Oesophagostomum, bowel worm Chabertia, whipworm Trichuris, the lungworms Dictyocaulus, Protostrongylus, the tapeworms Taenia echinococcus, Moniezia and Helicometra and the lancet liver fluke Dicrocoelium dendriticum. Ectoparasites include the ticks Hyalomma detritum and Haemaphysalis bispinosa, myasis, the sheep body louse Bovicola ovis, the sheep foot louse Linognathus ovillus, the sheep ked Melophagus ovis, warble fly Hypoderma bovis and the flea Vermipsylla.

Common infectious diseases of the yak are: pasteurellosis, anthrax, calf paratyphoid (salmonellosis) and bovine viral diarrhoea. Infectious diseases of sheep include braxy, struck, enterotoxaemia and sheep pox. Common non-infectious diseases are mastitis, trauma and eye troubles.
Animal Husbandry and Veterinary Stations at the Provincial, Prefecture, County and Township levels are responsible for overseeing and organizing all technical aspects of delivery of veterinary services. Each veterinary station is under the administrative control of its respective AAHB. The physical delivery of veterinary services is carried out by station staff (quarantine duties, outbreak investigations, supervision) and herder technicians (vaccination, parasite control and clinical services). Veterinary diagnostic laboratories have been established in the provincial, prefecture, and county levels. However, in the project area the county laboratories are poorly equipped and not used except to provide support during occasional field disease surveys or studies.

Herders are in theory organized into service cooperative groups comprising some 20 to 80 livestock-owning families, and the members of each group elect one of their number as their herder technician. Usually there is one herder technician per group in the project area. Training and technical supervision of the herder technicians are the responsibility of staff in the county and township stations. The salaries of herder technician are paid from the livestock tax levied on all herders by the county administration. County governors are responsible for the appointment, payment, dismissal and retirement of herder technicians.

The education level of herder technicians was found to vary widely: some had been trained for several weeks, whereas others have had no training at all. In the project area each herder technician takes care of 8,000 to 10,000 livestock. Each year herder technicians undertake 60 days of work, mainly vaccination. Their equipment is very poor, and they only have syringes.

Herder technicians play an important role in the veterinary system. It is necessary to improve their working conditions and salary, as well as organizing technical training to enable them to upgrade their skills so that they can carry out their duties competently. They must also be trained to improve herders’ understanding of disaster caused by disease.

Vaccination is a main measure to prevent infectious diseases. County and township veterinary stations are responsible for implementation of the annual vaccination programmes as directed by the Qinghai Agriculture and Animal Husbandry Bureau. Township stations issue vaccines to herder technicians who then vaccinate all livestock in their cooperative according to provincial policy. Staff from the township stations supervises the work of herder technicians. The vaccination programme is summarised in Table 7.

Table 7. Summary of the vaccination programme in the project area.

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Species</th>
<th>Class of animal vaccinated</th>
<th>Duration of protective immunity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasteurellosis</td>
<td>Yak</td>
<td>All, except calves</td>
<td>6-9 months</td>
</tr>
<tr>
<td>Anthrax*</td>
<td>Yak</td>
<td>In defined areas only. All, calves</td>
<td>9 months</td>
</tr>
<tr>
<td>Clostridium**</td>
<td>Sheep</td>
<td>All, except lambs</td>
<td>6 months</td>
</tr>
<tr>
<td>Sheep pox</td>
<td>Sheep</td>
<td>In defined areas only.</td>
<td>1 year</td>
</tr>
<tr>
<td>E. coli</td>
<td>Sheep</td>
<td>In defined areas only.</td>
<td>6 months</td>
</tr>
</tbody>
</table>
Notes: * Sheep are susceptible to anthrax but the recorded incidence in that species is very low and vaccination is not considered necessary nor economically justifiable.
** Contains antigens, which confer immunity to enterotoxaemia, struck, lamb dysentery and braxy.

The number of animals vaccinated in Zeku in 2005 is shown in table 8.

<table>
<thead>
<tr>
<th>Vaccination in Zeku county in 2005:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Total livestock number</strong></td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>Anthrax</td>
</tr>
<tr>
<td>Clostridia</td>
</tr>
<tr>
<td>Pasteurellosis</td>
</tr>
<tr>
<td>Paratyphoid of calf</td>
</tr>
<tr>
<td>Sheep pox</td>
</tr>
</tbody>
</table>

The degree of coverage seems reasonable in most cases at first sight but, since herders usually report fewer animals than they actually own, the true density of vaccination is lower than that shown which is taken from the official livestock population.

The incidence of parasitic disease is still very high, and causes enormous loss of livestock production, especially in winter and during natural disasters. Because of feed scarcity, animals become weaker and are easily affected by parasites which cause large numbers of fatalities and much debilitation in non-fatal cases. Herders are expected to pay for parasite control, which was previously supplied free by the government. Many herders are currently unwilling to pay for the necessary inputs, either because they are too poor or have not yet adjusted to the new economic environment which demands a far greater degree of self reliance. There is currently a serious funding shortage for both parasite control and clinical services, to the detriment of disease control. This is causing significant, as yet only partially quantified, losses to the livestock sector.

Vaccination is the major measure for preventing infectious disease; five vaccines are provided free of charge by the government (pasteurellosis, anthrax, clostridium, paratyphoid of calf, sheep pox). Because there are gaps in vaccination cover, there is a potential risk of infectious disease outbreaks. There are three main reasons for incomplete cover. First, herders make false reports of their livestock numbers since until last year herders were taxed on flock size; although the livestock tax was abolished in 2005 the situation did not change, since the local government has a policy of controlling stock numbers to combat overgrazing and pasture degradation. The second reason is that the herder technicians lack of transport and equipment, are poorly paid, have limited time and many livestock to treat over a large area, so their work is implemented ineffectively. Third, because there have been no serious diseases attacks in recent years, some herders do not realize the importance of vaccination, and do not cooperate well with herder technicians in the vaccination programme. All these reasons cause the existence of gaps in vaccination coverage.

Several types of disease, controlled by vaccination, have a common characteristic: they are caused by bacteria which can be survive for a long time in the nature environment or in animals’ bodies. Anthrax can survive in the soil, pasteurellosis in the respiratory tract. When animals become weak, they are easily infected by such diseases which cause sickness and death.
At present, parasite control is carried out twice a year, in spring and autumn. Project field work suggests that it would be preferable to treat the animals in January using Ivermectin, which can control both internal and external parasites effectively. Winter control is better than control in spring, since it can kill the parasites in their larval stage and reduce re-infection, prevent serious infection in spring, keep animals in good health for harsh winter conditions and improve their capacity to resist serious weather events. Death of animals due to weakening by parasite infection in spring would be reduced. In places with serious parasite infestation, Ivermectin would be offered again in March or April. Some seasonally active parasites, such as the ticks *Hyalomma detritum* and *Bovicola ovis*, will be controlled more effectively by using Butox.

In the past, the products mainly used were Albendazole and Ivermectin to control internal parasites; Dipterex and pyrethrum (*Chrysathemum cinerariaefolium*) were used to control external parasites. Now only Ivermectin and pyrethrum will be used. Dipterex has been prohibited.

**Chapter 6  MANAGING SEVERE RISK**

**6.1 Introduction**

The measures outlined so far deal principally with reducing the vulnerability of herders to long-term livelihood threats. This chapter deals with sudden severe threats to livelihood, which in Qinghai are usually caused by environmental factors such as drought or snow disasters, and how they can be managed.

Pastoral risk in Qinghai combines several elements. Summer drought may weaken the pastoral economy, and cause changes in everyday activities over the long term, making it more vulnerable. Summer drought reduces the physical condition of animals and their productivity, reduces household income, increases stress on people, animals and vegetation. But the trigger to a disaster is more often a sudden exceptional snow storm, or bad snow conditions and very low temperatures over weeks or months, which force households to take emergency measures. These measures will be much more efficient if they have been planned as far as possible in advance. The major actors will almost always be herder households and community organizations, but local and national government can support such local strategies and provide additional essential resources.

**6.2 Winter preparation**

Winter preparation by households, herder co-operatives, and by government, is a key risk management activity.

A well prepared household will have its own reserves of hay and concentrates. Warm and well maintained winter barns to protect adult and new born animals make an enormous contribution to helping herders cope with natural winter disasters. The four counter measures programme (4CM) has equipped most (but not all) herders in Henan and Zekou with winter barns and pens. This programme should be urgently extended to all households which have not yet participated.
6.3 Forecasting

Risk of winter-spring feed shortages and related threats
The most important cause of livelihood vulnerability for herders is insufficient feed for the household herd during the vulnerable winter-spring period each year, combined with a sudden major threat such as a severe snow disaster. Managing this threat makes it necessary to forecast two types of risk:

- first a forecast of animal feed available in autumn each year compared to the number of animals which will depend on it; this would include all related issues such as animal condition, disease status etc; this is called for short a ‘feed balance forecast’ although its scope would be much wider than simply the availability of feed;
- second a forecast of the likelihood of severe shocks to the system such as extreme weather conditions during that period; called in short a ‘severe risk forecast’.

Both forecasts need to be made in the early autumn so that decisions can be taken about the adequacy of preparations by herders and government if the worst happens. They should be published together in a ‘winter preparedness and risk early warning’ report each autumn.

Feed balance forecast
The main sources of information on which to base the feed balance forecast are:

(i) Livestock population: An essential part of risk planning is to have an accurate understanding of the total size and distribution of the livestock population of the province. At present this is not available. Livestock population figures are at best informed estimates. At village level herders and technicians have a much better idea of the number of animals, so estimates of the adequacy of feed and fodder resources to carry the livestock population through the winter-spring period and respond to any snow emergency are much better done at the village and township/county level. The recent decision to cancel taxes on livestock will remove a key constraint to obtaining reliable information from herders about the size of their flocks and herds.

(ii) State of pasture and availability of other types of feed: When RAPS is fully operational, it will provide data on fodder availability, livestock demand, potential winter-spring shortfall. Until this happens, existing pasture production and feed availability data will have to be used, including existing estimates of standing hay and other feed availability. Estimates are available in particular from the AAHB and the Meteorological service.

(iii) Animal condition: Estimates of condition of yak and sheep need to be gathered using among others the methods described by Xiaolin Luo through county AAHB staff and community organizations where they are active.

(iv) Animal health: Herder technicians need to be trained to report on a small number of key indicators, including animal health.

Severe risk forecast

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Existing meteorological bureau reports, especially the 3-6 month forecast, provide essential data for early warning of severe risk. The meteorological bureau also produces estimates and maps of pasture condition and trend.

### 6.4 Winter preparedness and early warning report

The information in the previous section will be compiled into an annual *winter preparedness and early warning report*, summarizing how well herders and the local authorities have prepared for winter, and what can be forecast about risks, especially weather and other environmental conditions. This report should be based on a combination of:

- comprehensive local monitoring by herder groups and local animal technicians of key indicators including, at the household level:
- outputs from the RAPS programme when available;
- reports by technical staff based at prefecture, county and township level;
- seasonal weather forecasts, remote sensing output (especially of vegetation dynamics and NDVI), and any other useful relevant information held by different parts of the administration.

Potential indicators for early warning include:

- Snow and other disaster-related meteorological forecasts;
- livestock condition and health,
- the state of pastures,
- levels of household feed reserves,
- the state of household winter preparations,
- likely household winter off-take of livestock;
- monitoring and forecasting rodents and pest populations and potential damage;
- monitoring and predicting grassland vegetation trends and fodder preparation activities;
- monitoring and forecasting the outbreak of animal epidemics and diseases;
- monitoring and forecasting grassland fires
- winter hay and feedstuff preparation

Information from these and other sources will be combined into the winter preparedness and early warning report, which will be issued each autumn. The report should be prepared by animal bureau staff, technical staff from other government services such as the Meteorology Bureau, with help from herder groups and knowledgeable herders. Forecasting should be based on both an analysis of scientific information, such as RAPS outputs and remote sensing data, and also on a general qualitative assessment of key indicators. The forecast would include wherever possible the views of herders themselves about the potential threats to their livelihoods. Hard data would include forecasts of likely weather conditions for 3-6 months ahead available from Meteorological Bureau, and the remote sensing information available from the same source.

Winter preparedness reports should be prepared at township/county level initially and completed and submitted upwards to the Qinghai Bureau of Animal Husbandry according to a strict annual schedule between September and November each year.
At first this process will inevitably be imprecise. However, over two or three years, and especially when the RAPS data come on stream, it should be possible to make reasonable estimates, accurate enough for useful preventive measures to be taken in advance when necessary.

### 6.4 Early warning stages

Based on the evidence of the winter preparedness and early warning forecast, a system of warning stages should be introduced. Local authorities (at county level) would assign the county a warning level on the basis of their September winter preparedness report and pastoral risk forecast. The warning stages would be confirmed or modified at provincial level. The warning stages are a standardised way of summing up information from many sources into a single statement about the vulnerability of a particular area to disaster in the forthcoming winter, and the actions to be taken. Proposed warning stages are: ‘normal’, ‘alert’, ‘alarm’, and ‘emergency’

### 6.5 Reacting to the forecast

A high quality early warning is still of very little use if it does not trigger early, well-planned reactions.

By early autumn each year, it should be possible to estimate whether there is enough feed for the animals known to be present to last them through the following six to eight months before the natural pasture starts to grow again. Although there are many imprecise figures, and several unknowns, a pastoral risk management forecast should be able to estimate the order of magnitude of the main factors involved.

An accurate forecast of whether available feed resources, including standing pasture, hay, concentrate and other stores held by individuals, by herder organisations and by local government, are adequate to support the over-wintering of the livestock population present at the beginning of winter, is a key element of disaster management. However, knowing that there is insufficient feed for the animals is only part of the story: to reduce the vulnerability of herders to a snow or other disaster, there has to be a plan to adjust livestock numbers to the estimated over-winter livestock support capacity.

If the livestock population significantly exceeds the total feed available, herders and local authorities should decide how to maintain the balance. The option of buying in more feed may be available, although in autumn it may be expensive, especially after a forecast of severe weather. The alternative is for herders to reduce animal numbers. There are five main ways for herders to reduce livestock numbers: (i) buy more feed, (ii) increase autumn slaughter, (iii) sell more animals, (iv) emergency migration to better areas, and (v) reduce mating to reduce the number of animals born in the crucial spring period. A pessimistic over-winter forecast should trigger efforts by herder group leaders and local officials to implement one or more of these strategies.
(i) **Buy more feed:** The animal feed market has been liberalized for many years and feed is handled by private traders. But fodder markets are small and inefficient in these remote areas. In case of disasters the Finance Bureau will subsidize formulated feeds; the present subsidy reduces the price from RMB 1.6 to RMB 1.2 per kilo, a reduction of 25 percent but still expensive for subsistence herders. Government needs to decide whether to subsidize the feed market further in bad years, using the early warning stages as a trigger to release the subsidies.

(ii) **Increase autumn slaughter:** Herders can be encouraged through their associations to increase the domestic slaughter rate of their animals if an unusually bad winter is forecast.

(iii) **Sell more animals:** Livestock markets are inefficient at persuading herders to sell before a crisis. If the autumn risk forecast warns that there is likely to be a bad winter ahead, many herders may try to sell animals, and prices will collapse, creating a disincentive to further sales. It may be necessary for government to intervene in livestock markets in this case, to support animal prices.

(iv) **Migrate to better areas:** There is little or no pasture unallocated to households in winter pasture areas, so this strategy is likely to be ineffective.

(v) **Reduce mating to reduce fodder demand next spring when young animals are born:** This practice, apparently not known in the project area, is common and effective in several similar countries, and should be discussed with herders.

Herder associations would be able to carry out, co-ordinate or encourage some of these responses.

**Managing the forecasting and early warning process**

The following diagram illustrates the proposed management structure for the early warning system and the information flows.
Responsibilities of county government in managing pastoral risk forecasting, early warning and rapid response

The functions and major activities that are the responsibility of county governments in the field of pastoral risk planning include:

- Plan and implement pastoral forecasting, risk management and rapid reaction measures through government line agencies, including County Government, the Agricultural and Animal Husbandry Bureau (including the grassland station and veterinary station), Civil Affaires Bureau and County Poverty Alleviation Office, etc. as well as their line agents at township level;
• Implement 4CM projects to strengthen long term disaster coping capacity;

• Organise and assist communities and households to prepare and store concentrate feedstuff and fodder for winter and spring;

• Construct pastoral roads to improve transport for remote pastoral communities;

6.6 Winter preparedness exercise

A part of the TCP objectives was to make proposals for better preparation each winter by herders and local government, and to develop and test an early warning and rapid reaction system to winter snow disaster. Through such a system, herders and local government would have an earlier warning of likely threats, more time to prepare, and greater capability to react to threats rapidly and effectively.

The project experimented during the 2004/5 winter with preparedness bulletins for Henan and Zeku counties. The bulletins included a risk forecast and the outline of a simple early warning system. The results were evaluated in summer 2005, and the lessons learned will contribute to a better design for more detailed winter risk management plans for 2005/6. The actual bulletins for Henan and Zeku is attached as Annex 5.

The chapter headings of the bulletins were as follows:

- Vulnerability profiles based on available statistics
- Level of local preparedness
  - Pasture adequacy as assessed by scientists, grasslands institutes and meteorological bureau, and by experienced herders
  - Weather forecast, meteorological bureau and experienced herders
  - Household hay and fodder reserves
  - Government feed stocks
  - Animal numbers
  - Animal health
  - Animal condition
  - Degree of implementation of four countermeasures
  - General level of household preparedness
  - General level of local government preparedness

An evaluation of these bulletins was carried out in summer 2005.

10 The methods used to research and write these winter preparedness reports are described in a project note Winter Preparation Reports and Pastoral Risk Forecasts: Background Notes and Methods. November 2004.
SECTION 3
KEY POLICIES AND STRATEGIES TO STRENGTHEN
DISASTER RISK MANAGEMENT AND REDUCE HERDER
VULNERABILITY

Section three of this report proposes an integrated policy agenda which establishes, in spite of the
need for further investigations on some aspects, guidelines for a comprehensive pastoral risk
management strategy for livelihood systems in Qinghai similar to those in Jilong and Zeku
counties.

Chapter 7 STRATEGIES TO MANAGE PASTORAL RISK AND
REDUCE VULNERABILITY

A successful programme to reduce pastoral risk and vulnerability in Qinghai means building on
and complementing structures and approaches already successfully in place, such as the 4CM,
and creating new strategies to enhance the ability of herders and herder communities to manage
risk. The policies of the provincial government must encourage such strategies.

The project identified twelve strategies directly relevant to pastoral risk and vulnerability in the
pilot areas and Qinghai province as a whole. The range of these issues goes beyond the scope of
the original TCP design which had, during project preparation, identified a more limited number
of key issues; these were researched by the TCP and presented in depth in section 2 of this
report. It is nevertheless crucial to consider in the PRM policy agenda a broader picture as
outlined by the twelve complementary strategies presented below. It is important to highlight
how inter-connected the strategies in different technical fields are. Reducing pastoral
vulnerability to risk in south eastern Qinghai will depend on an interlinked and coordinated
implementation of all the strategies in several technical disciplines.

This chapter presents the key elements of the proposed provincial pastoral risk management
agenda for adoption by the provincial authorities. The involvement of all levels of decision-
making in drafting and approving the strategy was important, because implementation will
depend on wide agreement and understanding of the objectives and means of risk management.

The proposed agenda is composed of 5 mutually reinforcing components, each presented as a set
of strategies. They are:

I. GRAZING AND PASTURE RESOURCE MANAGEMENT
- Strategy 1  Measuring and monitoring grazing resources
- Strategy 2  Managing grasslands

II. WINTER FEED

- Strategy 3  Feed and fodder production
- Strategy 4  Fodder markets, fodder banks and emergency fodder funds

III. LIVESTOCK PRODUCTION, BREEDING AND HEALTH

- Strategy 5  Animal production and breeding
- Strategy 6  Improvement of animal health

IV. ENCOURAGING HERDER RESILIENCE TO PASTORAL RISK

- Strategy 7  Early warning and rapid reaction system for PRM
- Strategy 8  Improved housing and infrastructure
- Strategy 9  Promoting herder cooperation

V. POLICY AND INSTITUTIONAL FRAMEWORKS FOR PRM

- Strategy 10  Mainstreaming PRM within a reshaped pastoral economy
- Strategy 11  Financing PRM
- Strategy 12  Improving governance for PRM

The agenda was discussed in detail and endorsed by the project TCP wrap up workshop involving high level representatives from provincial prefecture, county and village level. It should be finally endorsed by herder co-operative groups where they exist or are being formed. The capacity of all these organisations to manage a successful risk management strategy will need to be strengthened.
I. PRM AGENDA COMPONENT: GRAZING AND PASTURE RESOURCE MANAGEMENT

Strategy 1: Measuring and monitoring grazing resources

Standing hay at the end of the growing season in September/October is the chief component of winter feed for livestock, and, taken together with estimates of livestock numbers and physical conditions, determines whether the following winter/spring will be easy or difficult for pastoral households. Measuring or estimating this standing crop is an essential part of a risk management strategy.

A simple and rapid method of estimating standing forage availability at the end of the growing season, combining visual information with basic measurements, is needed for quick and accurate estimates of the current situation, and is a key part of a pastoral forecasting system. Such a method should be suitable for use by local technicians and experienced herders. Standardised reporting and handling of results will allow forecasts to be made on whether winter feed shortages are likely, and their possible severity.

A system of pasture monitoring has been in place in Qinghai for over a decade and has built up sound databases of information on grassland yield and growth patterns. The techniques used are labour-intensive so the number of sites which can be dealt with is limited; this prevents adequate cover of the various pasture types and quick assessment of standing herbage in autumn over a wide area which is required for risk assessment.

The project developed a methodology (RAPS) to collect and process these data much faster and more efficiently than systems currently in use. Together with an electronic pasture probe, used in conjunction with classical sampling, the RAPS system would allow standing herbage to be measured and analysed at a great number of sites very quickly; a probe was acquired by the project but arrived too late in 2005 for training in its use by the international consultant.

Recommended actions are:

- **Introduce pastoral resource assessments based on RAPS methodology**

  As described in chapter 2 of this report, the project developed an innovative approach to resource assessment in pastoral systems (RAPS). RAPS software can integrate grassland, livestock and climatic data, can provide accurate forecasting of threats to the herding economy, and can trigger pre-planned reactions.

  The project recommends that RAPS should be adopted by the AAHB as a primary tool for information collection and analysis in pastoral risk management. RAPS should be integrated into the Bureau’s routine work at provincial and lower levels. It should not be treated as a separate, parallel programme.

  For RAPS to reach its full potential, more, or more accurate, information is needed: mapping of vegetation types; verification of livestock numbers; and greater sampling cover for vegetation analysis.
Pastoral Risk Management Qinghai

- **Pasture mapping**

  The areas of different pasture types and their emplacement are not well known. Mapping the Qinghai grasslands using available remote sensing and GIS technology is urgent and will provide a baseline for use of the pasture probe and other methods to give a more accurate assessment of grassland yields.

- **Use of pasture probe**

  An electronic pasture probe should be used in conjunction with classic methods of herbage assessment.

- **Training**

  Further training and practical experience will be needed to make the RAPS system operational. If the system is accepted province-wide as a useful way to gather and analyse data on pastoral systems, substantial training will be needed at field level to collect production and use data, as well as in the analysis. Further training will be facilitated by use of the user manual and the software, both of which exist in English and Chinese, developed by the project. Further training is needed especially on the use of the pasture probe and the use of RAPS software.

- **Establish and maintain a regularly updated data base on livestock and pasture:**

  Present livestock numbers and grassland components and types are not well known, and existing statistics are very unreliable. Without more accurate numbers and a regular update, it will be impossible to plan in detail for the improvement of pastoral livelihoods and environmental conservation. In addition, accurate data on animal numbers and distribution are the essential basis for planning a vaccination strategy.

  The priority is for a detailed and comprehensive census of livestock, taken at regular intervals. The census should be based on a sample household survey, with cross checking of official statistics. The AHHB should investigate the utility, in Qinghai circumstances, of short-cut methods such as low level aerial survey.

### Strategy 2: Managing grasslands

The grassland use pattern is directly impacted by the pastoral land tenure and use right. The current grassland tenure rules arising from the dual responsibility system introduced in 1985, have had a far reaching impact on the herding economy. The grassland tenure system put in place in the early 1990s has many advantages, and some disadvantages.

Recommended actions to further improve the current grassland management system:
• **Systematic review of the current land tenure policy and its impact on grassland management**

In the project area, 50 year, non-rolling leases were issued in 1999. They run out in 2049. Some land inheritance, transfers of land and sub-leasing takes place, but it is essentially a closed system. People can leave and sub-let their land to others already in the system, but there can be no new entrants or major changes in and allocation before the leases run out, unless new legislation is passed.

Now would be a good moment to review the tenure system and the fencing of pasture which has followed. The lessons are important not only for the TCP, but also on a much larger scale for the Three River project, and the Qinghai Lake project, in both of which pastoral land tenure should be a central issue. There needs to be a review of experience in operating the 1985 grazing act, the tenure aspects of the 4CM and similar programmes. The functioning of the pasture lease system over the last twenty years and its contribution to risk reduction are key topics. Tenure issues specifically concerning a long term PRM strategy include:

- length and content of leases;
- problems which have arisen so far
- whether rolling leases would provide more security to herders and encourage more private investment;
- investigate whether new legal provisions are needed to regulate transfer of leases, including inheritance and sub-leasing;
- investigate whether there is a need for new forms of lease conditionality, for example maintaining ecological quality in the leased area, or preparing and adopting a local risk management plan? 
- investigate the impact of different types of pasture land lease on risk management?
- move towards a legal framework for the changes now under way: eg
  - recognise in law the growth of pasture renting provisions between individuals or community groups and encourage renting systems
  - deal with equity issues such as access to water located on land parcels allocated to individuals.

• **Formulation and implementation of amendment regulations**

New proposals about how best to manage pasture tenure might include:

- An extension of the areas of pooled and collectively managed winter-spring grazing, within which there should be a place for small fenced household winter grazing reserves. If small groups organise to pool and jointly manage their winter-spring pastures, fencing costs would be reduced considerably.

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11 With a rolling lease, at the end of each year, one year is added to the expiry date of the lease so that, if the lease conditions have been met, the leaseholder and his potential inheritors always have the same period of lease security ahead. This provides much greater security of tenure.

12 Lease conditionality is common in many areas where pastures are leased. Conditions include that the lessee will for example maintain a desired high value vegetation or landscape, not pollute or water, will undertake specified measures such as fencing or tree planting. The leased area is inspected every 1-5 years by the owner and the lessee can be warned about infractions. In extreme cases the lease can be terminated.
Local grassland management regulations might be formulated and implemented at the autonomous prefecture level in reference to *The Grassland Law of 1985* for effectively dealing with these issues. Regular inspection of implementation status of grassland management regulations should be carried out by county grassland station and upper level governmental law inspection institutions.

- Encourage inter-household and inter-community transfer of grassland use rights by concluding lease contract against compensation payment.
- Wrap up the grassland use rights, responsibilities for grassland management and vegetation protection obligations together as legal amendments to the current grassland lease contract.
- Encourage and enable herder cooperatives to play more coordination roles in community grassland management, especially in mediating resource utilization conflict.

**Reserve winter grazing areas**

At present some households have on their own initiative created small fenced and manured grassland reserves close to their winter house. These should be encouraged, but with care that too large an area is not fenced off.

Most serious disaster-caused economic losses occurred for the households with large number of livestock and limited winter pasture for emergency grazing. In Zeku, households with limited pastoral resource and large number of animals rented grassland for over winter and emergency grazing from households with relative large grasslands and a small number of livestock and neighbouring townships closed to Zeku county town. These practice should be encouraged by the county AAHB and the village committee.

**Improving grassland productivity**

It is unlikely that herders will spontaneously reduce herd size, without adequate direct or indirect compensation. At present stocking rates there is general agreement that there is little scope to improve animal productivity by better pasture management alone. Irrigated grassland is not a suitable option for herders in the project area and breaking open grassland to sow pasture is officially discouraged for environmental reasons. Reseeding of severely degraded land may be possible, but not in the short term.

In these circumstances, productivity gains will have to come primarily through a mix of activities, only some of which are directly related to pastoral tenure: an extension of the areas of pooled and collectively managed winter-spring grazing, within which there should be a place for small fenced household winter grazing reserves; increased haymaking; and use of supplementary feed including concentrates. One further area where there might be productivity gains from pasture management is in the balance of use between summer and winter pastures, the first being sometimes underused and the latter often overused.

**Improved control of soil degradation**

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13 The law was amended in 2002 by the People’s Congress
Black beach soil formation follows a sequence of sedge degradation, rodent burrowing, wind and water erosion, sedge mortality and increased bare ground, root shearing by frost heaving, and continued wind and water erosion.

Seriously degraded grassland should be re-vegetated, grazing density on moderately degraded grassland should be reduced to allow natural regeneration of the grasses and moderately degraded grassland should be disk-harrowed to loosen soil to allow natural regeneration; livestock grazing should be controlled on lightly degraded. Black beach rehabilitation using these methods has a productive stand life between five and eight years. The reseeding alone is not enough and fundamental changes in grazing management will be required to avoid recurrence of degradation. This is the sort of task a herders’ association or cooperative can undertake effectively.

II. PRM AGENDA COMPONENT: WINTER FEED

Strategy 3: Household based feed and fodder production

Growing and conserving hay and other fodders and purchasing concentrates are key risk management activities for households. In the current household contracted pastoral land tenure, a household based feed and fodder production system for winter preparation should be established.

Recommended actions are:

- **Intensified oats production for haymaking**

Hay should be a part of the normal feeding routine, and households should aim to incorporate hay growing, making and storage into their seasonal cycle. Government should promote this idea through all the extension outlets available to it.

Herders in the project area are being encouraged to grow oats for hay as part of the government’s four counter-measure programme. Oats are the most suitable fodder and have been widely used in high altitude herder extension work elsewhere in the province. Government strategy is to encourage the growing of oats in walled sheep pens in summer. The target figure is one third of a hectare (five mu) per household; this is rarely attained and most sheep pens are smaller than 5 mu, some small ones only a little over half a mu. At present the contribution of sown fodder to the overall feed availability in the project area is very small but there is considerable potential to provide more conserved fodder for use in periods of stress. The herders have no experience of cultivation or haymaking and a considerable effort in demonstration and training will be needed before they reach competence. While ploughing of open grassland to sow fodder is actively discouraged for environmental reasons there should be no objection to expanding fodder plots close to the homestead, or taking a small part of the winter pasture and re-fencing for fodder production purpose.
• **Manure application for fodder production**

In the project area some herders have started to enclose (with wire netting) small private grassland reserves close to their winter camps. They manure the natural pasture inside the pens, and are getting good yields. This should be encouraged.

• **Intensified use of feed concentrates**

Concentrates are available in market places and are part of most herders’ winter feeding routine. Herders should be encouraged to continue purchasing fodder concentrates in accordance with the annual winter risk forecasting system proposed in strategy 7. Government should monitor the supply of concentrates in accordance with the forecast of winter conditions. During severe crisis cash loans may be made to herders from the emergency cash funds held at county level to enable them to buy fodder.

Coordinated wholesale purchase of concentrates and joint transportation by herder’s groups or herder’s cooperatives should be encouraged.

• **Provision of technical services and training to households on fodder production**

Since herders lack essential techniques and skills in fodder production, county AAHB and grassland stations should provide extension and training services to herders. The following services should be provided:
- technical training on oats cultivation and haymaking;
- technical advice during the preparation of the pens or plots and the growing season of oats;
- oats seeds to herder households

**Strategy 4: Fodder markets, fodder banks and emergency fodder funds**

Hay and fodder production should be encouraged at the level of individual households. On the basis of past experience, village fodder banks are unlikely to be successful in Qinghai circumstances and should not be pursued. Herders already buy concentrates but the quantities vary widely without relation to herd size. Purchased fodder is part of the routine feeding system, and the development of fodder markets should be encouraged in participation with herder’s cooperatives and under support of local government.

**Recommended actions are:**

• **Strategic use of emergency fodder stocks**

Under normal weather conditions, central or local government should not hold emergency fodder stocks. Hay is a bulky fodder of relatively low feed value; it is expensive to transport
and store and it is not cost-effective to transport it over large distances. Households should produce and hold their own private hay reserves if the hay is produced locally.

Emergency fodder stocks may be constituted by local government at a higher level in the administration (county or prefecture) as part of a risk management strategy. They should contain high nutritive value feeds, such as bran and concentrates. Rules for management, release and turnover of government emergency stocks need to be established. Management of such emergency reserves to make them sustainable and responsive to the emergency need is complex. Effective and precise early warning is an instrument for increasing the degree of responsiveness of the emergency fodder supply.

Buying and storing extra concentrates for winter to form a county or prefecture fodder reserve should only be undertaken if the autumn pastoral risk forecast is pessimistic about the prospects for the coming winter-spring period. Even well-stored forage deteriorates quite rapidly if not used. Storage by groups would be even more problematical than by households.

• **Support development of fodder markets**

Concentrates and agro-industrial residues are readily available on the market in the farming areas of eastern Qinghai counties. Provincial, prefecture and county governments should incorporate fodder market development into the regional development planning and formulate preferential policies to encourage fodder trading between the eastern farming and pastoral areas. Herders’ cooperatives should also be encouraged to provide services to their members in wholesale fodder purchase.

• **Emergency cash fund**

The best option for reacting to emergency animal feed needs would be to have an emergency cash fund at county headquarters as a part of a coherent risk management system. Herders could draw on such a fund for loans for advance purchases if the risk forecast signals a severe risk of feed shortages in the following three to five months. County-level authorities should be able to call on the same fund to constitute a publicly-managed county level emergency stock. The dangers of this course of action – rapid physical deterioration of such reserves, and ‘routinisation’ (every year becomes a disaster year and the emergency stock becomes a normal part of seasonal feed deficit management by the local authority) – mean it should be approached with great care.

**III. PRM AGENDA COMPONENT: LIVESTOCK PRODUCTION, BREEDING AND HEALTH**

Good herders have for generations paid close attention to the breeding of their animals to promote resilience to extreme weather, and are skilful at this. Herders keep local breeds of livestock but, over the past twenty years, the average weight and productivity of their animals has apparently dropped.
According to project findings, the following reasons may be involved in declining productivity:

- Malnutrition in young animals caused by competition for milk between people and calves. For adult animals, almost all feed comes from grazing so grazing management is in theory the most important means of improving the condition of stock. However there is not much room for manoeuvre in terms of grazing management.

- Inbreeding in small herds: In the current household-based individual grazing system, inbreeding within small herds has degraded genetic productivity. Most herders do not recognize the importance of inbreeding.

- Animal health: The state veterinary service is established at grassroots level. However, due to lack of skills and insufficient township and village veterinarians, vaccination and diseases treatment is not of high quality. A lack of accurate livestock numbers (herders report many fewer animals than they actual have) is a constraint on vaccinating 100% of animals. In extreme cases, 15-20% of animals are not vaccinated.

### Strategy 5: Animal production and breeding

The classic livestock interventions will continue to be the main work of both herders and technicians. The control of contagious diseases must continue. Other interventions must be directed at having stock in good condition in autumn to better withstand the lean, cold season. Parasite control is important to ensure that stock benefit from grazing. Herders should give full attention to selecting breeding stock (locally) and culling poor performers as well as marketing excess stock before winter. Many herders now have stock shelters at their winter quarters which assist in protecting small-stock from winter cold.

Recommended actions for improving animal productivity and breeding practice are:

- **Innovative breeding strategies**:

  1. Within-herd selection: Selection of animals with the best performance and higher resilience to cold weather from within household herds; using the best performing bulls for inter-herd reproduction, locally called “transferring-the-bull breeding scheme”. This should be the first breeding strategy for improving production performance;

  2. Hybrid breeding: Introducing genetic resources from other varieties to improve the productivity of yaks and sheep. Such as hybrid breeding, using yaks and yellow cattle, can increase lactation performance. However, acclimatisation to the harsh feed and grazing conditions should be a goal for such inter-variety breeding.

- **Piloting improved yak and sheep varieties with herders**

  Improved yak and sheep varieties have been introduced but their performance is not yet known. Experiments started by the project should be continued since the initial signs are hopeful. Genetically improved stock are often more are risk in extreme environments than
the native breeds. Any programme to change the genetic makeup of local yak or sheep must be extremely closely monitored for any indication that risk to herd is being increased.

- **Creating and using ‘elite’ herds and flocks**

  The current natural inbreeding practice should be replaced by mating with high performance or ‘elite’ male animals. The creation of elite herds and flocks of genetically superior animals as the basis for spreading access to these genetic resources more widely needs to be supported by new institutions including herder cooperatives. The tasks include setting standards, certification and record keeping, compiling breeding plans, deciding which bulls to castrate, measuring the productivity performance of offspring, planning culling rates for each generation, making criteria for breeding stock selection. Systems appropriate to Qinghai need to be developed.

- **Developing multipurpose indicators of animal resilience**

  Better indicators of animal condition and resilience are needed as part of the winter risk forecast, and as a guide to which animals should be sold or culled if necessary. The main indicator used at the moment in this and other studies is weight gain. While important, weight gain is not the only indicator useful in this respect. Given that the ultimate goal is to improve livestock resilience, there is a need to develop more accurate, probably multipurpose, indicators of resilience. Weight gain could in some circumstances be misleading: heavier animals may be more vulnerable, need more feed, and perform less well on chronic feed shortages.

- **Yak and sheep body condition measurements**

  The methodologies developed by the TCP project for estimating yak and sheep body condition provide a useful guide to rapid methods for the autumn pastoral risk assessment and should be adopted as a part of that assessment. It is recommended that these methods be adopted as the standard methods for use in Qinghai. Information on stock weights is needed for use in RAPS modelling. Rapid estimation of livestock condition, using visual examination and palpation, should be used for this purpose.

- **Training**

  Training courses on how to manage breed improvement are important. Themes would include: how to select the best breeding stock; how to make breeding plans; how to improve breeding stock; alternative ways of increasing the offtake rate; how to evaluate body condition before winter in order to eliminate weak and sick animals in order to reduce grazing pressure.

**Strategy 6: Improvement of animal health**

Vaccination is the major measure for preventing infectious disease. Five vaccines are provided free of charge by the government (pasteurellosis, anthrax, clostridium, calf paratyphoid, sheep pox). Most animal diseases local to the project area are effectively controlled by the annual
vaccination programme. But parasitic diseases are still a serious problem and a major risk for livestock production. The incidence of parasitic disease is still very high, and causes large losses for livestock production, especially in winter and when natural disasters happen: feed shortages weaken the animals, and they then easily get infected by parasites. Large numbers of animals may die.

**Recommended actions are:**

- **Improve the veterinary care system**

  Herders and planners should accept that the present model of veterinary care is in most ways a reasonable adaptation to scarce resources and to the logistic difficulties of delivering animal health care to a widely dispersed and partly nomadic population. However there may be situations where the veterinary health care system, designed in the collective period when most livestock belonged to the collective, is not fully adapted to the new situation created by the household responsibility system. The willingness of herders to pay for drugs may be an example.

  Veterinary care should be strengthened. The role of herder technicians, acting where possible in the context of and with the support of, herder associations, is crucial.

- **Disease monitoring and livestock census**

  At present there is a largely passive system for disease reporting relying on herder technicians and anecdotal reports from herders to warn the veterinary specialists at township and county level of disease outbreaks or chronic persistence. Field surveys are currently mainly on an *ad hoc* basis.

  Accurate and reliable livestock population figures will be an essential input into RAPS and the risk early warning system. A comprehensive livestock census for Qinghai should be carried out as soon as possible. Provision should be made for such a census to take place at regular intervals (between 5 and 10 years), with a regular update between the main censuses.

- **Upgrading the skills of herder technicians**

  The herder veterinary technician system seems, at its best, to work well, given the size of the task and the scarcity of resources. However there are problems which should be addressed urgently. These include:

  a. Wide variation in the level and length of training: some have trained for a year, some have no training at all;

  b. Herder veterinary technicians are sometimes confronted by an impossible task – in some cases there is one technician for 10,000 livestock;

  c. Drug and anti-parasite products are in insufficient supply;

  d. Levels of equipment are variable, although mostly low;
Salaries are low. Upgrading the skills of herder veterinary technicians would be a cost-effective way of extending good quality animal health care to herders. This requires more training, including training in disaster early warning and reaction, better equipment, more extension, better salaries and conditions of service, and greater recognition by government and the community.

- **Adapting vaccinations to real stock numbers**

Vaccination (in which an important role is played by the herder technicians) is at present quite successful in keeping major infectious diseases under control. However there are problems: vaccination is not yet reaching enough animals to guarantee herd immunity, mainly because herders under-report their herd size, and because the herder technicians lack transport, equipment, and motivation to reach all the animals. The success of vaccination in keeping major disease threats at bay in recent years has also led some herders to doubt the importance of vaccination.

To correct for under-reporting of herd size, vaccine supplies should be increased by 20-40 percent over the number of livestock officially enumerated. In the longer run an accurate livestock census is essential. Timely delivery of vaccines to herder technicians is essential; otherwise they find it difficult to complete the vaccination campaign before the period when the disease occurs.

- **Timing of parasite control**

At present parasite control takes place twice every year – in spring and autumn. This could be replaced in most areas with a single campaign in January, using Ivermectin. A second campaign could be organised only in especially badly infested places in March or April. It is believed this would be a more cost-effective strategy. Herders are now expected to pay for parasite control, which was previously supplied free by government. Many herders are currently unwilling to pay, either because they are too poor or have not yet adjusted to the new economic environment. The government needs to explain the reasons for the charge more clearly to the herders. Herder associations would probably make this task easier.

- **Better use of veterinary laboratory service**

The veterinary laboratory service at all levels (county, prefecture and provincial) is under-utilised. These laboratories are an important resource for animal disease control and should be supported.

- **More active role for herders’ associations and family enterprises**

Animal health services can be greatly facilitated by herder associations which encourage herders to find joint solutions to their problems. Such associations can capture economies of scale in service provision, and can provide high levels of social capital and mutual support. Upgrading of veterinary services should be planned with this in mind. The AAHB should
investigate the degree to which the development of family-based livestock holdings requires different models of disease control and animal breeding from the previous more centralised methods. New types of disease control and veterinary service may need to be established. Sustainable development of drug supplies and services need to be established.

- **Herder technicians and veterinary staff involvement in early warning and rapid reaction**

Herder technicians and veterinary staff have a critical role to play in planning for and reacting to pastoral risk: in designing and implementing risk prevention and risk management strategies, compiling the annual winter preparedness and risk forecast, contributing to the early warning and rapid reaction system. They must be closely involved in these activities from the start.

**IV. PRM AGENDA COMPONENT: ENCOURAGING HERDER RESILIENCE TO PASTORAL RISK**

**Strategy 7: Early warning and rapid reaction system for PRM**

The main thrust of pastoral risk management is to reduce herder vulnerability and manage long term threats to stability and growth of pastoral communities. However, PRM should also be able to counter sudden severe threats to livelihoods. In Qinghai, such threats are usually caused by environmental factors such as drought or snow disaster.

Disaster episodes often arise from long term processes through which the pastoral economy is weakened and made more vulnerable. But the trigger to a disaster is more often a sudden exceptional snowstorm, or bad snow conditions and very low temperatures over weeks or months, which force households to take emergency measures. These measures will be much more efficient if they have been planned well in advance.

**Recommended actions are:**

- **Develop locally adapted risk assessment and management plans**

  Based on the project experience of drafting, implementing and evaluating a winter preparation and pastoral risk forecast for Henan and Zeku counties for winter 2004/5, government should further develop and standardise the methodology used to prepare such bulletins, and extend the area covered so that the entire province is covered by such bulletins by 2010.

- **Forecast risk of winter-spring feed shortage and other over-winter risk**

  Using methodologies (especially RAPS when operational) described in strategy 1 of this plan (‘Measuring and monitoring grazing resources’), the government should develop a province-
wide system to assess adequacy of grazing and feed reserves for forthcoming winter. The AHHB should operationalise RAPS as soon as possible. Until RAPS data and conclusions become available, it will be necessary to use existing methods to assess pasture and feed adequacy and over-winter prospects. A delay in the full operationalisation of RAPS must not serve as a reason for delaying the development of the pasture monitoring and assessment system.

- **Introduce regular winter preparedness and risk forecast bulletins**

Winter preparedness reports should be based on comprehensive monitoring by herder groups and local animal technicians of a set of key indicators including, at the household level: livestock condition and health, state of pastures, household feed reserves, state of household winter preparations, likely household winter off-take of livestock. The winter preparedness reports should be prepared at township/county level initially and completed and submitted upwards to the Qinghai Bureau of Animal Husbandry according to a strict annual schedule between September and November. Winter preparedness reports should also contain a long distance weather forecast and a set of early warning signals. On the basis of this information county authorities will declare a particular warning stage for their area. These warning stages (normal, alert, alarm, emergency) will trigger a set of activities appropriate to each stage.

- **Adjusting the livestock-feed balance**

If the livestock population significantly exceeds the total feed available for the following winter-spring period, herders and local authorities should agree on a course of action, essentially to buy in more feed or reduce animal numbers. Local government at township and county level should take the lead in organising such discussions and implementing the conclusions.

- **Emergency responses**

A set of appropriate responses, planned in detail in advance and triggered by the early warning stages, should be developed. Responses will be defined in advance of specific threats like frozen snow disasters in consultation with herders and technicians at village, township, county and higher levels.

Responses will include an emergency plan to (i) encourage higher levels of sales of animals by herders by subsidising livestock traders costs or supplementing the sales price directly, (ii) reduce the price of formulated feeds and concentrates; (iii) trigger the opening of a local disaster emergency fund.

**Strategy 8: Improved housing and pastoral infrastructures**

Through the 4CM programme which includes the support to construction of winter shelters for livestock and of permanent houses for the herders, the Qinghai Provincial government has already paid particular attention to housing and infrastructure for pastoral herders. The PRM
agenda strongly recommends the continuation of the programme with some modifications to be included.

**Recommended actions**

- **Better targeting and increased subsidy level for poor households in the context of existing 4CM programme measures**

  Government should extend the 4CM programme and subsidise up to 100 percent of the cost for poor herding households, starting with the construction of winter barns. The target should be that all households possess a winter barn by the year 2010.

- **Include additional elements into the 4CM programme to improve pastoral infrastructures**

  Poor transportation and communication infrastructures are major constraints for delivering emergency relief to affected households during snow disasters. 4CM programme should also address and include support to improve pastoral roads to the villages and sub-villages including small bridges, levelling tracks, etc., as well as the communications infrastructures which is important for timely emergency relief, and also for weather broadcasting and early warning;

  For that purpose government should increase public investment funds to pastoral areas. Since all pastoral communities are poor and lack community funds, funds for infrastructure improvement should be covered by governmental grant. Herders should contribute their labour to construction of this infrastructure and facilities.

**Strategy 9: Promoting herder cooperation**

Government has important responsibilities in preparing for and managing risk, but present formal institutions are sometimes inadequate to address the variety of tasks related to PRM in a co-ordinated and efficiently manner. Individual households, on the other hand, lack the flexibility and resources necessary to manage risk effectively and are often particularly vulnerable to risk. Community organisations however are well placed to complement government responsibilities for PRM at local level, since they are closest to the herders or even composed of herders, and can pool resources and capture economies of scale. But community groups on their own can not do everything.

Some formal herder’s cooperatives have been launched in Qinghai during the last few years, which in coordination with local government could take specific responsibilities in PRM. In addition, the TCP found a range of informal herder neighbourhood groups operating on a collaborative basis. With further support and capacity building they have good basic potentials for launching voluntary and trust-based cooperative development among herders. They might provide also an excellent option to promote cooperation based on them demands of herders and
white matches the management and other capacities of herders to absorb support from government and donor agencies

**Recommended actions are:**

- **Awareness raising**

  Cooperative development in project areas is at an early stage and it needs significant further effort and support from provincial and local governments to achieve the targeted objectives. Top down approaches to cooperative development should be avoided since they are often associated with a lack of attention to the identification of needs, as well as to the absorptive and management capacities of beneficiaries. There is a risk of inefficient use of resources including significant government contributions to establish new cooperatives, at least in the short term.

- **Promote demonstrations of collaborative actions**

  Some of the newly established formal cooperatives and informal herders’ organizations have potential as demonstration sites to promote and replicate collaborative actions. They need further support and institutional strengthening and management to develop as demonstration sites.

- **Define responsibilities/tasks of local stakeholder groups in PRM**

  Provincial and local government need explicitly to create a dialogue with herder community organizations and also with informal neighbourhood groups and others to agree on county level PRM strategies and the distribution of responsibilities and tasks between local stakeholder groups, based on comparative advantages and skills required for certain tasks.

- **Recognize the importance of informal groups and their comparative advantages**

  Government at all levels needs to recognise that existing informal groups can provide the basis for expanded collective action and for the formalisation of community organisations.

  Other sections of this PRM strategy highlight the TCP assessment that informal groups have good potentials to improve risk management capabilities of herders through information sharing. This is particularly the case of technical issues such as hay making, fodder planting, household preparation, non-herding income generation and social networks covering collaboration between the poor and rich. Local government and field technicians need also to recognise the potential contribution of community organisations to creating more demand-driven government services.

- **Training and capacity building**

  Tailored capacity building and training processes for community organizations to empower them as partners in economic development and PRM need to be designed and implemented.
Training topics should include:

- management and institution building;
- elementary accounting/book keeping;
- basics of farm management, marketing, sustainable pastureland management and conflict resolution techniques.

Facilitated discussions between group members using participatory techniques will help to identify priority needs as well as responsibilities of the groups and their individual members, and make them understand how collective actions and PRM would benefit each member.

V. PRM AGENDA COMPONENT: POLICY AND INSTITUTIONAL FRAMEWORKS FOR PASTORAL RISK MANAGEMENT

Strategy 10: Mainstreaming pastoral risk management within a reshaped pastoral economy

If it is to become sustainable, pastoral risk management has to be incorporated into the mainstream of government development strategy and relevant programmes.

The Qinghai livestock economy needs to position itself to take advantage of a likely growth in demand for livestock products arising from increased population growth and urbanisation, the new market opportunities created by the Qinghai - Lhasa railway and new roads; the potential for stratifying animal production between mountain grazing and agro-industrial fattening under which herders produce young animals on grassland, sell for fattening to eastern farming areas of Qinghai (but a price structure that shares the gains equitably between different stages in the chain is difficult to achieve).

There is an urgent need to ensure that the herders’ interests are not ignored in the two major environmental programmes (Three Rivers, Qinghai Lake). The success of those projects depends on positive herder involvement. This requires:

- Development of a new models of sustainable pastoral livelihoods and herder-friendly nature reserves in the 3R region, in which herders are partners in ecological regeneration, not enemies. Planning and designing of major program interventions and relevant policies should involve herders and community stakeholders;
- A multi-stakeholder negotiation mechanism for resource compensation should be established. A voluntary and socio-economically feasible resettlement scheme should be promoted for herders living in the core and buffer zones of 3R (Henan and Zeku county are identified as buffer zone areas) with full compensation;
- Assist herders and pastoral communities who want to leave pastoralism to develop new alternative livelihoods which can conserve the ecological systems and achieve sustainable social and economic development.
Recommended actions to achieve this are to:

- Integrate pastoral risk management into the provincial 11th five year plan;
- Integrate PRM into the DAAH 11th five year plan and link the pastoral risk management initiatives into the governmental regional and sectoral development programs;
- Scale up the TCP recommendations and integrate them into the Three River Ecological Conservation Programme (3R-Program) via DAAH; Allocate a certain proportion of funds from 3R-Program for construction of PRM long term risk avoidance infrastructures
- Integrate PRM into on-going pastoral development projects and programmes
- Integrate PRM with the national poverty reduction programme.
- **Link into the ‘national natural disaster management strategy’**

**Strategy 11: Financing pastoral risk management**

The best risk reduction strategy in the long term is equitably-distributed economic growth. The prospects for sustained growth in the livestock sector are good, but will require careful planning by the livestock authorities. Worldwide, including China, there is likely to be a sustained increase in demand for livestock products, including those produced by pastoralists in extensive livestock systems. This is because of growing human population; more urbanisation; larger household incomes; more consumption of livestock products. Taken together, this suggests a large growth in demand for livestock products. The Qinghai livestock economy needs to position itself to take advantage of this. Well-designed growth in the livestock economy will reduce pastoral risk substantially but requires support from government and the scientific institutions.

**Recommended actions are:**

- **Increased government investment**

  The justification for government spending tax revenue from lowland, downstream areas in the sparsely populated mountain watershed areas is that the ecological stability of lowland areas can easily be upset by land misuse in the watershed areas. Increasing floods in the lowlands may be the first sign that such upland changes are already happening.

  The following categories of provincial government expenditure are particularly important in the context of pastoral risk management:
  - First, further investment in risk mitigation infrastructure (eg winter barns, fodder stores, communications systems, roads and tracks linking remote and vulnerable areas to larger population centres and markets) is essential if remote rural areas are to
be protected from natural disasters to the same level as the rest of Qinghai. This process has started – for example through the Four Counter-measures policy – but it has been halted, perhaps temporarily. Because the 4CM policy required matching funding from herders for capital items such as winter barns, in general richer herders were able to benefit, but poorer herders, unable to provide the matching funds, did not benefit. Government needs to redefine the 4CM policy and include within it a subsidy element for poor herder households so they do not fall behind rich households in this respect and become more vulnerable to natural and other disasters.

- The second category of government investment in the pastoral economy concerns the role of subsidies more generally. Subsidy payments to farmers should include an element for supporting the maintenance of particular types and characteristics of landscape. If the government wants to protect the watershed areas in order to secure downstream land uses, and protect towns from flooding, it is right that upstream land users and especially herders should be subsidised to achieve this.

- The third category of essential government expenditure on risk management concerns disaster mitigation and emergency needs. Government needs to explore the best way of creating and managing emergency funds for natural disaster relief.

**Mobilizing private finance**

Investment in risk management activities should not only be the responsibility of government. There is an urgent need for private financial initiatives in the risk management field. Government should create an economic and legal environment and institutional support conducive to the growth of micro-finance initiatives, private financial institutions and financial incentives for risk management. Government should also be ready to guarantee rural disaster insurance schemes in the early stages when they are most vulnerable.

- Conventional savings and credit schemes designed specifically for herders and linked to risk management;
- New types of loan (for example with new types of collateral, using subsidized lower interest poverty loans) for herders to encourage them to make private investments (eg in wells or animal health) for risk reduction;
- Introduce index insurance for pastoral animal husbandry. Basic terms for index insurance should be based on variations of weather, a grassland production measure such as NDVI, or livestock mortality.
- New approaches to herder micro-finance through herder co-operative and other groups rather than individuals.

**Mobilizing governmental institutional support for financing the PRM**

These financial products for supporting the PRM are new concepts for Qinghai, and need to be tried experimentally before being implemented across the whole province. Government needs to act as a back-stop in pilot schemes, providing a guarantee to private sector actors while they develop durable financial products.
Government needs to explore the best way of creating and managing emergency funds for natural disaster relief, including stand-by funds which can be accessed rapidly in an emergency.

Government should create an economic and legal environment and institutional support conducive to the growth of agricultural banks, micro-finance initiatives, private financial institutions and financial incentives for risk management.

Current subsidies may tend to favour richer households. Poorer households may not be able to pay even the subsidised price. Government should examine its subsidy programme to assess (i) what its impact is on risk, (ii) whether subsidies are effectively reaching those people who most need them.

- **Set up a transparent PRM fund management system**

Subject to the mobilization of resources PRM funds should be established at county, prefecture and provincial levels as part of governmental annual public budget for supporting local PRM actions. Budgeting process and allocation and channels for governmental PRM funds must be operated in a transparent way. An independent fund auditing and monitoring mechanism should be established to insure the funds will be provided to the planned target communities and herders.

**Strategy 12: Improving governance for pastoral risk management**

Government has important responsibilities in preparing for and managing pastoral risk, but present formal institutions are sometimes inadequate to the task. Community groups also have an essential role to play, in ways that should complement government’s. A review of the ability of government and communities to respond rapidly and efficiently, and in a co-ordinated manner, is needed. A fundamental prerequisite to addressing the demands of herders and communities, is that a bottom-up risk management planning mechanism complements the currently dominant top-down planning approach. A start in this respect has been made. Herders’ representatives, community leaders and representatives of herder cooperatives should be closely involved in the risk management planning process. Government should request that risk impact assessment studies become an integral part of all project preparations that involve herders and other groups chronically exposed to recurrent risks.

**Recommended actions are:**

- **Improve the legal framework**

There is a need to design and adopt a legal and policy framework which:

- rewards herders for maintaining and enhancing ecological security in the watershed of 3R, and desired maintains a desired landscape, which is the basis of any major expansion of tourism;
- encourages development of specialized markets for livestock products;
- emphasises quality above quantity in production;
- develops adequate bio-safety procedures;
- develops and protects specific trade marks and copyright regional identities for particular products (e.g. “Qinghai yak butter”).
• **Strengthen governmental functions and capacity in PRM**

There is a need to review government’s ability to respond rapidly and efficiently to pastoral risks. The results of the review will contribute to formulating a plan of institutional capacity building for PRM. Institutional capacity building for PRM through staff training and improvement of the institutional facilities should be incorporated into the governmental development programs.

• **Build up partnerships between government organizations and herder and community organizations**

Provincial and local government need explicitly to create a dialogue with herder community organisations and also with informal neighbourhood groups and others to agree on a PRM strategy initially at county and province level. It should be recognized that the community associations are better equipped to manage some aspects of PRM than government.

• **Strengthen stakeholder cooperation and coordination**

Co-ordination and information exchange between government agencies in the field of PRM needs to be improved both vertically and horizontally. The existing Pastoral Emergency Coordination Committee (PECC) at county, prefecture and provincial level should be the coordination body. The mandate of the committee should be extended to coordinate between all related stakeholders and all issues related to PRM and emergency response.

Under coordination of the PECC, the following PRM task designation matrix can be developed and agreed among different stakeholders. Table 9 presents the tasks in RPM of different line agencies and stakeholders in Qinghai

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<tr>
<th>Tasks and functions</th>
<th>Responsible Institutions and Stakeholders</th>
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Table 9. Responsibilities for PRM task
| Policy formulation implementat| Provincial government, |
| coordination | PRM Coordination Committee at provincial, prefecture & county level |
| Risk planning | Provincial AAHB, County AHB, Grassland Station, herder’s groups |
| Winter Preparation | Herder households; herder cooperation, AHB |
| Fodder production | County and prefecture Grassland station; herder groups |
| Animal health care | Veterinary station at prefecture, county and province |
| Animal breeding | AHB, herder cooperatives |
| Early warning | County Grassland station, meteorological bureau, TV, Radio, etc. |
| Emergency relief | County government, AHB, Grassland station, Civil Affaire bureau, etc |
| Funds and financing the PRM | Provincical Commission for Development and Reform; Department of Finance ABC, RCC, AAHB, Auditing Bureau, etc |
| Training and technical service | County AAHB, Grassland Station |

**Strengthen the pastoral extension service**

In the much changed atmosphere of China’s economic boom, the concern with very large environmental conservation programmes, and in view of the new attitudes towards herdeing livelihoods, there should be comprehensive review of requirements for a better, tailor made pastoral extension service.
Appendix

1. Report on participatory survey methodology and baseline study


3. Report on grazing management, fodder production and year round Feeding systems

4. Report on ranch management

5. Report on the livestock management system

6. Report on animal health and breeding