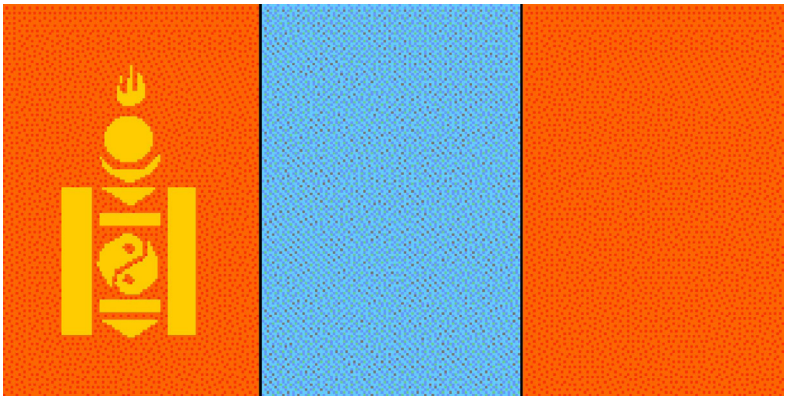
Country Pasture/Forage Resource Profiles

MONGOLIA



by
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CONTENTS

1. INTRODUCTION

Mongolia is one of the few truly pastoral countries; its economy depends almost entirely on livestock, with little crops, forestry or industry. It's cold, arid climate is only suitable for extensive, transhumant grazing with local, hardy breeds, which is still practised with few inputs other than the hard work and skill of the herders. This ancient grazing system has proved itself for many centuries and remained sustainable through the political changes of the past century. The grazing lands are in good condition and the local breeds intact and thriving; this contrasts with the situation in some neighbouring countries which now face the consequences of excessive use of exotic breeds and reliance on bought, imported winter feed.

Mongolia lies between 42° and 52° N and 88° and almost 120° E. About half the land is above 1 400 m. It is completely landlocked (see Figure 1), bordering Russia, Buryatia and China; well-defined natural boundaries delimit the Mongolian steppe; the Altai and Gobi Altai mountains to the west and Southwest, the Khangai mountains in the North Centre, the Gobi desert to the south and the taiga to the north; these do not facilitate trade or transport. Access to the sea is through the Chinese port of Tianjin, 1 000 km from the frontier. There are few hard-surfaced roads; the main Russia–China railway traverses the country (with change of gauge at the border), but few internal lines. Livestock move to market by droving, other commodities have to be transported over poor, unsurfaced roads and tracks.

Grasslands and arid grazing cover 1 210 000 km² (80% of the land area) and forest and forest scrub 150 000 km² (10%). Some 90 000 km² are said to be used in settlement and infrastructure and 52 000 km² in national parks. The arable area is under 10 000 km², all mechanized, large-scale farms; some has fallen out of cultivation since the demise of the state farms (about 7 000 km² are estimated to be recoverable). About 80% of the country, therefore, is extensive grazing exploited by traditional, pastoral methods. The five main biogeographical zones are: (i) High mountains (70 000 km²), (ii) mountain taiga (60 000 km²); (iii) forest-mountain &steppe – mixed forest and grazing (370 000 km²); (iv) dry steppe grassland (410 000 km²); (v) Gobi – desert steppe and desert(580 000 km²). Extensive livestock production is, by far, the country's major land use and industry. See Table 1.

Table 1. Land resources

Land use	Percentage	Area km²
Total land area		1 500 000
Grasslands and arid grazing	80.7	1 210 000
Forest	6.9	104 000
Saxaul forest in Gobi	3.1	46 000
Arable*	0.5	7 000
National parks	3.5	52 000
Hay land*	1.3	20 000

** = Figures from early nineties - much now fallow*

Most of the population, about 80%, is Mongol; the extreme west is inhabited by Kazahks and there are some reindeer people in the extreme north, Buryats, Tuvans and other Mongol-related peoples make up the rest. The total population has

Figure 1. Map of Mongolia

risen sharply, more rapidly than livestock numbers, tripling since 1950 (see Table 2). The degree of urbanization rose very steeply on collectivization – originally urban dwellers were only 15%, but ten years on this had risen to 40% and by 1989, the end of the collective period was 57% – including those in the *sum* centres. The 1997 figures show a slight decrease in the proportion (but not number) of town dwellers – perhaps reflecting some families returning to herding.

Table 2. Population (,000)

Year	1950	1960	1970	1980	1997	1998*
Total	772.4	968.1	1 265.4	1 682.0	2 387.0	2 422.8
Rural and urban population						
Year	**1956**	**1963**	**1969**	**1979**	**1989**	**1997**
Urban	183.0	408.8	527.4	817.0	1 161.1	1 226.3
Rural	662.5	608.3	670.2	778.0	877.9	1 127.0
Total	845.5	1 071.1	1 197.6	1 595.0	2 044.0	2 353.3
Urban %	15.3	40.1	44.0	51.2	57.0	52.1

** According to the World Factbook the July 2006 estimate was 2 832 224 and the growth rate 1.46%.*
Source: State statistics office

The rise since 1950 has been large and rapid, projections for the next twenty years show a near doubling! Education from 6 to 16 has been compulsory for many years and the level of literacy in the population is very high. There are strong training institutions to university level - many post-graduates have trained abroad. There are technical schools in each *aimag* More girls than boys follow secondary and university studies - their families do not require them for herding and there are adequate women to attend to dairy duties.

The herders all practise transhumance; this means that they must move seasonally with their livestock on the pastures. They live in *gers* (yurt in Russian), cylindrical, domed structures with a wooden framework covered with felt. The *ger* is free-standing, not held in place by guy-ropes like a tent. While the *ger* is easy to take down and erect and domestic equipment designed for ease of transport, the moving of the family's *gers* and baggage requires frequent hard work and transport. Fuel for cooking and heating is generally dried dung, except in the forest zone where firewood is also used.

Mongolia is rich in wildlife; its herds share the grazing with antelope, gazelle, elk and deer. Rodents are widespread and can cause much local damage to grassland through feeding and burrowing, control was once done through poisoning but this has stopped, there are abundant predators, hawks, buzzards, eagles and foxes which feed on them. Wolves prey on sheep and in the Gobi Altai the protected snow-leopard may cause damage.

Crops and industry are very minor components in the national economy; mineral resources have yet to be tapped on any scale, the forest is relatively small in area and slow-growing. Agroindustrial processing, almost entirely livestock-based, has contracted since economic liberalization. Traditionally herders did not till the land, their economy and life-style was entirely pastoral; the climate gave little incentive to do so with the technology available. A little irrigated cropping, mainly wheat and barley, was done in the region of the Great Lakes; the grain was parched and ground to a pre-cooked flour (similar to the "tsampa" of Tibet). When suitable agricultural machinery became available during the second half of the twentieth century, however, it was possible to undertake large-scale cereal production. In some of the less unfavourable areas of Central Mongolia over a million hectares were cultivated. The land used was, of course, among the best pasture. Some fodders (discussed below) and potatoes were grown but the area was small compared to that of grain. The technology used, based on a rotation of alternating strips of crop and fallow, was adapted from Canadian practice.

State farms and *negdel* in suitable sites produced enough grain to meet the population's needs - more cereals were eaten during the collective period than before or now. FAO 1996 quotes a 40% reduction in the consumption of flour to 1992. In a semi-arid area with a very short thermal growing season, all agricultural operations must be carried out very rapidly, especially seed-bed preparation and sowing; yields potential is low, production methods had, therefore, to be extensive and highly mechanized. Considerable seasonal risk is involved; harvest can be difficult through dull summers delaying ripening, early frost or snow. Cropping is not attractive to smallholders. Production was highly mechanized, field sizes large, over a square kilometre. Harvesting was by combine harvester, often with assisted drying. Straw was recovered and handled mechanically – some was ground up as a component of "concentrate" feed. The fallow had to be cultivated in summer to control weeds and prepared for the coming year's crop.

Since the collapse of the former producing organizations, the crop area is greatly reduced, although some companies are still active. There are many financial as well as technical problems, including seed supply, and competition from imported flour. The country is now very much dependent on its neighbour

Table 3. Mongolia statistics for livestock numbers, beef, veal, sheep, goat meat and milk production, goat and sheep exports and beef and veal exports for the period 1996-2005

Item	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Cattle nos. (,000,000)	3.3	3.5	3.6	3.7	3.8	3.1	2.1	2.1	1.8	1.8
Camel nos. (,000)	367.5	357.9	355.4	356.5	355.6	322.9	285.2	253.0	256.7	256.6
Sheep nos. (,000,000)	13.7	13.6	14.2	14.7	15.2	13.9	11.9	11.8	10.8	11.7
Goat nos. (,000,000)	8.5	9.1	10.3	11.1	11.0	10.3	9.6	8.9	10.7	12.2
Horse nos. (,000,000)	2.7	2.8	2.9	3.1	3.2	2.7	2.2	2.0	2.0	2.0
Beef and veal prod. (,000 mt)	89.9	86.6	99.3	104.6	113.4	66.9	60.7	43.6	52.3	47.0
Sheep meat prod. (,000 mt)	93.2	78.5	90.1	96.7	90.0	76.6	74.9	61.9	65.1	67.0
Goat meat prod. (,000 mt)	28.1	25.9	30.1	32.2	30.0	28.0	20.0	19.0	33.0	35.0
Total Milk* prod. (,000 mt)	337.3	370.7	402.1	524.0	434.6	350.3	336.5	347.0	386.6	359.0
Goat+Sheep exports (nos) (,000)	59	62	65	72	110.5	115.3	100.3	80.2	80.2	n.r.
Beef and veal exports (,000 mt)	3.4	7.0	7.2	14.0	16.3	14.6	15.6	9.8	10.5	n.r.

Source: FAO statistics 2006 n.r. = no record

** Total milk production for cows, sheep, goats and camels.*

for grain supplies, a problem for national food security. Much of the former arable is in tumble-down fallow, the area is not known but it is estimated that 700 000 ha might be recovered for cropping; this provides some grazing but would require continual weed-control work if it is to be cropped. Straw is not, therefore, an important source of fodder.

Details of livestock numbers, meat production and exports are given in Table 3. Also reference should be made to Tables 4 and 7 as there are slight differences depending on the source of the statistics.

Changes in administrative systems in the twentieth century

The cold, arid climate is well suited to extensive grazing and transhumance which best makes use of pastures where forage availability in any one place can vary greatly from season to season and year to year. The ancient, original systems were transhumant with a wide range of possible travel. In the late thirteenth century Marco Polo described Mongol transhumance and their *gers*. The country's pastures have probably always been heavily stocked, hard grazing is a historical phenomenon, not something of recent development. Kharin *et al* (1999) quote Przhevalsky (1883) who "said that all suitable agricultural lands were reclaimed and all grazing lands were overloaded by livestock." Feudal land ownership was done away with on the founding of the Mongolian Communist State in 1921; transhumance continued with government supervision.

A fundamental change took place in 1950 with the collectivization of the livestock industry; while this facilitated the provision of government services and marketing (and probably control of a nomadic population), it decreased the range over which herds could travel and thus reduced opportunities for risk-avoidance in times of feed scarcity. The unit of management was the *negdel* covering the same area as a single district (*sum)*; it was primarily an economic unit responsible for marketing livestock products, supplying inputs and consumer goods as well as fodder and transport services to members; it provided health, education and veterinary services. Although livestock was collectivized, each family could keep two livestock units (*bod*) per person, so about a quarter of the herd was under private control (see Table 11).

During the collective period, the Government intervened heavily in livestock production through the provision of breeding stock, fodder, marketing, transport and services. It was a heavily subsidized production system which did not allocate resources efficiently. The loss of mobility through collectivization was compensated by the production of supplementary forage and a State Emergency Fodder Fund (SEFF) was established to provide feed during weather events which would threaten survival but, with heavily subsidized transport and undervalued prices, herders soon became dependent on it as a regular source of feed. By 1991 the SEFF, handling 157 600 tonnes, had become a major component of the state budget. A network of stock-routes allowed slaughter stock to be trekked to market, fattening en-route. There were marketing and primary processing facilities for hides, skins, wool and cashmere.

Eighteen a*imag* » provinces were subdivided into 225 districts "*sum*", in turn divided into brigades. *Negdel* HQ had administration, schools (boarding), medical facilities, a veterinary unit, communications, recreational facilities and shops. *Negdels* were set production quotas and paid accordingly with bonuses –

the system was production driven. A vast number of salaried administrators and specialist staff was built up at all levels, especially in the capital.

Negdel were divided into production herding brigades and were further sub-divider into *suuri* - individual units made up of one to four households (*sur).* There were other, salaried brigades for haymaking, mechanization etc. Brigades set production targets for each *sur* determining the quantity of meat, wool and other products to be delivered according to the annual state procurement order. A *sur* was usually involved in the production of single-species herds for which a monthly salary was paid (each household, however, had private livestock for subsistence). Pasture management was organized along rational lines and the seasonal movement of herds (and resting of grazing land) planned by the *sur.* Emphasis was on output rather than pasture improvement but the system did assure better pasture management than to-day's anarchy. Hay lands were reserved and managed separately from grazing.

The *negdel* were privatized in 1991; this was meant to take place in two stages. Thirty percent of *negdel*s' assets were distributed between members; a further 10% of the livestock was distributed to *sum* inhabitants (administrative and health workers etc.). The remaining 60% of assets was formed into a limited liability company; these companies were generally unsuccessful and the livestock industry reverted towards its earlier family-based transhumance. Sometimes the stock was distributed without the formation of a company.

2. SOILS AND TOPOGRAPHY

The level to undulating topography of the Mongolian plateau is frequently interrupted by low mountain ranges and is surrounded by rough topography. Luvic Xerosols associated with Orthic Solonchaks occupy the largest part of the land, the steppes of the Gobi desert. Associations of Haplic Yermosols and Orthic Solonchaks also occur there. Luvic Kastanozems associated with Orthic Solonchaks occupy a large area in the north and east, the best of Mongolia's pasture lands. Mountain ranges are covered by Lithosols associated with Luvic Xerosols or Haplic Yermosols (FAO/UNESCO 1978).

3. CLIMATE AND AGRO-ECOLOGICAL ZONES

The climate is cold, semi-arid and markedly continental (see Appendix). High mountain ranges isolate the country from the influence of the Atlantic and Pacific climates; the Siberian anticyclone determines the low temperature in winter and the low precipitation. The frost-free period at the capital is around 100 days. There are four distinct seasons: a windy spring with variable weather – spring rain is especially valuable to get the pasture growth started before the main summer rains – a hot summer when the main rains fall in the earlier part, a cool autumn and a long cold winter with temperatures as low as $-30^{0.}$ The growing season is, therefore, generally limited to about three months. Precipitation is low, mainly in the warm season between June and September; the largest grazing areas, the steppe and the mountain steppe and forest, get between 200 mm and 300 mm annually; the desert steppe receives between 100 and 200 mm; the desert gets below 100 mm; only the northern zone has over 300 mm. Most of the precipitation returns to the atmosphere through evapotranspiration; about 4% infiltrates to the aquifer and 6% contributes to surface flow. Strong winds (with velocities in excess of 20 m/second) are common in spring and early summer and then dust storms can cause disaster to people and livestock.

Major biogeographical zones are shown in Figure 2. There are five major steppe zones with different livestock production capacities. The Khangai-Khosvol region in the north-west is mountainous with scattered larch forest. It includes Arkhangai, Khovsgol and part of Bulgan and Zhagvan *aimags;* this is mixed grazing with yaks replacing cattle at the higher altitudes. Selenge-Onon in North Central (Tuv, Selenge and parts of Bulgan) is the main area of agricultural production. These two regions drain to Lake Baikal. Altai (covering Uvs, Bayangoli, Khovd and parts of Zhavakan and Gobi-Altai *aimags*) is a high, mountainous, area with internal drainage and contains large lakes. In the north of the region this

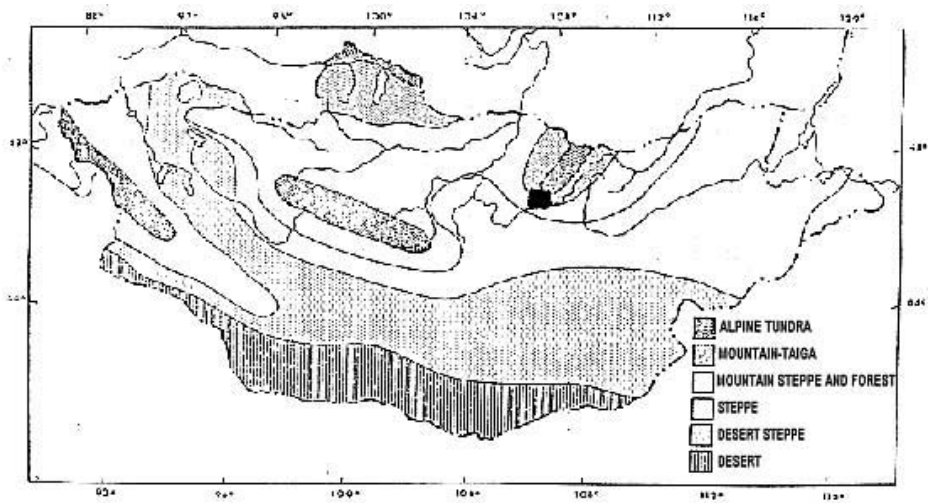

Figure 2. Map of biogeographical zones

again is grazed by the main types of livestock with yaks; there is some localized fodder and horticultural production under irrigation in the lower parts. The Central and Eastern steppes (comprising Dornod, Hentii, Sukhbaatar and parts of Dorongobi and Dungovi) are characterized by broad, treeless plains; of which the Herlen river traverses part; the primary activity is herding of horses, cattle, sheep, goats and camels. Gobi (mainly Bayankhongor, Omnogobi, much of Ovorkhangai and parts of Dungobi, and Gobi-Altai) is desert steppe and desert; used for grazing camels, horses, cattle and goats with very limited hay harvesting; drainage is internal; oases produce vegetables and fruit.

4. RUMINANT LIVESTOCK PRODUCTION SYSTEMS

Grazing livestock production

Mongolia's livestock are raised at pasture in traditional, extensive grazing; this is the best, and in most cases the only, type of exploitation to which the grazing lands are suited. Livestock are herded on the open pasture, by mounted stockmen, and return to the camp each night, to be penned or tethered, although camels may be left at pasture. The intensive sector, which was government-run on state farms, has largely broken down since it could not be based on natural pasture and depended on large external inputs of feed. Local cattle are poor milkers and exotic dairy cattle require good, warm housing to survive the long winter; provision of feed for housed dairy stock is expensive and forage for the eight-month winter has to be saved during a three-month growing season. Some small semi-intensive dairying is developing in peri-urban areas and where cropping and grazing land intermingle. Swine and poultry numbers have fallen drastically since decollectivization. Nowadays livestock are privately owned: over 95% were in private hands at December 1998; there were 83 600 herding households with 409 600 herders. The average household herd was 170 head; 71% of the total herding families have herds between 51 and 500 head.

The major infectious diseases have been under control for many years through regular vaccination. Recently veterinary services in the field have been privatized; the state still supplies vaccines, free of cost, for the major diseases but herders now have to pay their veterinarian to deliver and carry out the vaccination. Dogs were, previously, licensed but are now breeding rapidly and their numbers are uncontrolled. Gid, "circling disease, as translated locally", of sheep is common; dogs are intermediate hosts of a tapeworm, probably *Taenia multiceps,* the intermediate stage of which is known as *Coenurus cerebralis*.

Livestock in herding systems

Six species are commonly raised, their distribution and frequency depending on ecological conditions and pasture type; camels (Bactrian), horses, cattle, yaks, sheep and goats. Although small ruminants are by far the most numerous, large stock predominate in terms of livestock units – camels, horses

Table 4. Cattle, yaks and their hybrids (,000)

Year	1940	1950	1960	1970	1980	1990	1995	2000*	2004*	2005*
Total cattle & yak	2 634.9	1 950.3	1 905.5	2 107.8	2 397.1	2 848.7	3 005.2	3 824.7	1 792.8	1 841.6
Yak	725.8	561.0	495.6	452.2	554.5	566.9	570.8	n.r.	n.r.	n.r.
Khainag (F1)	73.6	52.4	69.2	69.1	50.7	70.0	56.3	n.r.	n.r.	n.r.
Yak & *khainag* as % of total	30.3	31.5	29.7	24.7	25.2	22.4	20.9	n.r.	n.r.	n.r.

Source after Cai Li & Weiner, 1995
**2000/2004/2005 data from FAOSTAT, 2006*

Table 5. Livestock – main seasons

Species	Mating	Birth	Slaughtering
Camels	early Dec. – late Feb.	late Feb. – mid May	December
Mares	mid May – late Aug.	mid April – late July	December
Cows	mid May – late Sept.	mid March – late July	December
Yaks	early June – late Sept.	early April – late May	December
Ewes	late Sept. – late Dec.	late Feb. – mid May	Nov. Dec.
Does	mid Sept. mid Nov.	mid Feb. – mid March	Nov. Dec

Source: Telenged 1996

Table 6. Average liveweight (kg) of livestock sold to State

Species	1950	1960	1970	1980	1985
Cattle	242	248	243	217	259
Sheep	37	36	36	33	41
Goats	28	28	28	26	32

and cattle account for about 69% of the total. Some data on liveweight are given in Table 6. In the mid-1990s the overall livestock population was estimated at over 31 million head, but as the years after 2000 several bad winters have reduced the numbers to just over 25 million head; nation-wide statistics from 1918 to 2005 are given in Table 7. There has been a steady increase in numbers, except for camels which have declined from a peak of 859 000 in 1960 to 358 000 in 1995 and as low as 272 000 in 2004; this drop coincided with collectivization when motor transport became available for moving camp (and probably mechanization of the military) – their lack may be felt by the, now unmotorized, private herders. However the severe dzud in 2000 and again in 2003 were a culmination of ten years of harsh winters and 3 years of dry summers which reduced herbage and as a result of the combination over a period of four years 1999–2003 it is probable that approximately 8.5 million head of livestock perished.

The traditional livestock are all, of necessity, well adapted to the harsh climate; they can regain condition and build up fat reserves rapidly during the short growing season. The hump of the camel and the fat rump of local sheep breeds provide energy reserves to help tide them over winter and spring. Yaks, camels and cashmere goats develop winter down in their coats which helps reduce heat loss. All can survive outdoors throughout the long, cold winter with little or no shelter nor supplementary feed. The young are generally born in spring and their dams benefit from the fresh grass; generalized breeding seasons are given in Table 5. The livestock are generally small. Table 6 gives the average liveweight of those sold to the national abattoir which is probably a fair indication of the general run of stock; some authors claim heavier weights, which are, no doubt, possible with selected or better managed flocks.

Bactrian camels are important in the Gobi and other dry regions, and are used in many other areas to pull carts or carry baggage; they are the only class of pastoral livestock whose numbers are falling. There is anecdotal evidence to suggest that the fall has ceased and numbers may be beginning to rise. Camels are used for milk and meat as well as transport; camel-hair is a minor but high-priced product. Three breeds are recognized, all from the Gobi, but for moving herders' camps camels are important in most of the country. Camel as subsistence herds and camel-breeding is mainly in the desert and semi-desert zones.

Horses of the local breed are small but hardy; they are extremely important as part of the herders' essential equipment as well as for sport, meat and milk – fermented mares' milk (*airag)* is a favourite, and highly saleable, beverage. Horse-racing is popular and herders' preferred selection is for speed.

The small local breed of cattle is the basis of the pastoral beef industry; in many areas signs of admixture with exotic blood (Alatau, Simmenthal and, most obviously, White-faced Kazakh) are obvious, but in harder areas pure Mongolian prevails. They are very hardy but poor milkers and most dairy products are reserved for domestic consumption. Cows are dried off as the feed supply diminishes in late autumn and those which do not get in calf may be disposed of. At the colder limit of the range cattle-yak hybrids are used.

Yaks and their hybrid with cattle, the *khainag,* are kept in the higher areas. There are no named breeds, polled animals are common and are preferred. The proportion of yak and *khainag* in the national

cattle herd dropped (see Table 4) from one-third to one-fifth between 1950 and 1995. The proportion of yak in their main areas is said to be increasing again.

Sheep unlike the other species, have many local breeds, adapted to different ecological zones. These are described in detail in an article in World Animal Review (Batsukh and Zagdzuren 1990). Sheep numbers have been declining slowly since 1990. In 1996 there were 13 560 600 which was 90% of the 1990 figure. But numbers dropped considerably after 2000 to around 12 million head. Mongolian sheep produce mainly carpet wool. Average production from adult sheep is 2.0. to 2.4 kg of greasy wool.

Table 7. Evolution of stock numbers 1918–2005, ('000 head)

Year	Camels	Horses	Cattle*	Sheep	Goats
1918	228.7	1 150.5	1 078.7	5 700.0	1 487.9
1924	275.0	1 389.8	1 512.1	8 444.8	2 204.4
1930	480.9	1 566.9	1 887.3	15 660.3	4 080.8
1940	643.4	2 538.1	2 722.8	15 384.2	5 096.3
1950	844.2	2 317.0	1 987.8	12 574.6	4 978.6
1961	751.7	2 289.3	1 637.4	10 981.9	4 732.6
1970	633.5	2 317.9	2 107.8	13 311.7	4 204.0
1980	591.5	1 985.4	2 397.1	14 230.7	4 566.7
1985	559.0	1 971.0	2 408.1	13 248.8	4 298.6
1992	415.2	2 200.2	2 840.0	14 657.0	5 602.5
1996	357.9	2 270.5	3 476.3	13 560.6	9 134.8
2000**	355.6	3 163.5	3 824.7	15 191.3	11 033.9
2004**	256.7	1 968.9	1 792.8	10 756.4	10 652.9
2005**	256.6	2 005.3	1 841.6	11 686.4	12 238.0

** cattle includes yaks and their hybrids; Source: ADB 1998*
***Data from FAOSTAT 2006*

Mongolian goats are renowned for the quality of their cashmere; their number has increased rapidly in recent years, more than doubling since 1988. This is partly due to the ease of commercialization of a product with a high price to weight ratio since the old meat marketing organization broke down; traders now purchase cashmere from herders. Goats were traditionally kept in drier areas with plentiful browse – now they are increasing in areas where, previously, they were a minor component of the herd. Production per head varies from 250 g (female) to 340 g (male castrates) per head of raw combed product. Twinning is commoner in goats than in local sheep and weaning rates of 100% and over are claimed.

The dairy products of the herding sector are consumed domestically. Cows and mares are the main sources but ewes are sometimes milked for a few weeks after weaning. Lactations are short and cattle are usually dried off by December, when feed has become scarce, to avoid strain on the developing calf. Much of the milk in the short season is processed to conserve it for later use. A wide range of traditional dairy products are made but clotted cream and dried curd are the main ones. Fermented mares' milk, *airag,* is a favourite, saleable beverage; it is also distilled to produce an alcoholic drink, *rakhi*.

Evolution of stock numbers: The numbers of the five species between 1918 and 2005 are shown in Table 7; since grazing pressure depends on species as well as overall numbers these figures (for 1918–1996) have been transformed into stock units (on the basis of the traditional *bod*) in Table 8. The transformation is crude and does not take account of the different stages of maturity of animals within the herd but serves for rough comparisons. Present stock numbers are high but, in terms of livestock units, little higher, about 6%, than those of 1950 immediately prior to the development of collective management. Historically there was a very rapid rise between 1918, a time of troubles, and 1930 when numbers approached modern levels.

From 1961 until the early 1990s the number of livestock units remained relatively stable, reflecting the organized management and marketing arrangements of the period. Since economic liberalization there has been increase in both stock numbers and livestock units, although numbers are rising most rapidly because of the great increase in the goat flock. The decrease of the camels, however, almost compensates for the rise in goats; the greatest increase is in cattle by about a million or 12% of all livestock units. Small ruminants account for about 30% of the total. From 1950 and 1996 in terms of livestock units the sheep and goats population was in a very narrow range between 28.8 and 31.9; large ruminants and horses, therefore, account for by far the greater part of the grazing pressure. However, with the various dzud there have been considerable decreases in the numbers of camels, cattle, horses and sheep since 2000. The exception has been the number of goats that have continued to increase.

Mongolia's pastures have, therefore, already carried livestock populations equivalent to modern ones; how they were distributed in space in the early years is not known. The number of livestock per head of population, however, has declined steadily since records began from 34 head (11.6 units) in 1950 to 23.6 (8.1) in 1961 to 16.1 (5.6) in 1970 to 13.4 (4.5) in 1980 and 12 (3.8) in 1996; the human population,

in a livestock-based economy, now has only one-third of the livestock per capita that it had in 1950.

Table 8. Evolution of stock numbers as livestock units and species as percentages

Year	Camels %	Horses %	Cattle %	Sheep %	Goats %	Total SU '000
1918	9.7	32.5	30.5	23.0	4.2	3 535.3
1924	8.7	29.3	31.9	25.5	4.7	4 741.2
1930	10.6	23.0	27.7	32.8	6.0	6 820.8
1950	10.8	28.4	30.5	24.6	5.7	8 933.4
1961	16.1	29.5	25.3	22.8	6.3	7 865.3
1970	15.9	32.2	23.1	22.1	6.7	7 096.4
1980	12.3	30.1	27.4	24.7	5.5	7 698.0
1985	11.1	26.1	31.9	25.1	5.7	7 540.2
1992	7.5	26.5	34.1	25.2	6.7	8 317.1
1996	5.9	24.9	38.6	21.2	10.0	9 134.4

Stock units converted as "bod" Values derived from Table 7

Intensive livestock production: Localized intensive livestock production grew up with the collective movement; state farms and some *negdels* were involved. The main enterprises were dairying, using exotic stock in "mechanized dairies", pig and poultry rearing. All were aimed at the urban market. An Artificial Insemination Service supported the dairy industry. Keeping exotic dairy stock in such a climate was always difficult and expensive since they have to be warmly housed in winter, and supplying high-quality feed for the eight to nine month period when there is no fresh grass was expensive in cultivated fodder and, often imported, concentrates. Pig and poultry farms were largely dependent on imported stock and feed. After Economic Liberalization most of the "mechanized dairies" and piggeries collapsed and there is a serious scarcity of dairy products in urban areas. Some small semi-intensive dairying is developing in peri-urban areas and where cropping and grazing land intermingle but its progress is slow and economic viability still unclear.

Grazing management

The first land law was enacted in 1933; the introduction of collective production in the 1950s, however, was the first major change from customary practice. A new law in 1971 introduced a classification of land according to its use and the responsibilities; the obligations as well as rights of economic organizations and the administration, were defined and land tenure arrangements introduced. A draft pasture law to take account of the changed political situation, drafted in 1997, is before the *Ikh Hural* for debate: individual ownership (by herders, economic entities and organizations) and group owners (*bag*) of natural pasture and areas for winter and spring camps, rules for use of grazing in emergencies, stock-raising in settled areas, rules for contracting grazing to right-holders, setting up of inter-*aimag* and inter-*sum otor* areas, granting of haymaking rights to individuals and groups of herders. Customary grazing rights, however, remain powerful and are a major factor when considering land issues.

Transhumance

The regular movement of herds between summer and winter pastures, is widespread in pastoral areas of Europe and Asia. The classic cycle is from low ground in winter to mountain pastures in summer, often associated with alpine herbage which is snow-covered in winter. The pattern of transhumance in Mongolia is not usually of this classic kind; most of the precipitation falls in the warmer months, wind-chill is a very serious winter hazard and livestock are not housed. Winter and spring camps, which are the key to transhumance, are chosen for availability of some shelter and access to forage and water. In the steppe, winter camps may be sited in valleys of suitable hills; in some areas riparian forests provide shelter. In mountain areas movements may be more vertical with winter camps generally at the hillfoots; mountain transhumance is over shorter distances than in the steppe. Access to summer and autumn pasture is less contested than to winter camps and, within a *sum* or similar sub-unit, may be almost communally used. Grazing circuits cannot be firmly fixed under conditions of great variation in feed availability which have many weather-related causes; transhumance must be flexible and highly mobile so that herds can be taken where feed is available which may be much further in some years than others - this presupposes a degree of co-operation between graziers' groups insofar as one group will allow emergency grazing to another should weather events make it necessary.

Risk in herding

Herding in Mongolia is a risky undertaking and much of the herders' work and planning involves avoiding or minimising risks. The term *dzud* describes serious weather events associated with snow and

cold; the major risks can be classified as *dzud*, drought, disease and others. Risk in herding is discussed in detail by Erdenbaatar (in press). *Dzud* and drought are traditional, and effective, controllers of stock numbers. From the point of view of pasture condition a white *dzud* has a double effect - it provides moisture for spring regrowth while reducing stock numbers. *Dzud* takes several forms:

Black *dzud* occurs when, in winter, there is a prolonged lack of snow and continued want of water because of freezing of surface sources so both staff and herders suffer from lack of water to drink. This type of *dzud* does not occur every year, nor does it usually affect large areas. Wells provide water in black *dzud* conditions but often a long trek would be necessary and at the wells shelter and bedding would not be available in the new camping areas.

White *dzud* is caused by deep and prolonged snow cover. It is a frequent and serious disaster which has caused a great number of deaths. Opinions on how deep snow has to be to constitute *dzud* varies: over 7 cm causes difficulties in Khangai yak pastures while up to 10 cm leaves fodder accessible to small stock in the forest-steppe and steppe; in the steppe of less mountainous provinces 6 cm is considered a *dzud*. White *dzud* is, of course, more serious if it follows a dry summer and herbage is short.

Storm *dzud* is caused by continuous snowfall and drifting over large areas. If it occurs at the coldest time of year it is very dangerous; animals may run many kilometres before the wind and most mortality is through exhaustion or falling into rivers.

Khuiten dzud is caused by extreme cold or freezing winds; when winter temperatures are 10^0 below seasonal averages stock can no longer graze freely and expend much energy in maintaining their body heat. It usually occurs when night temperatures drop sharply for two or more consecutive nights. Serious losses occur when *khuiten dzud* follows white or storm *dzud.*

Drought, from the herders' viewpoint, is a lack of rain during the warmer part of the year. Drought in late spring and early summer is the most serious since the pasture is starting to grow and the animals are in greatest need of good forage to rebuild body condition and provide milk for their young. Drought over a wide area leads to concentration of livestock around water-points and better grazing and thus causes damage to the vegetation.

Uncontrolled fire can be serious; it rarely originates from, or near, *gers* or winter shelters since great care is taken in such flammable surroundings. In the mountain regions unprotected fires of hunters and gatherers of wild fruit are a common cause. While accidental fire destroys standing forage and causes scarcity, and wastes much labour in control (to protect *gers* and property as well as grazing), controlled burning may be used to remove unpalatable old material and encourage a young flush. Predation, mainly from wolves is an increasing risk now that the premium on wolf-killing has been removed. Protection of snow-leopards in the Gobi Altai raises a problem of how to recompense herders for stock taken by these rare and protected beasts. Stock theft is a very rare risk although there have been reports recently of trans-border rustling in northern frontier regions.

5. THE PASTURE RESOURCE

Grazing lands

The natural grazing has a very short growing season, limited by low temperatures. Pasture growth begins in mid-May and usually ceases after mid-August because of drought. Frosts can occur at the end of August; the thermal growing season is shorter in the mountains and longer in the Gobi. The grazing lands were surveyed in detail and pasture maps covering the country produced about twenty years ago. Under *negdel* management pastures were monitored and seasonal movements of livestock respected. The monitoring needs up-dating so that the present situation can be defined and policies formulated on a basis of fact rather than opinion;. The dichotomy of interests between the grazers and the grazed in recognized at government level: livestock are under the Ministry of Agriculture and Industry while the grazing lands are the responsibility of the Ministry of Nature and Environment.

Opinions on the present state of Mongolia's pastures vary widely, especially those of external missions. There is general agreement that there is overstocking close to agglomerations, especially the capital, and along herding routes; damage through random track-making by vehicles, in valley-bottoms

is widespread. Thereafter opinions vary from declaring that the nation's pastures are seriously degraded, risking an ecological disaster, to the view that overstocking is a localized phenomenon and labour availability, not pasture production is the main constraint to herding. While stock numbers are at an all-time high since recording began in 1918, the 1996 levels are only marginally higher than those of 1950 (Table 8). Problems vary from place to place and outlying (summer and autumn) pastures are under-utilized while winter-spring pastures are often abused. Natural control of stock numbers is the traditional way to correct overstocking. Periodic *dzud,* or prolonged drought kills large numbers and put the grazing stock back in equilibrium with the forage supply: however effective natural disasters are in protecting the grazing vegetation, they lead inevitably to poverty and suffering among the herders.

The vast grasslands of Mongolia are part of the steppe, a prominent transition belt in Inner Asia and Central Asia between the forest and desert belts. Steppe vegetation is characterized by a predominance of grasses, especially *Stipa* and *Festuca* spp.. Legumes are scarce, the commonest are *Medicago falcata* and *Astragalus* spp. *Artemisia frigida* is frequent and is the main steppe-forming plant of the desert steppe. The montane forest steppe has *Festuca* and *Artemisia* spp as dominants.

Sown fodder

Some was grown during the collective period, for hay, by *negdels* and State Farms in the higher rainfall areas. Some silage was made by "mechanized dairies". The area has dropped dramatically with the change of system, from 1 470 km^2 in 1989 (Table 9) to 250 in 1993 and probably much less now. Oats, *Avena sativa*, was the main hay crop; their cultivation suits the wheat-growing equipment already available, a crop can be grown to the hay stage in the short season available and harvesting and curing is easy. All operations were, of course, mechanized. Locally-saved seed was mainly used. Sunflower, *Helianthus anuus*, was a common silage crop; in the main crop producing areas sunflower can develop to the full heading stage with seed set, suitable for ensiling, before low temperatures affect growth; it is a very drought-tolerant crop. Seed cannot, however, be successfully ripened in the main silage-making zone. Some farms arranged for seed to be produced at lower, warmer sites in Eastern Mongolia but much of the seed was imported from Central Asia.

Lucerne, *Medicago* spp., has been cultivated on a small scale, under irrigation, in the area of the Great Lakes in the Northwest for a very long time. This was expanded greatly during the collective period but is now on a lesser scale. Local landraces are used, probably *M. media* types; their seed set and production is good. *M. falcata,* yellow-flowered lucerne, has been grown under irrigation on some State Farms, including Khar Horin*,* and was also grown on several small irrigated areas in the Gobi. The Gobi sites have been converted to the more popular and profitable melons and vegetables. Sown fodder does not have a high priority under the present economic and social conditions but could play a role in supplementing low quality winter and spring feed in favoured sites. Oat hay could be developed as a cash crop on cereal farms once the crop industry is re-established. Screening and selection of cultivars will, however, be necessary as will development of a seed supply chain.

After the great 1944 *dzud* the government decided to encourage the creation of reserves of fodder by private herders but this really developed during the collective period. The State Emergency Fodder Fund was set up in 1971, operating twelve centres and forty-one distribution points; its origins date from the 1930s when haymaking stations were started with horse-drawn technology brought in from Russia. By 1991 the SEFF operated 22

Table 9 Fodder and straw production 1989–1993

Fodder type	1989	1990	1991	1992	1993
Area of fodder ha	147 700	117 800	79 900	52 900	25 600
Hay harvest tonnes	1 166 400	866 400	885 500	668 800	698 400
Straw used tonnes	99 500	58 300	54 600	31 900	26 500

Source: State statistical office 1994 quoted by FAO 1996

Table 10 Haymaking by producer and year - tonnes

Year	State farms	Coops	Other state	Private
1960	49.8	728.8	12.5	-
1970	116.2	328.9	34.4	42.7
1980	246.6	563.2	161.8	98.6
1985	323.8	615.3	228.3	108.2

Table 11. Stock ownership (percent head) during the collective period

Species	State farms	Coops	Private
Camels	1.7	84.5	13.9
Horses	2.4	54.3	38.8
Cattle*	2.2	46.0	43.6
Sheep	2.0	75.0	15.6
Goats	0.8	73.7	24.1

** cattle includes yaks and their hybrids*

centres; because of financial problems most were transferred to *aimag* administrations. The SEFF played an important part in reducing the impact of weather emergencies but, as economic liberalization progressed, central government could not provide the previous level of subsidy.

In 1997 total fodder production was estimated at 340 000 fodder units; the national average was 4.9 forage units per sheep, less than a tenth of the average of 1980. The biggest bottleneck in haymaking by herders is the amount of labour involved and the lack of machinery. Herbage reaches its maximum yield and feeding quality in the second half of August in most ecological zones; this is a season of relatively heavy rainfall and it is laborious to mow and turn low-yielding crops of hay to make a quality product.

Grazing management on *negdels*

The grazing management of the collective period was based on limited mobility within the bounds of the *negdel* and while brigades usually handled monospecific herds, they might overlap in space to provide multi-species grazing of the same pasture for greater efficiency; further mixed grazing pressure was provided by the private stock of the families. The areas and seasons of grazing were specified by management, giving a broader coverage than at present and avoiding undue concentration of stock. Organized marketing avoided both the build-up of excess stock and the congregation of camps close to roads and centres.

The present grazing situation

Change to private ownership shifted the responsibility for risk avoidance and economic management abruptly from state to household. Herders very rapidly reverted to traditional mobile transhumance in small family groups. Ex-salaried staff took to herding with stock from *negdel* break-up but not all succeeded . One hundred to one hundred and fifty head is considered to be the threshold herd size for a reasonable living; fifty is the poverty line. In 1995 over 40% of households had under 50 head, 45% had over 100 and only 15% owned over 200 animals. Controlled grazing has gone – in some areas pasture use is anarchic, with immigrant herders trespassing on the traditional lands of others. At neighbourhood and community levels other customary institutions have re-emerged. Groups provide an approach to regulating access to grazing. They are often kinship-based and related to a natural grazing management unit such as a valley, or, in dry areas, a water source. Hay and fodder are now negligible - overwintering survival dependent on autumn condition and herding skills.

Extensive herding, of course, goes on but the control of the collective period has gone. The transition has, however, given women a far greater role in decision-making since under the collective all the governmental bodies were overwhelmingly male although many veterinarians are women; women now take an active role in management and especially marketing. Water is a determining factor in pasture use, especially in the steppe and Gobi regions (the mountain-steppe often has plentiful surface water); some areas can only be grazed in winter when snow is available as a water source, in others wells supply, or used to provide water; in the Gobi herders' movements are governed by watering places. Breakdown of most of the deep "mechanical" water points has rendered many areas inaccessible, especially in the eastern steppe - gazelle numbers are increasing as they colonize the deserted grazing.

All herding families now keep multi-species herds, that is having at least three kinds of livestock each forming over 15% of the herd; subsidiary species are those forming under 10%; e.g. camels in many areas and yak in the foothills of the mountain-and-steppe zone. Multi-species herds have many advantages, but increase the labour needs. The different species vary in their grazing habits and preferences, a mixture, therefore makes better use of the overall forage available; yak and horses, for example, can go further into the mountains than other stock; goats and camels make better use of browse. There is a complementarity of species in winter grazing: large stock, especially horses, are used to open trails in heavy snow cover to facilitate grazing by sheep and cattle. A mixed herd spreads risk much more than a monospecific one. Part of the necessity of mixed herds is, of course, the herders' needs for a range of products including transport and traction.

The herders' year is divided according to the seasons. The winter and spring camps and grazing are the key to their overall system; it must provide shelter as well as accessible forage through that difficult season. Rights to winter grazing are jealously guarded and frequent subjects of dispute; finding winter

grazing is a major problem for many "new" herding families. In contrast to many transhumance systems elsewhere, herders often go to the hills in winter to find shelter from the cold winds which sweep the steppe; the hills frequently have less snow and more accessible forage than the plains. Some areas are used in winter because water scarcity precludes their use when there is no snow. Spring grazing is also critical since it is there that most of the young are born at a season when feed is very scarce.

Taking livestock to more distant fattening pastures "*otor*" is an important part of well organized herding and if done with skill, greatly improves the condition of stock before the long winter. Going on *otor* requires effort and labour, and camping away from the main group; it may reduce surveillance of winter camp sites, but is a key to better herd survival. Many herders now undertake much shorter transhumance circuits than previously and produce far less hay. Herders' objectives in supplementary feeding are: to minimize loss of condition, ensuring better yield in the coming year and enable early mating, mainly for cows and camels; to improve disease resistance and lessen the incidence of abortion, small stock and mares; to support suckling females and their young; and to maintain working stock. They contend that supplements to weak stock, once begun, must not be withdrawn before both weather and pasture conditions are suitable for the stock to forage for themselves.

Winter and spring shelters were a very useful innovation of the *negdel*; generally simple wooden structures sited in a sheltered spot and often south-facing; they provide valuable protection to stock. With privatization, no rights to shelters have been assigned to herders, so they are often dilapidated although little other than labour inputs are required to make them useable.

With state subsidies for inputs removed and services reduced or absent, herders have reverted to traditional risk-management (in what has always been a risky environment) including keeping multi-species herds and co-operating with other households in herding tasks to help cope with the greater labour needs of diversified herds. The basis of this collaboration is the *khot ail*, a traditional level of household collaboration, camping and working in a group, which existed before collectivization, especially for summer and autumn grazing. The *sur* of the *negdel*s partly copied this, but avoided the kinship basis which is common in the *khot ail*. These units are often, but not necessarily, based on family ties, associations between households with common interests are as important. The size of the *khot ail* varies with season and ecological zone: in the Gobi the *khot ail* often consists of a single household; in better watered areas up to five households may group together. At neighbourhood and community levels other customary institutions have re-emerged. At neighbourhood level groups provide an approach to regulating access to grazing. They are often kinship-based and related to a natural grazing management unit such as a valley or, in dry areas, a water source. They exist within the limits of a wider traditional unit the *bag*, a customary institution which was responsible for pasture allocation and dispute settlement in the pre-collective era: present *bag* boundaries are generally based on those of the brigades.

The changes have had a marked effect on the accessibility of basic foodstuffs and the dietary pattern of the herders. FAO 1996 states: "Herders are self-sufficient in meat and milk products, and consumption of those products increased by 30% and 50%, respectively, between 1990 and 1992. In the same period the consumption of other food decreased, e.g. by 40% for flour and by more than 80% for various food grains. This was a result of the worsening of rural trading services, as herders could only get commodity goods in *sum* centres, instead of from brigade centres and travelling agents as previously". Reforms have changed a highly organized grazing system into one where privately-owned livestock graze public land; this is often a certain recipe for pasture abuse. Although ownership of land is often a prerequisite for its good management, this is not the case for extensive grazing land in Mongolia (for arable, intensive livestock, residential and mining land the situation is different); some form of group registration of grazing rights is considered adequate and more desirable. The reasons quoted by Mearns and Swift (1996) and the PALD team, are:

"There are strong arguments in favour of increasing security of tenure over pasture land in Mongolia's extensive livestock sector, in order to promote sustainable land management and reduce conflicts over pasture. It is more likely that individualized, private ownership of pasture land, under Mongolian conditions, would actually increase conflict and jeopardize environmental stability, particularly given the lack of administrative capacity to enforce such rights.

"While ownership often increases investment and creates a demand for and a supply of credit, since the land would be managed as a capital good in which investments must be made to promote

sustainability and prevent land degradation. This assumption does not hold for most pasture land in Mongolia's extensive livestock sector in which few if any external inputs are required to maintain productivity. Sustainable pasture management in such an environment depends primarily on mobility and flexibility rather on capital investment. There are certain exceptions: investment may be made in winter/spring camps and shelters, and in wells and other water resources, and there may be a demand for credit to overcome transport constraints in seeking to maintain mobility. But it is not clear in the Mongolian case that lack of secure title is the principle obstacle to supply of such credit, nor that it could not be satisfied by means of certified possession rights at the level of a group such as the *khot ail*, which is the appropriate level at which most such investments are likely to be made.

"In addition there are strong ecological reasons why the development of a market in pasture land would be undesirable. Sustainable land use under an extensive grazing system requires mobility of livestock between pastures suitable for use in each season. Such seasonal pastures must be shared between neighbouring households since their patterns of movement overlap and vary between years according to forage availability. The spatial arrangement of Mongolian landscapes vary considerably between ecological zones; larger areas are required to encompass land suitable for all seasons in desert-steppe zones, while smaller areas are required in the steppe and mountain-forest-steppe zones. In most cases the risk of drought and/or *dzud*, among other natural hazards, requires that herders have access to traditional areas of pasture for emergency use. Taken together these factors account for the indivisibility of pasture land in Mongolia below a certain spatial scale varying by ecological zone. On no account should transfers of land be permitted that would fragment in any way these minimum sustainable pasture resource areas."

6. OPPORTUNITIES FOR IMPROVEMENT OF PASTURE RESOURCES

The constraints to sustainable grazing management in Mongolia are discussed above. Its harsh climatic conditions are not a constraint; they are the reason for the extensive, mobile, animal production, based exclusively on natural pasture, which have proved sustainable over many centuries. Many constraints are organizational rather than technical and have their roots either in the present economic situation of the region or changes in governmental policy during the twentieth century. The main organizational constraint is the lack of recognition, or title to, grazing rights, especially for winter camps and hay-fields; legislation to deal with this is under consideration. Lack of regulation of grazing is becoming serious locally, with the abandonment of some areas and over-use of others; a revitalized monitoring system is needed to provide a factual basis for advice and control on the use and maintenance of grazing land. Herders are not organized above the family group, *khot ail*, level which is too small for decision-making over the very large areas of land needed for management under extensive herding.

Guidelines on grazing management are a necessary adjunct to any control of use and advice; these must be developed with herders' participation, after organization of the herding community. National guidelines may be necessary as a framework but it will be necessary to develop a series of others which take into account the ecological conditions, situation, topography and production systems of individual areas: it is at that level that very close consultation with the users will be necessary. While rising stock numbers are a cause for concern, they have been up to near present-day levels during the 50s; the rapid rise in the human population and the increase in the number of herding families, however, is likely to make control of grazing pressure yet more difficult.

Herders have been affected by a reduction in the levels of services available and have not yet come to terms with having to help themselves where, previously decisions were taken and services provided centrally. Lack of availability of selected breeding stock is noticeable, although that may change if markets and profitability improve. Lack of marketing infrastructure affects access to outside purchasers as well as both offtake and the quality of products on sale. Similarly lack of access to consumer goods and supplies reduces the incentive to sell and may lead to accumulation of non-breeding stock. The closure

of the State Emergency Fodder Fund has thrown herders back on their own resources for supplementary fodder supply. Research, training and technical support services now operate on very reduced budgets.

Opportunities for improving grazing management and herbage condition while maintaining and increasing output are many-fold. Mongolia's grazing lands are well suited to extensive livestock raising and are generally in good condition. Herding has always been the main occupation; the people are highly skilled and motivated; they also have the support of a solid body of technical expertise and knowledge. Once legal problems associated with grazing rights have been resolved, coupled with the organization of the herding population, the industry should be able to manage its resources properly while improving the livelihood of the rural population.

Many of the actions to remove or palliate these constraints require administrative decisions or actions: definition and granting of grazing rights, probably emphasising winter camps and hay lands in the first instance; a structure for the organization of the herding population so that they can participate in the regulation of local land use as well as pasture management, development, and maintenance, all of which must have users' participation; monitoring of pasture condition and regulation of its use, which will also require the participation of herders' associations as will the establishment of guidelines (down to local level) on the use of grazing land. Research and training must be maintained and, at herders' level, expanded. Rehabilitation of water supplies and revitalization of haymaking are two very obvious activities for better pasture use and stock survival; these can now only be tackled by the herding communities once organized; haymaking by individual households needs access to simple implements, security and training. Water development must await both granting of grazing rights and organization of the users before it has a realistic chance of success.

Mongolia has maintained mobility for its vast extensive livestock sector throughout the changes of system. Transhumance, with few if any external inputs, has clearly demonstrated its resilience and sustainability. The *negdel*, although restricting transhumance distances compared to the original traditions, still ranged over sufficiently large areas to cope with many weather events. Selected stock of local breeds were used, some crossing of cattle took place in favoured areas, but the overall livestock population has remained hardy, productive, good foragers and suitable for mobile herding. Under the *negdels* there was an excessive use of subsidized fodder which may have contributed to their eventual economic collapse, but they left behind both herders and stock adapted to the conditions and economic realities of the country's grazing lands. The lack of orderly transfer of grazing rights, however, has led to some transitional problems. It is clear that improvement of grazing management in Mongolia must be within traditional transhumance and based on the proper use of grazing land with the minimum use of external inputs. In addition to making best use of the available grazing in an organized manner, the redevelopment of family haymaking, from natural herbage, where hayfields can be developed is a primary area for encouragement.

7. RESEARCH AND DEVELOPMENT ORGANIZATIONS AND PERSONNEL

The Research Institute of Animal Husbandry is a long-established, well staffed, research organization closely integrated with field development teaching which contains a wealth of knowledge on pasture ecology and management, animal production and health, and the associated scientific disciplines. It deals with all aspects of pasture and livestock management. Many of the more senior researchers use Russian as their technical language.

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Enquiries in English will require translation before they can be dealt with by specialized technicians so replies may take time.

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9. CONTACTS

This profile was drafted in 2000 by J. M. Suttie (FAO retired) who was responsible for the FAO pasture programme in the country and undertook numerous missions to Mongolia since 1989. Some of the livestock data were amended by S.G. Reynolds in October 2006.

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Arrangements are being made for local revision and up-dating

APPENDIX METEOROLOGICAL DATA

Station. Ulaanbaatar Latitude 470 55'N Longitude 1060 50' Altitude 1325 m													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Average temperature C°	-22.3	-21.0	-13.0	-0.5	5.5	14.0	16.5	14.5	8.0	-1.0	-13.0	-22	-3.1
Max. temperature C°	-19	-13	-4	7	13	21	22	21	14	6	-6	-16	3.8
Min. temperature C°	-32	-29	-22	-8	-2	7	11	8	2	-8	-20	-28	-10.1
Precipitation mm	1.5	1.9	2.2	7.2	15.3	48.8	72.6	47.8	24.4	6.0	3.7	1.6	233
Av. Rel. humidity%	75	73	66	50	47	56	65	65	64	63	72	73	64.1
Number rainy days	-	-	-	1.0	4.1	9.0	14.0	12.0	7.0	2.0	-	-	49.1
number snow days	3.7	3.0	3.5	3.0	2.1	-	-	-	1.3	2.8	4.6	3.4	27.4
Average wind speed, m/s	0.9	1.4	2.3	3.4	3.7	3.4	2.6	2.4	2.3	1.9	1.3	0.8	2.2
High wind days > 15 m/s	1.2	1.2	2.6	5.0	5.4	3.0	1.7	1.2	1.6	1.2	1.3	1.7	27.1
Sand-storm days	0.5	0.2	2.1	4.1	4.2	2.1	1.0	0.7	0.6	0.6	0.5	0.3	16.9

Source "National economy of the MPR for 60 years" Ulan Bator 1981; Pearce E. A. and C. G. Smith 1998 The Hutchinson World Weather Guide. Helicon, UK, Oxford

Station. Mandalgov - Middle Gobi													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	tot/av
Average temperature C°	-18	-15.3	-7.0	-2.7	-10.6	-16.9	-18.8	-17.2	-10.3	-1.8	-8.3	-16.8	1.1
Max. temperature C°	3.3	12.2	18.7	26.9	32.6	35.6	35.4	35.5	29.7	27.0	15.4	5.3	22.3
Min. temperature C°	-38.3	-36.0	-30.6	-25.4	-12.1	-4.6	1.5	-2.6	-8.3	-19.9	-32.7	-36.8	-20.4
Precipitation mm	0.7	1.4	2.0	3.3	10.2	33.0	46.5	45.6	14.1	3.8	1.8	1.4	163.8
Av. Rel. humidity%	68	63	52	38	39	47	55	57	51	48	57	68	54
Number rainy days	-	-	-	-	2.6	7.8	10.5	8.7	3.5	-	-	-	33.1
number snow days	1.6	1.7	2.4	2.0	1.4	-	-	-0	0.5	1.7	2.2	1.8	15.3
Average wind speed, m/s	3.9	4.2	4.4	5.5	5.8	4.9	4.2	3.7	3.9	3.6	4.0	4.0	4.3
High wind days > 15 m/s	1.4	1.6	2.3	4.5	4.8	2.5	1.0	1.5	2.1	1.5	2.1	2.0	27.3
Sand-storm days	0.7	1.0	2.2	3.8	3.6	1.1	0.6	0.8	0.8	1.3	1.6	0.4	18.0

Station. Dalandzadgad - South Gobi													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	tot/av
Average temperature C°	-15.4	-12.2	-3.2	6.1	13.6	19.4	21.2	19.5	13.2	4.8	-5.8	-14.0	3.9
Max. temperature C°	8.9	18.6	21.0	28.7	32.1	37.0	38.3	36.5	31.1	27.9	20.1	2.5	
Min. temperature C°	-36.4	-34.2	-27.8	-20.2	-8.9	-1.1	4.5	2.5	-9.7	-17.3	-30.1	-36.5	
Precipitation mm	1.1	1.5	2.8	5.6	11.2	23.9	33.5	34.6	12.4	2.9	1.9	1.1	132.5
Av. Rel. humidity%	67	61	44	34	33	40	47	44	42	42	52	63	48
Number rainy days	-	-	-	1.1	2.1	6.8	9.0	7.1	3.4	0.8	-	-	30.3
number snow days	1.8	2.4	2.9	1.6	0.5	-	-	-	0.3	1.2	2.6	2.7	16.0
Average wind speed, m/s	3.0	3.5	4.4	5.6	5.6	4.4	4.0	3.6	3.7	3.4	3.8	3.1	4.0
High wind days > 15 m/s	2.0	2.2	3.2	6.0	2.5	2.0	1.6	1.5	2.0	1.8	3.2	2.3	30.3
Sand-storm days	0.7	1.3	1.4	3.9	3.3	1.1	0.2	0.4	0.6	0.5	1.4	0.5	15

Station. Saishand East Gobi													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	tot/av
Average temperature C°	-18.4	-14.8	-4.7	5.9	14.0	20.6	23.2	21.1	13.8	4.3	-7.5	-16.5	3.4
Max. temperature C°	1.8	13.4	21.7	32.1	36.7	40.0	39.6	40.7	33.1	26.0	17.2	5.0	
Min. temperature C°	-40.7	-35.8	-29.9	-22.6	-10.2	1.3	5.9	1.9	-4.0	-17.1	-31.9	-41.4	
Precipitation mm	0.7	1.4	1.3	4.2	10.4	19.6	34.9	27.0	9.8	4.3	1.5	1.0	116.1
Av. Rel. humidity%	75	68	49	36	36	43	52	52	50	49	58	72	53
Number rainy days	-	-	-	1.2	3.2	5.6	8.3	6.3	2.4	1.6	-	-	28.5
number snow days	1.7	2.0	1.6	0.8	0.3	-	-	-	0.2	1.2	1.8	1.9	11.5
Average wind speed, m/s	3.8	4.0	4.7	5.7	5.8	5.0	4.1	3.8	4.0	3.9	4.1	4.2	4.4
High wind days > 15 m/s	1.2	1.2	2.6	5.0	5.4	3.0	1.7	1.2	1.6	1.2	1.3	1.7	27.1
Sand-storm days	0.5	0.2	2.1	4.1	4.2	2.1	1.0	0.7	0.6	0.6	0.5	0.3	17