

Population and the Pastoral Economy in Mongolia

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Population growth may impinge on the process of sustainable development of the pastoral economy

Although Mongolia has existed for centuries as a distinct society, modern Mongolia can be traced to the year 1924, when independence from China was achieved and a socialist "People's Republic" founded. Its centrally planned economic system dates from the late 1930s. The ensuing decades witnessed a dramatic process of economic and social change, a strengthening of ties with the former Union of Soviet Socialist Republics (USSR), and increasing industrial and mining activity facilitated by aid from that country. By 1990, like other former socialist countries, Mongolia began a process of transition towards a free-market economy (Bawden, 1968; Milne and others, 1991; Sanders, 1991; ADB, 1992).

Mongolia has a hyper-continental climate, with low precipitation, long winters, and average temperatures below freezing for seven months of the year (Academy of Sciences, 1991). One geographical characteristic of Mongolia that has shaped its economy and culture is the steppe, the vast grassland zone which, in spite of adverse climatic conditions, has made the country particularly apt for extensive animal husbandry. Nomadic pastoralism has been precisely the determinant of the Mongolian way of life and main economic activity from ancient times until the present. Traditional herds include cattle, horses, camels, goats and sheep.

By the early 1950s, animal husbandry was still the main economic activity of most of Mongolia's population. The population was completely pastoral and nomadic, and groups of one to three families formed the basic stock-breeding unit (Cooper and Gelezhamtsin, 1993; Mearns, 1993; Potkanski and Szykiewicz, 1993). As might be expected, livestock breeding activities based on a multitude of nomadic smallholdings were not consistent with the principles of a centrally planned economy. By the beginning of the 1950s, the Government began a process of collectivization of the agricultural sector, which was completed by the early 1960s. Private ownership of livestock was restricted, private ownership of land abolished, and all production reserved for the state (Milne and others, 1991). The rural population was employed by collectives (negdel) or state farms. The collective was the economic unit responsible for managing livestock breeding, producing livestock products, marketing them, and supplying inputs and consumer goods as well as fodder and transport services to its members (Neupert and Goldstein, 1994). In spite of collectivization, important features with respect to the organization of production in the pastoral economy varied little from the past: herding remained pastoral and nomadic, the basic unit of production continued to be the household units, and the division of labour within the household experienced only small modifications.¹ Each household was generally involved in the production of single-species herds, for which activity a monthly salary was paid. Households were permitted to own a small number of animals that could be sold or used for their own consumption.

Compared with the situation during the first half of the present century, Mongolia's livestock sector has experienced some progress. However, improvements have been largely limited to the construction of winter shelters in some cooperatives, water supplies in areas with inadequate river, lake or spring water, and production of some winter fodder. There have been some efforts to control endemic and parasitic diseases, but generally veterinary care is inadequate (UNIDO, 1993). Industrial cattle breeding or modern dairy farms are more the exception than the norm. For the most part, animal husbandry continues to be a traditional and labour-intensive activity and much more progress is likely to be needed to make production competitive in the world market.

Although limited, the improvements introduced in the livestock sector by the early 1960s should have resulted in a substantial expansion of the national herd. Nevertheless, the increase has been quite modest. Between 1930 and 1990 the growth of the national herd has been only 25.6 per cent (see table 2). It has been argued that the intrinsic inefficiency of the collective or negdel system has been the main limitation to increasing production and herd growth² (Milne and others, 1991; Potkanski, 1993; Goldstein and Beall, 1994). Although the economic and productive inefficiencies of the system may have limited the growth of the herds, it seems that other factors also played an important role.

The main purpose of this article is to argue that the population dynamics experienced by the country during the past seven decades have played an important role in limiting the growth of the national herd and the intensification of the livestock economy. Moreover, it is proposed that the interdependent relationship between human and animal populations is essential to understand the persistence of nomadic pastoralism in Mongolia. A second objective is to examine the possible effect on the pastoral economy of the privatization of agricultural activities, the end of the collective system and some other economic transformations that the country has experienced since the 1990 reform movement.

Human population and animal population

Population increased at a modest pace in Mongolia until the first half of this century as the result of a combination of political and economic instability and high mortality rates (Neupert, 1994). By the beginning of the 1950s, however, the

population dynamics of Mongolia became similar to other developing countries. High fertility rates, combined with declining mortality, resulted in unprecedented rates of growth. Total fertility rates (TFRs) fluctuated between seven and eight children per woman. By the mid-1970s, however, fertility began to undergo a slow but sustained decline and during the 1980s this decline significantly accelerated. By the end of that decade the TFR was approximately 4.5 children per woman. This fall increased even more during the 1990s; the official estimate for 1993 is 2.5 children per woman (State Statistical Office, 1994a). Fertility has declined in the whole territory, although the fall has been more rapid and substantial in urban than in rural areas (Neupert, 1994). In spite of this decline in fertility rates, population growth has been substantial. The large cohorts born during the 1950s, 1960s and 1970s, who have already begun their reproductive careers, will maintain a comparatively high rate of growth for the next three to four decades. When a population has a large and young population base, it takes a generation or more for declining growth rates to offset the numerical effect of high growth rates in the past.

Although natural population growth has been considerable in rural areas, high rates of rural-to-urban migration limited a significant rural population expansion. As shown in table 1, the growth of the rural population was modest compared with the growth of the total and urban populations. For the purpose of this discussion, changes in the size of the economically active population in rural areas in general and in the pastoral economy in particular are more important than the growth of the total rural population. Between 1960 and 1990 the economically active population in agriculture increased by only 0.7 per cent per year. The population engaged in animal husbandry declined by 34.0 per cent between the same years. The reasons for this substantial decline will now be explored.

Table 1: Mongolia's population patterns and trends, 1960 to 1990

	Population (thousands)				Average annual rate of growth (%)		
	1960	1970	1980	1990	1960-1970	1970-1980	1980-1990
Total	968.1	1265.4	1682.0	2149.3	2.71	2.89	2.48
Urban	337.1	584.8	887.3	1225.1	5.66	4.26	3.28
Rural	631.0	680.3	794.7	924.2	0.76	1.57	1.52
Economically active population in agriculture	254.2	220.8	202.7	256.1	-1.40	-0.85	2.37
Economically active population in livestock breeding	227.9	162.0	170.4	149.9	-3.36	0.51	-1.27

Source: State Statistical Office, National Economy of the MPR for 70 Years, 1921-1991, Ulaanbaatar, 1991.

After the Second War World, development began to be planned through Soviet-type five-year economic plans. The Government realized that agriculture in general, and livestock breeding in particular, should be a basic branch of Mongolia's economy. However, Mongolian leaders also shared the Marxist view held by theorists in the former USSR that industrialization was a desirable goal and the only real base for economic and social progress. During the 70 years of socialist rule, the overall economic strategy was to develop an industrial-agricultural society (Milne and others, 1991). Emphasis on the need to industrialize as the only way to achieve development and progress characterizes all the economic plans (Bawden 1968; Academy of Sciences, 1991; Milne and others, 1991). While in 1940 the contribution of industry to the gross social product was only 13.7 per cent, in 1990 it contributed 48.9 per cent. In 1960 non-agricultural employment represented 39.2 per cent of the total employment; in 1990 it represented 67.3 per cent (State Statistical Office, 1994b: tables 3.1 and 2.7) .

The spatial distribution of the population in the 1950s conflicted with these economic goals. The population concentrated in urban areas was small and insufficient for initiating and developing an industrial sector. Therefore, rural-to-urban migration was encouraged to satisfy the growing industrial labour demands. This was not difficult considering the standard of living in rural areas which was lower than in cities. The standard of living of the rural population under collectivization was certainly an improvement on the situation during the first decades of the century; however, economic opportunities and economic and social conditions were much better in cities, especially for the younger generation who have been educated in the vast network of provincial schools (Neupert and Goldstein, 1994). According to the 1989 census, 35.6 per cent of the population living in the capital city, Ulaanbaatar, were born in rural areas. In Darhan and Erdenet, the two largest cities after Ulaanbaatar, these percentages are 46.6 and 56.5, respectively. In other urban areas the percentage of the population born in rural places varies between 40 and 60 per cent.

Studies conducted in nomadic pastoral societies in diverse arid and semi-arid regions of the world suggest that there is a close relationship between population size and the size of the herd (Stenning, 1959; Leeds, 1965; Dahl and Hjort, 1976; Dahl, 1981; Horowitz, 1981; Thebaud, 1995). On the one hand, the size of the animal population must guarantee food requirements and, on the other, population size has to correspond to the labour requirements for the proper care of the herd. However, the matching sizes of the human and animal populations cannot be explained solely in terms of subsistence

requirements and labour capacity but also in terms of the formation of domestic groups (Lefebure, 1979), especially when the main unit of production is an autonomous nuclear household as is the case in most nomadic pastoral societies (Khazanov, 1978).

Families and herds develop along parallel lines in most nomadic populations. Each stockbreeder seeking to found a new production unit is faced with two requirements: firstly, he needs to acquire livestock and get married; secondly, he must be able to increase the size of his herd and beget heirs (Lefebure, 1979). The cycle of the family herd assumes that the newly married couple will receive a herd from the herds of their families of origin, usually through a system of pre-inheritance and dowry. From the initial nucleus received after marriage, the new family herd has to grow substantially in the subsequent years, firstly to satisfy food requirements and secondly, these having been satisfied, to accumulate animals to give as a pre-inheritance or dowry to their own children. A major incentive to increase the family herd beyond subsistence requirements is the eventual need to divide the herd. Each additional child posits the need for more animals to provide the additional food necessary to feed him or her and also for the child to take following marriage.

Therefore, a rapid process of population growth in a nomadic society as a result, for example, of a decline in mortality, results in the formation of a larger number of households, that is, in an increase in the absolute number of productive units. More children survive up to age of marriage and consequently, more productive units are created. This process would tend to increase substantially the size of the herds provided that natural resources are plentiful. The newly formed families will try to maximize the size of the herds. In a context of extensive pastoralism this is possible through skilful management of the demography of the herds.³ On the other hand, slow population growth limits the formation of new productive units and, therefore, the expansion of the herd. In addition, low rates of population growth may result in a situation in which the size of the herd exceeds the labour capacity of the human population. Although nomadic pastoralism is not a labour-intensive activity (Horowitz, 1981), insufficient labour reserve is a major difficulty because it substantially affects the mobility of the herds. It is when the herds are moved in search of pastures and water that the herder needs to allocate more labour. Mobility constraints resulting from insufficient manpower prevent the adequate watering and feeding of animals and therefore the herds' productive and reproductive capacity will be threatened. Nutritional stress will substantially reduce the fertility of the animals. Herd size will reduce until it reaches a number adequate for the provision of the labour force.

As previously mentioned, after collectivization, the basic productive unit in the Mongolian collective system continued being the domestic group. However, the pace of formation of new households and, therefore, new productive units, was limited by heavy rural out-migration. Between 1963 and 1989 the number of households in rural areas increased from 151,031 to 192,221, that is by 27.3 per cent. During the same period, the increase in urban areas was from 84,201 to 235,613 households, or 179.8 per cent. The total increase was 81.9 per cent (State Statistical Office, 1994b: table 8.2). Mongolia developed an extensive educational system. To facilitate the access of nomad families' children, boarding schools were established in all rural districts. The state assumed the cost of education, including accommodation and board. The educational system provided a path of upward mobility for herders' children and a source of workers for Mongolia's urban sector (Goldstein and Beall, 1994). Only a limited number of children remained in the pastoral economy as herders, slowing down the process of family formation that seems essential to expand the size of the herds.

The collective system in Mongolia removed from herder families the need and motivation to increase their number of animals by restraining the number of private animals that each family could own and, therefore, by limiting the intergenerational transfer of herds. Education provided most children with the means to move out of the pastoral economy and large private herds were not permitted. The collective system provided herder families with some incentives such as bonuses, free trips, medals, titles and honours; it also penalized inefficiency and mediocre production. However, incentives and disincentives were not substantial enough to result in differences in the standard of living of those who over-fulfilled and those who under-fulfilled (Goldstein and Beall, 1994), and they never replaced the strong motivation provided by the need to expand the number of animals for the intergenerational circulation.

Table 2 shows the livestock population of Mongolia, between 1930 and 1990, according to the five species of animals herded in the country. The last column shows the size of the herd in sheep forage units (SFUs). This measure makes it possible to express the size of herds containing diverse species in a common unit. It is based on the food requirements of the different species relative to sheep (a horse corresponds to 7 sheep, a goat to 0.9 sheep, a cow to 6 sheep, and a camel to 5 sheep).

Table 2: Mongolia's: livestock population, 1930 to 1990

Year	Camels	Horses	Cattle	Sheep	Goats	Sheep forage units (SFUs)
1930	480,900	1,566,900	1,887,300	15,660,300	4,080,800	44,029,620
1940	643,400	2,358,100	2,722,800	15,384,200	5,096,300	56,031,370
1950	844,200	2,317,000	1,987,800	12,574,600	4,978,600	49,422,140
1960	859,100	2,502,700	1,905,500	12,101,900	5,631,300	50,417,470
1970	633,500	2,317,900	2,107,800	13,311,700	4,204,000	49,134,900

1980	591,500	1,985,400	2,397,100	14,230,700	4,566,700	49,578,630
1985	559,000	1,971,000	2,408,100	13,248,800	4,296,600	48,158,140
1990	537,500	2,262,000	2,848,700	15,083,000	5,125,700	55,309,830
SFU equivalent	5.0	7.0	6.0	1.0	0.9	

Sources: State Statistical Office of Mongolia, Annual Statistical Yearbook, Mongolian Economy and Society in 1993, Ulaanbaatar, 1994; Honhold, H., Livestock Population and Productivity and the Human Population of Mongolia 1930-1994, European Union (Project ALA/MNG/9209), Ministry of Food and Agriculture, Ulaanbaatar, 1995.

The food supply system

Although the rural population experienced a modest rate of growth, and the herding labour force an absolute decline, the overall population increased substantially: between 1960 and 1990 it more than doubled. As a result, the national requirements for food also increased considerably. This increase placed substantial pressure on the livestock sector to increase production; however, as previously discussed, production increase in the Mongolian extensive animal husbandry system would have required a larger rural population increase. The Government was not willing to jeopardize the industrial development plans with labour shortages by limiting the transfer of labour resources from the livestock sector to the non-agricultural sector. The solution would have been to increase labour productivity in the pastoral economy. However this would have been accomplished only by increasing the resources available and by improving the efficiency with which such resources were used. This would have been possible only by establishing a sedentary system and major investments would have been necessary, such as intensive production of fodder, artificial pastures, storage facilities, pens to confine animals and watering wells.

The option to intensify the livestock sector was not adopted by the Mongolian Government. Instead, a process of intensification was induced in the crop-farming sector. Starting in the 1960s, arable farming became an independent sub-branch of agriculture. It was developed after overcoming many difficulties connected with the country's geographical and climatic conditions. Huge mechanized state farms were established for this purpose and they specialized in the production of grain and some vegetables able to replace animal products (Academy of Sciences, 1991; Warden and Savada, 1991; UNIDO, 1993; Neupert and Goldstein, 1994). The policy was apparently successful in replacing extensively produced meat and milk with intensively produced cereals (Honhold, 1995). This enabled Mongolia's economy to adapt to a rising population without intensification in the livestock sector. This also prevented an excessive culling of animals that might have even resulted in a reduction of the animal population. State procurement of meat has increased comparatively modestly during the past three decades: between 1960 and 1990 procurement increased from 135,600 to 175,300 tons, that is, by only 29.3 per cent (State Statistical Office, 1991: table 4.15). As shown above, during the same period population increased by 122 per cent.

Why did the Government opt for an intensification in the crop-farming sector instead of one in the livestock sector? One possible explanation is that the necessary technology and capital equipment for an intensification of farming activities were readily available from the USSR; however, technologies for animal husbandry intensification were more difficult to obtain. A second explanation is that the Government probably perceived agricultural diversification as being similar to industrialization: a desirable development goal. Unfortunately, very little has been published about the process of collectivization in Mongolia except in official and very general terms.

Before collectivization, in the traditional pastoral system, herds relied entirely on standing forage during winter; so the central management strategy of herder families was to fatten the animals as much as possible during the summer so they could withstand the long winter with only senescent vegetation (Mearns, 1993; Potkanski and Szykiewics, 1993). After collectivization and with the introduction of crop farming, hay crops began to be produced and some winter fodder became available in most collectives (Templer, Swift and Payne, 1993). Nevertheless, production was not substantial enough to replace winter grazing on standing forage and to avoid nomadic movements. For example, in 1990 the fodder crop harvest was 527,100 tons (State Statistical Office, 1994b: table 4.14). The size of the herd in that year was the equivalent of 55,309,830 SFUs (see table 2). Thus, in 1990 the availability of fodder per SFU was only 9.5 kg. Fodder is used mainly as a reserve for emergencies and to provide some nutritional supplement for the animals in winter. The introduction of crop farming and in particular the introduction of fodder crops, as well as advances in the Mongolian pastoral economy, can be considered as an intensification of technological factors. However, this intensification was not directed towards the implementation of a sedentary system. Rather, it was a by-product of the intensification induced in the farming sector and was used only to reduce the typical uncertainties of the nomadic pastoral production system. Production continued being nomadic and extensively practised in natural pastures by family productive units.

An uncertain future

The pastoral economy will be strongly affected by two major economic changes that Mongolia experienced after the 1990 reform movement: the collapse of the industrial sector and the privatization of agricultural activities.

Industrial investment has almost stopped since 1990. The former USSR, previously the main provider of Mongolia of financial and capital resources for industrial development, because of its own economic crisis, discontinued its assistance

(Kaser, 1991; ADB, 1992). Internal resources are extremely limited and the financial help provided from other countries is being used mainly to maintain the functioning of the deteriorated economic and social infrastructure. The possibilities of foreign investment are also modest mainly because of the delay in establishing a clear and consistent legal framework, the limited infrastructure, and the lack of institutional capacity (Hahm, 1993; UNIDO, 1993). This situation may change, but it is very unlikely that a massive flow of foreign investment will be generated during the next 10-15 years.

In September 1991 the privatization of the collectives began. By August 1992 the transition was completed in most areas and parallel developments in the liberalization of the rural economy were taken, especially regarding marketing and property. Collectives were given the opportunity to remain as shareholding companies that retained ownership of as many as 70 per cent of the animals. Individual herders could join the company or herd privately or a combination of the two; or members could simply decide to disband the collective. Meetings of the members in each collective would decide these issues. In most areas the company has remained as a popular and viable means of organizing herding production; in other areas companies have broken up to be replaced by more localized units of cooperation among herders (Potkanski, 1993; Goldstein and Beall, 1994). However, there is consensus among herders and also throughout the Mongolian political spectrum that agricultural land should not be privatized.

A real free-market agricultural sector has not yet been established. The Government still has a major influence on fixing prices and remains the major purchaser of agricultural products (Edstrom, 1993; UNIDO, 1993). It is too soon to assess whether privatization will result in an increase in production or in improving the living conditions of the rural population. However, it is relatively safe to propose two emerging characteristics of rural development that will affect its adjustment to a market economy. Firstly, heavy investments in agricultural development are not likely in the near future for the same reasons that restrict industrial investments. Therefore, modernization of agricultural activities will be quite limited, at least during the 1990s and the following decade. Secondly, agricultural production, and in particular the livestock economy, will increasingly rely on independent family productive units and less on cooperatives or other forms of collective organizations. This form of organization of production, especially in livestock breeding, is encouraged in the official agricultural privatization plan. The past ideological basis of rural development based on the Marxist principles of collectivization are being replaced by the more nationalistic concept that the Mongolian livestock economy was traditionally based on family production. Collectives, under the guise of private shareholding companies, will probably continue to exist, but their role will be different from in the past, focusing more on commercialization than on production itself.

Future significant job creation is unlikely in urban areas. Even if a more optimistic scenario is assumed and comparatively important industrial investments take place, the resulting new employment opportunities will not be likely to surpass the number needed to absorb the rapidly growing number of working-age people already living in urban areas. The population born in the 1960s and 1970s has, since the second half of the 1980s, expanded substantially the economically active population. Therefore, urban areas will cease to be poles of attraction to the rural population as in the past when substantial industrial and infrastructure investment took place. Currently, the country is experiencing a deep economic crisis characterized by a substantial decline in the standard of living, inflation, unemployment and severe food shortages. Urban areas, where industries and services are concentrated, appear to have been affected more by the crisis than rural areas.

The collapse of Mongolia's industrial base seems to have abruptly ended the rural-to-urban migration stream. As shown in table 1, between 1960 and 1990 the total population experienced an average annual increase of 2.7 per cent, while the rural population increased by 1.3 per cent per year. However, between 1990 and 1993 the urban population increased by an average of only 0.1 per cent annually while the rural population increased by 2.5 per cent. The total population increase was 1.2 per cent annually during this period (State Statistical Office, 1994b: table 2.3). It is difficult to explain this different rate of population growth only as a result of differential fertility between urban and rural areas, especially considering that until recently the urban population grew much faster than the rural population. Part of this difference appears to be the result of the emergence of an urban-to-rural migration stream. It seems that as a result of the crisis an increasing number of people are returning to the countryside where at least employment and subsistence are assured. It is too soon to consider this an indicator of a lasting urban-to-rural migration trend, but it is quite likely that the labour force engaged in the pastoral economy will substantially increase in the current and next decade.

The decline in fertility experienced by the Mongolian population has resulted in a significant deceleration of population growth; however, this deceleration will have little effect on the growth of the working-age population for a long time. Because of past high fertility, the population of working age is increasing at a very rapid rate and will continue to do so for the next 30-40 years. Between 1990 and 1994, the average annual rate of growth of the population aged 15 to 65 years was approximately 3.5 per cent (State Statistical Office, 1994a). In addition, the collapse of Mongolia's industry and the subsequent unemployment that has occurred mean that only a small number of today's herders' children are likely to be able to find jobs outside the herding sector. Most of them will probably remain in the rural economy as herders.

The past restricted and slow process of family formation that prevented the expansion of the animal population will not exist any more. Moreover, the expected rapidly growing rural population will cause substantial pressure to expand the herds. Mongolians have centuries of experience in animal breeding and there is little doubt that they will be able to manage the herds well enough to increase the herd size up to a new equilibrium between animal and human populations. The most important limitation, however, will be that imposed by the carrying capacity of the pasture.

Carrying capacity is a difficult concept and its relationship to production even more so. However, without any input, as in the case of livestock breeding practised in natural pastures, any piece of land can produce only a limited amount of vegetation (biomass) per year. Of this material only a certain amount can be consumed by the herds without causing damage to the ability

of the pasture to regrow in those and subsequent years. A small size moderate size harvest resulting from a small herd may lead to faster regrowth of pastures, but with a larger herd grazing above these levels, regrowth will fall (Honhold, 1995). Each year a given amount of plant biomass is produced and only a limited proportion can be eaten or harvested in that year. If more than that is taken, then the root systems of the prairies will be adversely affected and the ability of plants to regrow will decrease. A deterioration of the root systems would lead to substantial soil loss through erosion and a decrease in soil quality.

An initial solution adopted by nomad pastoralists is to move the herd longer distances in search of new pastures, that is, to expand the grazing area (Goldstein and Beall, 1994; Horowitz, 1981). If the population continues to grow, this horizontal expansion will soon become exhausted. In some cases the availability of grazing land may be limited while in other cases the distances that the herds need to be moved become too long. During this stage a solution is obtained through a process of intensification based on the development or adoption of new technologies such as irrigated artificial pastures, fodder crop production, and improvements in fodder storage facilities and management. This process starts when part of the nomadic population chooses to settle and became engaged in sedentary agriculture (Boserup, 1965). As more land is used for crop farming, nomadic pastoralism begins to be replaced by sedentary animal husbandry.

In spite of being a geographically large country with vast pasturelands, the carrying capacity of the Mongolian steppe is limited. There is some evidence that the current size of the national herd is near the limit. It has been estimated that approximately 45.6 million tonnes of plant material is produced by the 121 million hectares (ha) of grassland existing in Mongolia. Of this amount, half is required to maintain the pasture species. Therefore, there is about 22.8 million tonnes of potential feed for grazing animals. It is estimated that one sheep consumes 1 kg of forage per day; thus, one sheep unit requires 365 kg per year. Mongolia can potentially support the equivalent of 62.5 million SFU per year. Since the 1994 animal population was the equivalent of 55.5 million SFU, 90 per cent of the potential offtake is being used, leaving only 10 per cent for expansion (Honhold, 1995). Therefore, even a modest increase in the size of the herd may exceed the carrying capacity of the grasslands and, in turn, precipitate a spiral of ecological degradation that could be devastating.

The limits to the growth of the herd imposed by natural pastures can be expanded by a process of intensification. This process has taken place in Mongolia, although on a very limited scale. There are major constraints to a process of agricultural intensification conducive to sedentarization of animal breeding in the country. The most important one is the severe continental climate: very low winter temperatures, a short growing season and erratic and low rainfall. High levels of technological inputs have been required to overcome these problems, making the unit production cost very high. Taking into consideration the economic crisis that Mongolia is experiencing, further intensification in the agricultural sector currently is hardly possible. In addition, the resilience of the Mongolian steppe ecosystem seems to be particularly narrow. It would be extremely difficult to increase the size of the herd without endangering the stability of the ecology, and a sedentary livestock economy would probably require an extremely complicated and expensive environmental management system to prevent environmental degradation.

The Mongolian livestock economy is likely to reach a point of non-sustainable stocking rates as early as the end of the present decade. Rapid population growth within an agricultural system based on extensive animal husbandry in the particular ecology of the Mongolian steppe may have devastating environmental consequences. The future does not look particularly bright. Nevertheless, population growth and rising animal densities need not lead necessarily to resource depletion and environmental degradation. The relationship between population and environment is neither immutable nor direct (Panayotou, 1994). It is also important to remember that fertility in rural areas is declining and, therefore, population pressures will diminish substantially after two decades.

Proposing specific solutions to avoid a process of environmental degradation as a result of increasing animal densities goes beyond the aim of this article. However, some technical strategies can be mentioned. Bringing in improved breeds of animals or increasing the production of the natural pastures through non-native species are options that may be worth exploring. However, more than searching for technical solutions, efforts should be directed towards the adoption by the former collectives, and the pastoral economy in general, of a suitable management system to accommodate human and animal population increases within the future context of limited resources.

The most critical aspect in this regard is access to pastures. Customary grazing rights continued through the collective period. Pastures have remained controlled-access commons and there are identifiable norms that regulate their use. These practices worked well most of the time in the past, but it will be difficult for them to cope with the pressures of privatisation. A new, formal system of land tenure which can support and extend them is essential. New land laws intended to regulate the use of pastures under the new system are being discussed by Parliament (Mearns, 1996, PALD, 1993). However, only time will tell whether or not sufficient safeguards will be built into this system for it to be successful in controlling access and managing conflict. Studies show that a considerable proportion of environmental destruction in third world countries is associated with situations of open access to limited resources and lack of internalization of destructive practices (Pingali, 1989). National and local policies regulating the use of pastures in a sustainable form are urgently needed. What is proposed here is not privatization of the grasslands but clear directives regarding their use. In this respect it is essential to set stocking densities (number of livestock units per ha) for the different regions of the country that are equal to or below the carrying capacity of the land. It is also important to remember that the transition that Mongolia is experiencing is resulting in both winners and losers. Severe rural poverty problems have already emerged (Cooper and Gelezhamtsin, 1993; Harper, 1994). A concentration of livestock property may have negative ecological consequences since wealthy herders will be in a strong position to use the better pastures, forcing small herders towards more extensive and intensive grazing practices. Therefore, government policies towards the pastoral economy should also include interventions to reduce the vulnerability of poor households. An agricultural policy based on small productive units organized in private cooperatives or other forms of

association is valid. Moreover, in terms of social justice and the welfare of the rural population, and even from an ecological perspective, it seems that such an approach would provide the most appropriate model for the development of the rural sector in Mongolia. The problem is whether or not the cooperatives will be able to respond to rapid population growth with an adequate and flexible resource management system which is able to prevent environmental degradation.

Since a process of sustainable intensification through sedentarization and settled farming is virtually impossible in the near future, environmental degradation will also depend on the capacity of the pastoral economy to accommodate population growth by creating non-herding employment in the former collectives. This will depend also on the government policies towards the sector. A policy to provide former collectives with credit to develop small-scale agro-industrial enterprises linked to livestock activities may substantially increase non-herding employment. On the other hand, if the scarce available resources are used to maintain or revive the urban industrial sector, as has been the case until now, the pastoral economy will have little hope of sustainable development and of breaking the link between population growth and resource degradation.

Conclusions

Views on the possible consequences of population growth on the environment range from absolutely negative, even devastating, to positive and highly advantageous. From the neo-Malthusian position, population growth is the main cause of environmental degradation and destruction (Ehrlich and Ehrlich, 1990). It places growing demands against the planet's finite resources and limited carrying capacity. At the other extreme, population growth is perceived as a source of increased efficiency and economies of scale, as well as the seed of technological innovation able to expand the Earth's carrying capacity and make possible increases in living standards and environmental improvements (Simon, 1990). Most studies of the relationship between population and environment consist of analyses realized at an aggregate or macro level; the relationship, however, seems to be highly conditioned by the particular characteristics of the ecosystem and modulated by a society's institutional structure (McNicoll, 1989; Pingali, 1989; Panayotou, 1994). To understand the association between population and environment, analysts require a number of case studies encompassing a wide range of experiences (Cassen, 1994). These should be undertaken in countries which have different ecosystems, are at various stages of development, and have used diverse modes of adjusting population growth to limited natural resources. The experience of Mongolia provides a valuable case study, elucidating a specific environment (the steppe), a predominant economic activity consistent with such an environment (nomadic pastoralism), changing population dynamics, and rapid and substantial shifts in the organization of production.

Although there are abundant examples in the literature of the effect of population growth on crop farming systems (Boserup, 1965, 1981; Robinson and Schutjer, 1984), the effect of demographic factors on livestock breeding systems has received less attention. As in the case of crop-farming, population growth seems also to have major consequences on animal husbandry and, in particular, on the transition from nomadic pastoralism to sedentary livestock breeding. In the particular case of Mongolia, in the past, limited population growth in rural areas, as a result of substantial cityward migration, was a major determinant of the limited expansion of the herds. The possible substantial rural population increase during the next three decades as a result of the recent political and economic reforms, as well as demographic factors, will bring substantial pressures to maximize animal numbers and induce a process of intensification. However, as in crop agriculture, in pastoralist systems there are also environmental and institutional limitations to a sustainable intensification as a response to population growth. In Mongolia, the environmental characteristics of the steppe are the most important limitation to a more intensive system based on sedentary animal breeding. It is difficult to think of Mongolia with its wide open spaces and scattered population as overpopulated relative to productive capacity, but that is the most likely conclusion from this study.

Two factors have been identified here as the main determinants of the capacity of the pastoral economy to accommodate an increasing rural population without or with limited resource depletion of the grasslands. The first is whether the cost of environmental degradation will be brought into the decision-making of individual herder families and former collectives by suitable resource management systems, pricing policies and regulations; the second is whether government policies will favour the former collectives with economic resources to increase employment in non-herding activities such as small agro-industries. With an economic crisis gripping Mongolia and the shock of transforming the economic system from socialism to capitalism, the Government has been engaged largely in coping with emergency conditions. Specific policies regarding the livestock sector have not been formulated. Some official documents outline general principles to guide the process of privatization but they do not spell out policies or interventions with any precision, nor do they recognize the ecological problems that may soon begin in the grasslands. After the 1990 reform movement, the official pro-natalist policy that had been implemented for the past 40 years was discontinued and a family planning programme even began. However, the idea that a large population is best continues to be a deeply rooted conviction of the Mongolian Government (Neupert, 1994). The current rate of population growth is considered unacceptable and it is likely that some pronatalist interventions of the past can be revived. Most policy makers cannot imagine that population problems may exist in a country with such a low population density and that the much-desired population growth may impinge on the process of sustainable development of the pastoral economy. On the contrary, a slowdown of population growth is considered as a limitation to the growth of the animal population and, therefore, to the development of the livestock sector. Currently, the most vital need is for the Government to recognize the problem of increasing human and animal densities for the pastoral economy and for an informed and expert debate on this issue where possible solutions can emerge.

Footnotes

1. In a strict sense, Mongolian herders cannot be considered as nomads but as semi-nomads. They practise only

small-scale movements with reference to a permanent settlement (the sum centre) and within a previously established area (Goldstein and Beall, 1994). Even before collectivization, nomadic movements were not made over large distances (Bawden, 1968). However, movements not only are made by the whole household but also include the transport of the dwelling unit. In order to cope with the harsh steppe environment and to conduct nomadic pastoralism, Mongolians have developed simple but effective technologies during the centuries. Transportable shelters are essential to a pastoral way of life and, in the freezing cold of Mongolia, are a matter of survival. The Mongolian gerh, or yurt, is superbly adapted to this. These are demountable and portable round tents, usually made of felt, which can accommodate a family of four to eight members.

2. It has also been argued that a major limitation to the growth of the national herd has depended largely on climate (UNIDO, 1993). Climatic conditions may explain variations in numbers through time, but they do not seem to be related to the limited increase of the herd. Although animal numbers are still very dependent on climatic conditions and losses may be high after severe winters, available statistics show that survival rates for younglings are, in general, relatively high, i.e. approximately 90 per cent (Honhold, 1995). Therefore, the natural reconstruction of the herds does not take long periods. In addition, extremely heavy losses, involving for example more than 20 per cent of the national herd, have never taken place (Potkanski, 1993).

3. For example, herders keep a large number of females not only to increase natural growth but also to increase milk production in order to limit culling. To speed the increase of the herd, pastoralists focus for a few years on herding small ruminants, mainly goats and sheep, because their rate of growth is much higher than that of large ruminants. Eventually, small ruminants can be sold and herders can purchase more cattle, camels and horses (Thebaud, 1995).

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