Review

The present status, ecology and conservation of the Mongolian gazelle, *Procapra gutturosa*: a review

JIANG Zhaowen¹, Seiki TAKATSUKI², GAO Zhongxin³ and JIN Kun³

¹Laboratory of Wildlife Biology, School of Agriculture and Life Sciences, The University of Tokyo, Yayoi 1-1-1, Bunkyo-ku, Tokyo 113-0032, Japan
Fax. +81-3-3815-7653, e-mail: jiang@um.u-tokyo.ac.jp
²The University Museum, The University of Tokyo, Hongo 7-3-1, Bunkyo-ku, Tokyo 113-0033, Japan
³College of Wildlife, Northeast Forestry University, 26 Hexing Road, Harbin 150040, P. R. China

Abstract. The grassland ecosystem of Mongolia and adjacent areas of Russia and northeastern China is an important component of the natural ecosystems of Eastern Asia. This grassland ecosystem is unique in that it has been utilized for grazing for a long period of time without deterioration. The Mongolian gazelle, *Procapra gutturosa*, an important species occurring in this ecosystem, used to be abundant and widely distributed, however, populations have decreased in recent decades and the distribution of the species has become greatly reduced. The contraction of its range began in the early years of the 20th century in China, during the 1970s in Russia, where they completely disappeared, and after the 1950s in Mongolia where the majority of the population now remains. The total population has decreased from about 1.5 million heads in the 1940s to 300,000–500,000 at present. In Mongolia, their range spanned about 780,000 km² in the 1950s, but this has contracted to only 170,000 km² at present. Mongolian gazelles inhabit grasslands and eat mainly grasses such as *Stipa* spp. and *Anchrolepidium chinense*. During summer they occur in small groups of 20–30 individuals, and in winter usually of 100–120 individuals, although they sometimes gather into herds of several thousands during periods of snow. They migrate seasonally, but their routes and the distances travelled are unclear. Their reproductive capacity is high with very high pregnancy rates ranging from 80% to 100% among females older than 1.5 years. The present problems facing the population and the future needs for conservation are discussed with the main conclusion being that international cooperation for the establishment of reserves is urgently required.

Key words: China, Mongolia, Mongolian gazelle, *Procapra gutturosa*, Russia, wildlife conservation.

The wildlife living in the natural ecosystems occurring in developing countries faces severe difficulties, and many species are already either endangered or even close to extinction. There are many such examples in China.
It is well known that China's natural forests have been reduced rapidly during the latter half of this century. Natural forests, however, are not the only ecosystem in decline. Natural grasslands are also under serious threat. About 42% of China's land area is classified as grassland, more than half of which is in northern China (National Research Council 1992). In 1989, for example, grasslands still covered 70% of Inner Mongolia and supported more than 37 million livestock. Eastern Inner Mongolia, adjacent to Russia and Mongolia, consists predominantly of that part of the Mongolian plateau known as the Hulunbeier plateau grasslands. This grassland ecosystem has been degraded because of human expansion, agricultural development and overgrazing since the 1960s. As a consequence, wildlife populations and their ranges have been seriously reduced. In particular, ungulates and their predators, such as wolves, have been greatly reduced by human activity.

Though there have been relatively many studies of the vegetation and plant ecology of these grassland ecosystems by Chinese scientists, animal ecology has received less attention except for the ecology of rodents because of their impact on grassland productivity. As a consequence, little is known of the wildlife of the grasslands. Understanding the interrelationships between wild ungulates and livestock is important in order to promote better management of these grasslands.

Among the wild ungulates of this region, the Mongolian gazelle, *Procapra gutturosa*, used to be the most numerous and was a significant component of the grassland ecosystem. The population has, however, decreased dramatically and now faces extinction in China.

It is very important, therefore, to develop a conservation strategy, and this should take account not only of the conservation of the Mongolian gazelle itself but also the management of the grassland ecosystem so as to facilitate the coexistence of wild gazelles and domestic livestock.

Although there has not previously been a review of the information available on the Mongolian gazelle, a number of papers on the species has been published. One reason for *P. gutturosa* being so poorly known in the Western World is that most literature on the species has been published either in Chinese or in Russian. We have tried, therefore, in this paper to rectify that situation by referring to as much of this literature as possible. Because of the limited availability of some of the Russian literature, however, some literature has been cited from abstracts. It is hoped that this review will help to provide the necessary information required to construct a conservation strategy for the future of this species.

**General Description and Taxonomy**

The genera *Gazella*, *Saiga* and *Naemorhedus* are all closely related, and formerly the *Procapra* were even included within the genus *Gazella*, however, most taxonomists now agree on placing the *Procapra* in their own genus. Ellerman and Morrison-Scott (1951, 1966) only recognized two species in the
genus, but today three are recognized (Corbet 1978), these are: the Mongolian gazelle, the Tibetan gazelle, *P. picticaudata*, and Przewalski's gazelle, *P. przewalskii*.

Adult Mongolian gazelles measure from 1 to 1.3 meters from head to rump, and stand about 75 cm high at the shoulder. Males weigh about 30 kg and females 25 kg. The summer coat is orange-buff, the flanks are pinkish cinnamon, and the belly is white with a long-haired dewlap. The winter coat is paler. During the rut, the males have swollen throats. Only males have horns and they range in length from 255 to 355 mm (Walker 1975, Jiang et al. 1991).

Fawns are born in May or June, weigh 2.8-3.0 kg, and measure 51-56 cm from head to rump (Генчера et al. 1961). New-born lambs begin grazing about 10 days after birth, and grow quickly so that they attain weights of about 19 kg by six months of age. By one month old their body lengths are 74-82 cm, and by late September they have doubled in size since birth. Horns begin to appear when males are about four months old and reach full size when they are one year old (Bannikov 1954). Males and females both reach virtually full adult body size at 1.5 years old (Jiang et al. 1991), at which age females reach sexual maturity. Males, however, according to Lhagvasuren and Milner-Gulland (1997), reach sexual maturity at about 2.5 years old, however Генчера et al. (1961) reported them breeding at just 17-18 months of age.

Soma et al. (1979, 1980), who studied the Giemsa banding pattern of the chromosomes of the Mongolian gazelle, found that \(2n=60\). Soma et al. (1980) concluded that these banding patterns closely resembled those of the goral, *Naemorhedus goral*. Analyses of the karyotypes of the saiga, *Saiga tatarica*, and the Mongolian gazelle have shown that they too are closely related (Soma et al. 1979).

Allen (1940) thought that two subspecies, the Mongolian gazelle, *P. g. gutturosa* (Allen 1938) and the Altai gazelle (*P. g. altaica* Hollister 1913) could be distinguished. Allen's (1940) classification was based, however, on differences in the lengths of the horns and in the ratio of the distance between the horn tips, over the distance between the horn bases. This ratio changes, however, with age, thus it is difficult to distinguish the "subspecies" using it. Furthermore, the "subspecies" often live sympatrically, leading Zhao (1963) to consider Allen's (1940) classification invalid.

**DISTRIBUTION**

Mongolian gazelles once occurred widely across northern China, in most areas of Mongolia and in southern areas of Russia.

1. **China**

During the 19th century and even until the beginning of the 20th century, Mongolian gazelles were still widely distributed in northern China (Figs. 1 and 2). The southern limit of their distribution was in the northern part of Hebei Province around Beijing at 41°N, 112°E, and they seem not to have reached as
Fig. 1. Map showing the names of places relating to the distribution of the Mongolian gazelle.
Fig. 2. The historical changes of the distribution of Mongolian gazelle in China and Mongolia.
far as the Yellow River (Лужков 1927). As agriculture has spread and
developed, however, the gazelle's distribution has continuously shrunk. In
the early decades of the 20th century, its range was still extensive (Figs. 1 and 2):
it occurred in Inner Mongolia across the Great Xingan Ranges, southward to
the Nenjiang River and to the Songhuajiang River area of Heilongjiang
Province, and to Baicheng in Jilin Province. The easternmost point of its
range was reached in the middle of the watershed of the Liaohe River. At
present, its southeastern limit is to be found in the leagues of Hulunbeier,
Xilinguole and Wulanchabu at the border between China and Mongolia (Zhang
et al. 1995). It is extinct now in Heilongjiang Province.

2. Mongolia

Most Mongolian gazelles are now to be found only in Mongolia. As
recently as the 1950s, Mongolian gazelles were distributed widely across about
two thirds amounting to about 780,000 km² of the country, though they were not
to be found in northern forested areas or in southern desert areas, and the
population still numbered about a million individuals (Bannikov 1954). During
the 1950s, the northern limits of their range were reached in the Ubsa Nor lake
basin (50°N, 91°E, Геитнер et al. 1961), however, during the second half of the
20th century, the range of the species in Mongolia has been shrinking. A
survey conducted during the decade from 1975 to 1985 revealed that its distribu-
tion had decreased dramatically to just one quarter or one fifth (about 170,000
km²) of its range during the 1950s. Over the same period, the population
decreased by half to about 500,000 animals. The remaining population was
confined to areas such as: Khentii, Dornod, Suchbaatar and East Gobi in
eastern Mongolia (Lushchekina et al. 1983, 1985, 1986, and Lhagvasuren and
Milner-Gulland 1997). Small scattered populations remain in other parts of
western Mongolia (Fig. 2, Lhagvasuren and Milner Gulland 1997). The most
recent information (IUCN 1993) shows that most gazelles are now confined to
an even smaller area (10% in size) in the eastern part of Mongolia and that the
population amounts to only about 300,000 animals, of which about 60% are
migratory and the rest sedentary.

3. Russia

Until the 1970s, Mongolian gazelles still occurred in small numbers in the
southeastern Altai Mountains, southern Tuvinskaya and east Zabaykal of
Russia (Figs. 1 and 2), though previously they had been common in some areas.

In the 19th century, several thousand Mongolian gazelles were to be found
in east Zabaykal during winter (Черкасов 1867). During the winters of 1925–
1926 and 1944–1945, several thousand Mongolian gazelles lived in east Zabay-
kal, while the number was fewer in west Zabaykal. During the winter of 1947–
1948 only groups of fewer than 100 animals were found (Львов 1949). In the
grasslands of the southeastern Altai Mountains, hundreds of Mongolian
gazelles were often found and large groups sometimes immigrated from
Mongolia, but by the end of the 1950s the gazelles had become rare there
In 1935 there were still several hundred gazelles in Tuvinskaya, but by the winter of 1940 only a few individuals remained, and thereafter no gazelles have been seen there (Якушев У и Блашовецкий 1952). At Kosh-Agach and in the border area between Russia and Mongolia (Fig. 1), only 5–6 gazelles were found in the 1956–57 winter (Гептнер et al. 1961). In west Zabaykai there were not many Mongolian gazelles and some of them migrated from Mongolia during winter. Their last visit was in the winter of 1947–1948, when they numbered fewer than 100 animals (Леонтьев 1949). In east Zabaykai the population was relatively stable until the 1940s, but during the 1950s the gazelles decreased and by the end of the 1950s only a few small groups were to be found in the border area of China, Mongolia and Russia (Гептнер et al. 1961).

Sludskii and Shubin (1963), who conducted aerial censuses of the Kazakhstan Desert area in the winter of 1960, reported 9,300 gazelles, about 60% of which were in the northern part of the Kyzyl-Kum Sands (at about 60–70°E), though was, however, contrary to Гептнер et al. (1961) who defined the distribution of Mongolian gazelles in Russia as limited to areas east of about 85°E. Whatever the original limits of their distribution were, since the 1970s no gazelles have been seen in Russia, and it is believed that they are now extinct.

Habitat

Information on the Mongolian gazelle's habitat in Mongolia and Russia is limited, and therefore information on the characteristics of their habitat is based on observations in China. Their main preference seems to be for flat or undulating steppes or dry grasslands.

1. Topography

The Great Xingan Range extends from northeast to southwest in the central Hulunbeier League (Fig. 1). To the west of the range is the rolling Hulunbeier Plateau which lies above 600 m. The highest point reached at 1,038 m is Bain Mountain, while the lowest place, the 2,200 km² Dalai Lake, is at 540 m. The areas around the Dalai and Beier Lakes, and along the Wuersun River are lowlands where rich water systems such as the Erguna River and Dalai Lake develop (Pan et al. 1992).

2. Climate

Because the Great Xingan Range blocks the movement of moist oceanic winds, the climate here is semi-arid. The average annual temperature is as low as -3 to 0°C, while the lowest temperature reached is -40°C, and the highest 35–40°C. Continuous snow-cover lasts from 120 to 180 days each winter, and the frostless summer period is of 80–120 days. The annual rainfall is of only 250–380 mm, of which 70% falls in summer, while annual evaporation amounts to 1,300–1,900 mm (Pan et al. 1992). The main natural calamities that the gazelle's face in this region are snow, snowstorms and frostbite.
3. Vegetation

The vegetation which comprises typical gazelle habitat consists of cool temperate tall grassland (Hu et al. 1992). Five types of such grasslands are recognized according to their species composition: 1) *Stipa grandis/Anurelepidium chinense* type, 2) *Stipa grandis/Cleistogenes squarrosa* type, 3) *Cleistogenes squarrosa/Lespedeza* spp. type, 4) *Artemisia frigida* type and 5) *Anurelepidium chinense/Stipa grandis/Herbs* type (Hu et al. 1992).

4. Other Animals

About 200 species of birds and more than 20 species of mammals have been recorded in the area (Office of Local Chronicles in Hulunbeier 1986). Other mammals that are common in the area include bobak marmot, *Marmota bobak*, cape hare, *Lepus capensis*, steppe polecats, *Mustela eversmanni*, red fox, *Vulpes vulpes*, Corsac fox, *V. corsac*, the wolf, *Canis lupus*, and many species of mice.

**Food Habits**

The Mongolian gazelle eats a wide range of plant species, however the bulk of its diet consists of a very limited number of species. Bannikov (1954) identified just 21 plant species in the stomach contents of 22 gazelles from Mongolia. These included: *Stipa capillata*, *S. gobica*, *Allium polyrrhizum*, *Agropyrum pseudoagropyrum*, *Kochia prostrata* and *Koeleria gracilis*. Interestingly, the gazelles avoid *Diplachne* spp. even though these are relatively abundant. Of the 21 plant species recorded, *Stipa* spp. accounted for 60% of the stomach contents collected in January. Bannikov (1954) found clear seasonal variation in diet with Gramineae, *Artemisia*, *Caragana*, *Allium* and Leguminosae in stomach contents sampled in spring, while in August about 80% of the stomach contents consisted of onions, *Allium* spp. (Lhagvasuren and Milner-Gulland 1997).

Fecal analyses of Mongolian gazelles in the Hulunbeier grasslands of Inner Mongolia, China during 1993–94 have revealed 38 plant genera in the diet with *Stipa* spp., *Anurelepidium chinense*, *Caragana microphylla* and various Liliaceae and Compositae being of particular importance (Jin 1994, Gao et al. 1995). In winter, the three main components of the diet were found to be *Stipa* spp. (38.6%), *A. chinense* (21.8%) and *C. microphylla* (7.5%). In winter, the diet of the Mongolian gazelle is very similar to that of domestic sheep, the diet of which consists of *Stipa* spp. (30.1%), *A. chinense* (28.4%) and *C. microphylla* (6.7%) (Gao et al. 1995).

**General Habits and Activity**

1. Adaptation to Grasslands

Like other grassland dwellers such as the saiga, the Tibetan antelope, *Pantholops hodgsoni*, and the North American pronghorn antelope, *Antilocapra americana*, Mongolian gazelles can run very fast. They can reach speeds of
60–65 km/hr, jump height up to two meters and lengths of 4–6 m with a maximum of 13 m (Лукашкин 1927). Mongolian gazelles find it difficult to run on ice or move in snow that is deeper than 20 cm (Bannikov 1954). Mongolian gazelles have keen eyesight but relatively poor senses of smell and hearing.

In order to obtain sufficient food, Mongolian gazelles must graze all day long during autumn and winter, whereas during summer they graze only from dawn to 10:00 or 11:00, and then again from 19:00 or 20:00 to dusk (Geithner et al. 1961).

During summer, because sufficient water for their needs is contained in their green fodder, Mongolian gazelles are able to forage tens or even hundreds of kilometers away from open sources of freshwater.

2. Group Formation

Mongolian gazelles usually live in groups all year round, but in larger groups in winter than in summer. Group size increases from September to April in Russia (Geithner et al. 1961). During summer, the largest groups consist of fewer than 100 individuals, and usually groups number about 20–30 individuals. From late August or early September onwards, group size increases to 60–80, or even to several hundreds in some cases. During the rutting period from late November to early January, group size further increases to reach 100–120 individuals. If snow falls, groups increase in size to several thousands or even 10,000 animals. These large groups begin to break apart during May and June (Bannikov 1954). During spring and autumn migrations, they form large groups, some as large as 80,000 animals (Lhagvasuren and Milner-Gulland 1997).

In Inner Mongolia, mixed groups were most common during spring (63.1%), autumn (51.0%) and winter (56.2%), however in summer female groups were most common (60.7%), and solitary individuals were common in male groups (Guan 1996). Before the rutting season from September to November, the male/female ratio is about 1.3, and males often form bachelor groups. These groups join to form larger groups during late November, then separate again from the beginning of the rutting season (Zhao 1963).

3. Society and Behavior

The social system of the Mongolian gazelle is not yet well understood, however it is known that they are polygynous with one male gathering on average 13 females into his harem (range 6–25, Lhagvasuren and Milner-Gulland 1997). In Russia, rutting begins in late November and continues until early January (Geithner et al. 1961), whereas in Mongolia it begins during mid-November and continues until early February with the peak between mid-December and mid-January (Lhagvasuren and Milner-Gulland 1997). During the rutting season, males battle with each other though the fighting is not serious (Geithner et al. 1961). Pregnant females close to parturition in spring move to open rolling countryside where it is easy for them to avoid disturbance (Bannikov 1954).
4. Migration

Mongolian gazelles migrate during winter. In the northern part of their range, this migration is from south to north, whereas in the southern part of their range it is from north to south or east (Bannikov 1954). Part of the southern population migrates from Mongolia to Inner Mongolia, and before the 1970s some migrated from Mongolia into Russia. Since the 1970s, however, and since the population has been so reduced, migration into Russia has not been reported. These migrations may have occurred because of reduced food availability in the center of the range.

During summer, gazelles travel widely over ranges of several hundred square kilometers, often moving more than 10 km in a day with distances increasing as forage deteriorates. During the parturition period, however, females stay in restricted areas (Gerritsen et al. 1961). Gazelles do not migrate when food is abundant or when there is little snow, which indicates that their migrations may be adaptive to avoid food shortages and heavy snow (Bannikov 1954).

Population Ecology

During the 1940s, the population of Mongolian gazelles is estimated to have reached approximately 1.5 million, with one million in Mongolia and 500,000 in China. During the 1950s and 1960s in China, 200,000 gazelles were hunted each year (Xiao et al. 1982), and as a result of this over-hunting, combined with over-grazing and desertification, the population has decreased considerably during the last 40 years.

1. Age Estimation

On the basis of tooth eruption and wear, Zhao (1982) categorized Mongolian gazelles into seven age groups. Jiang et al. (1995) have determined the exact age of 224 gazelles by counting growth layers in teeth cementum and have shown that the accuracy of Zhao’s (1982) method is 72.3%. Of the remainder of the samples, 69.4% were over- or under-estimated but within just one year. Therefore, for practical purposes in the field, Zhao’s (1982) categories are useful.

2. Demography
   a. Natality

   Females become fertile at about 17–18 months of age (Gerritsen et al. 1961). The gestation period is about six months, and parturition occurs during May and June in Russia (Gerritsen et al. 1961), and from mid-June to mid-July in Mongolia (Lhagvasuren and Milner-Gulland 1997). The pregnancy rate of Inner Mongolian females older than 1.5 years is as high as 100% (n=122, Jiang et al. 1993), and over 90% in Russia (Bannikov 1954), although in two populations in Mongolia, it has sometimes been lower at 40% and 60–85% (Lhagvasuren and Milner-Gulland 1997). Fawns are usually born singly with twins only
occurring rarely (2.5–8.2%) in both Mongolia and in Russia (Bannikov 1954, Lhagvasuren and Milner-Gulland 1997).

The survival rate of fawns in their first summer reaches 80%. Because of the high rate of pregnancy and of fawn survival, the rate of increase of the population sometimes reaches 20–25% (Bannikov 1954). Zhao (1988) estimated that the annual rate of increase in Inner Mongolia was also considerable at about 27%.

b. Mortality

Predation, periodic epidemics and severe winters are the main causes of death of the Mongolian gazelle. The main predators are wolves, domestic dogs and steppe eagles, with manul, *Felis manul*, and red fox also able to catch newborn fawns. Wolves attack the gazelles during late winter and spring, particularly after rutting when males are exhausted and unable to run for long. In early summer, wolves attack pregnant females. According to Гепер et al. (1961), birds such as kites and vultures sometimes attack young fawns.

Information on diseases contracted by Mongolian gazelles is limited, however, that diseases do seriously affect them is well documented. In 1974, for example, about 140,000 animals were killed in eastern Mongolia by an unknown disease, and since then similar outbreaks have occurred regularly, though fewer gazelles have died (Lhagvasuren and Milner-Gulland 1997). Captive Mongolian gazelles are known to suffer from "foot-and-mouth disease" (Оликов and Носова 1940, Цветеева 1941) and *Pasteurellosis* (Yuan 1991). Rotshil’d et al. (1988) showed that the high level of molybdenum in their onion diet can be a cause of *Pasteurella* infections.

Various parasites of the Mongolian gazelle have been found including: *Przewalskiana aenigmaticata*, *Pharyngomyia dzerenae*, *Melophagus* spp. (Hippoboscidae), *Cysticercus tenuicollis*, *C. bovis*, *Eimeria* spp. (Coccidia) and warble flies (*Hypodermatidae* and *Oestridae*) (Колесов 1939, Мачульский 1941, Грушин 1950, Sugar 1981/1982, Minar et al. 1985).

In Mongolia, severe winters, occurring about once every seven years since 1932, have killed thousands of gazelles (Lhagvasuren and Milner-Gulland 1997), and heavy snows and food shortages were recognized by Bannikov (1954) as sometimes causing losses of one third or half of Mongolian gazelle populations.

c. Sex Ratio

In Inner Mongolia, the sex ratio varies from year to year, but is slightly biased towards males (M/F = 1.1 in 1979, Xiao et al. 1982, and 1.3 in 1988, Jiang et al. 1993), whereas in Russia, Bannikov (1954) found it to be slightly biased to females (M/F = 0.92). Subsequently, Lhagvasuren and Milner-Gulland (1997) have found ratios in Mongolia strongly biased to females (M/F = 0.1–0.14 in autumn, 0.08 in winter, and 0.05 in summer).

d. Life Table

Jiang et al. (1993) estimated the age structure of the Inner Mongolian
gazelle population as consisting of fawns (0.5 year old, 39.7%), reproductive females (over 1.5 years old, 25.0%), and older animals (more than 4.5 years old, 12.7%). Three mortality peaks were noted among 0.5 year olds (39.7%), 3.5 year olds (57.4%) and among those over 6.5 years old (100%). This population was considered to be increasing because of the high proportion of young gazelles, the high rate of fecundity and the low mortality rate.

The oldest known-age individuals in an Inner Mongolian population of 1,026 animals were 7.5 year old males and 9.5 year old females (Jiang et al. 1995), making them much younger than other related ungulates. For example, mountain goat, *Oreamnos americanus*, males reach 14 years of age and females 18 years (Cowan and McCrory 1970), chamois, *Rupicapra rupicapra*, have survived to about 22 years of age (Walker 1975) and male Japanese serow, *Capricornis crispus*, reach 20 years while females may live as long as 24 years (Miura and Tokida 1988). Jiang (1990) considered that Mongolian gazelles live short lives partly because of quick teeth wearing.

The net reproductive rate (*R*_0) of a population in Inner Mongolia was 1.134 in 1979 and 0.864 in 1988, while the finite rate of increase (*E*) was 1.043 in 1979 and 0.954 in 1988 (Jiang et al. 1993). The abrupt decrease in both *R*_0 and *E* between these years may have resulted from habitat deterioration such as desertification, overgrazing by livestock, and particularly from over-hunting and poaching.

As a result of over-hunting and poaching, gazelles have been exposed to shooting for longer periods. Poachers shoot more rutting males just after the rut, and more pregnant and lactating females after the legal hunting period because they are easier to shoot. As a consequence, the proportion of reproductive females in the total population dropped from 32.5% in 1979 to just 25.0% in 1988 (Jiang et al. 1993). The reduction of pregnant and lactating females would result in a decrease in fecundity, and the reduction of reproductive males would result in unhealthy sex ratios.

**Conservation and Management**

Mongolian gazelles seem to be the Asian ecological equivalent of the pronghorn which is a member of the grassland ecosystem of North America. Both gazelles and pronghorns are highly adapted to northern dry grassland ecosystems, however, they differ because the grasslands where Mongolian gazelles live are unique, in as much as they are not truly natural but have been utilized by humans as grazing lands for thousands of years. In the past, people maintained this ecosystem based on an understanding of suitable grazing levels from experience, and hence they avoided deterioration of the grasslands. In other words, these grasslands are the historical product of a system of "sustainable use". The Mongolian gazelle has long been a representative member of this managed grassland ecosystem.

The most significant natural mortality factors of the gazelles seem to be predation, periodic epidemics and severe weather, however, the factor causing
Mongolian gazelles to be endangered is human activity. These activities include over-hunting, poaching and deterioration of their grassland habitat resulting from the over-extension of cultivated lands and by over-grazing. The impact of poaching is extremely biased towards males because of their large body size and their horns making them particularly valuable. This leads to a strongly biased sex ratio and, as a consequence, reduces the fecundity of females. Lhagvasuren and Milner-Gulland (1997) have calculated that Mongolian poachers kill 80,000 animals each year, at least 80–85% of which are males. Poaching just after rutting and during the birth period reduces numbers of reproductive males and females. Over-hunting is also responsible for the decline of populations. The heavy harvest (100,000 each year) for meat for soldiers during the Second World War, and during severe winters after the war, probably resulted in the rapid decline of populations during the 1950s and 1960s (Sokolov et al. 1982). Deterioration of grasslands results in the disappearance of suitable habitats which reduce the carrying capacity of the environment. One major factor contributing to the decline of the population in western Mongolia is thought to be the construction of the Ulaanbaatar-Beijing railway at the end of the 1950s. This obstructed the gazelles’ east-west migration routes (Lhagvasuren and Milner-Gulland 1997).

In Inner Mongolia the extent of the grasslands has been declining. Compared to 1965, the grassland area has decreased by 62,000 km², degraded grasslands have increased by 287,000 km², and total grass production has dropped by 30% (National Research Council 1992). As a result, the Mongolian gazelle is facing a dangerous situation. It was estimated that the Mongolian gazelle population before the 1940s was about 1,000,000 in Mongolia and 500,000 in China (Гемпн и др. 1961), but today just 300,000–500,000 remain in total.

Taking this situation into consideration, the Chinese government listed the Mongolian gazelle under its 1989 wildlife protection law as a Class II species for conservation. Under this law, nature reserves are to be established in the species’ main distribution areas, and inspection of the condition of the habitat is to be made regularly. Construction projects that will degrade the habitat and trading of the gazelles and their parts are to be controlled. Hunting is prohibited and poaching may be prosecuted under criminal law.

In the Russian Federation’s “Red Data Book”, the Mongolian gazelle was listed as a “disappearing species”. In Mongolia, hunting has been controlled since 1932, and in 1995 a new hunting law was introduced in order to control poaching (Lhagvasuren and Milner-Gulland 1997).

Establishment of hunting controls based on population ecology is necessary. Zhao (1988), who has taken into consideration the current system of hunting in China together with the ecology of the Mongolian gazelle, has recommended that the open season for hunting gazelles should be limited to the period from early November to the middle of December because body weight is greatest and the meat quality is at its best during this period. On the basis that the Mongolian gazelle’s capacity for increase is high at about 25%, Zhao (1988) also recommended that hunting intensity should be limited to 19% of the total
population. Because of its high reproductive capability, the Mongolian gazelle population would then be able to recover quite quickly despite continued hunting, once hunting and poaching are controlled.

Besides control of legal hunting, a reduction of poaching is also vitally important. Both the Chinese and the Mongolian governments are trying to control poaching, but this is extremely difficult to carry it out in vast, remote steppe areas. Consequently, nature conservation education is seen as crucially important in such areas.

Because of the rapid shrinkage of distribution and the reduction of population size, it is urgently necessary to establish reserves. A steppe plain in the Matad-Somon area of Mongolia (Fig. 1) is recommended as a reserve (Sokolov et al. 1982, Lushchekina et al. 1985, 1986). The first national park of Mongolia, the Eastern Steppe National Park, was established in 1995 to conserve the Mongolian gazelle. More reserves are needed in China. The reintroductions have been done in 1978 and 1988–1990 in Mongolia and small populations survived in Dzavkhagan, Gobi-Altai and Uverkhangai maybe because of the reintroductions. Trials of captive breeding in the reserves and transplantation should be considered. Studies on epidemics, migration routes, genetic structure etc. are also needed. Since Mongolian gazelles migrate between Mongolia and China, consistent plans for management, conservation and cooperative activities between the countries are necessary. Grassland productivity should be improved based on both agricultural and ecological sciences. The traditional grazing system of Mongolian people should be also reconsidered.

Acknowledgments: We appreciate Mr. Xie Xuchang for translation of Russian literature and Mr. Guan Dongming for the permission of use unpublished data.

REFERENCES (Russian references are listed below)


Грунин, К. Я. 1950. Овьда дзерена из Монгольской Народной Республики. Докл. АН СССР, т. 73, No. 4 (cited in Гептнер et al., 1961).


Леонтьев, А. Н. 1949. Охотничий промысел. Тр. Кяхтинск. краеведческ. музей и Кяхтинск. отд. Всес. географ. обва, т. 16, Улан-Удэ (cited in Гептнер et al., 1961).


Оликов, Б. М. и О. А Носова. 1940. Некробациллез у паркокопытных и кенгуру Московского зоопарка. Тр. Моск. зоопарка, т. 1 (cited in Гептнер et al., 1961).

Павлов, Е. И. 1949. Промысловые звери Читинской о бласти. Чита (cited in Гептнер et al., 1961).


Якушев, А. и И. Благовещенский. 1952. Промысловы звери и птицы Западной Сибири. Изд. 2-е. Ново-сибирск (cited in Гептнер et al., 1961).

(accepted 24 October 1997)