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The ungulates of northern China

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Abstract: Presently, thirty five species of ungulates occur in northern China. Some species are threatened or endangered. There are three species of Equidae (*E. przewalskii, E. hemionus, E. kiang*), one of Suidae (*Sus scrofa*), one of Camelidae (*Camelus bactrianus*), 14 species of Cervidae (with the genera *Moschus, Elaphus, Cervus, Elaphurus, Alces, Rangifer, Capreolus*) and 16 species of Bovidae (within the genera *Bos, Gazella, Procapra, Pantholops, Saiga, Nemorhaedus, Capricornis, Budorcas, Capra, Pseudois, Ovis).* They inhabit different biotopes, i.e. temperate mountain forest and steppe, temperate desert and semi-desert, and vast alpine ranges. Ungulate fossils are widespread in China evidencing that Asia was an evolutionary centre for some ungulates. Although new data have been gathered through research efforts in China since 1949 it is a fact that some ungulate species have suffered serious population set-backs and some have become endangered or even extinct. Detailed studies of ungulate populations and protection of habitats are now most important future research needs.

Key words: ungulates, China, distribution, fossils, evolution.

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Introduction

Northern China is a region of varied topography. It holds extensive mountains, steppes, deserts, forests and highlands and its mammalian fauna belongs to the Palaearctic. The transition line between the Palaearctic and Oriental regions is from eastern Huai river of Jiangsu Province via central Qin Ling mountains of the Shaanxi province to southwestern Hengduan mountains of the Yunnan province in China. Although China shares ungulate species with other Asian countries, there are some ungulates endemic to northern China.

Before 1949, foreign mammalogists studied the animals of China and made some important discoveries e.g. Milne-Edwards (1866); Lydecker (1916); Pocock (1902, 1913, 1918); Brobrinski & Flerov (1934) and Allen (1940) investigated and reported on ungulates of northern China. After 1949, Chinese scientists continued the mammal studies: Shaw (1962); Wang *et al.* (1962); Gao (1963); Gu & Gao (1985); Cai (1988); Wu (1990); Ohtaishi & Gao (1990) published about ungulate classification, ecology, anatomy, and zoogeography.

The present number of ungulate species in China is 35, belonging to Perissodactyla *(Equidae)* and Artiodactyla *(Suidae, Camelidae, Cervidae and Bovidae)*, five Families and twenty Genera. They are living in four eco-geographical subregions in northern China (Figure 1, Table 1).

The zoogeography of recent and past ungulates of China shows that some species are related to the Arctic ungulate fauna and some species are related to the fauna of North America and Europe. But some species have perished altogether or are endangered. The Chinese government passed a law in March 1989 that makes hunting of protected species illegal. About 33 species of ungulates were placed under protection.

Table 1. List of ungulates and their ecogeographical distribution in North China.

Ungulate species	Eco-geographical distribution			
	A	B	C	D
ORDER PERISSODACTYLA				
Family Equidae				
Wild Horse *Equus przewalskii (caballus)*		+(d)		
Mongolian Wild Ass *Equus hemionus*		+		
Tibetan Wild Ass *Equus kiang*				+
ORDER ARTIODACTYLA				
Family Suidae				
Wild Boar *Sus scrofa*	+		+	
Family Camelidae				
Camel *Camelus bactrianus*		+(e)		
Family Cervidae				
Siberian Musk Deer *Muschus moschiferus*	+		+	
Forest Musk Deer *Moschus berezovskii*			+	
Alpine Musk Deer *Moschus chrysogaster*				+
Horse Musk Deer *Moschus sifanicus*				+
Black Musk Deer *Moschus fuscus*				+
Tufted Deer *Elaphodus cephalophus*			+	
White-lipped Deer *Cervus albirostris*				+
Red Deer *Cervus elaphus*	+	+		+
Sika Deer *Cervus nippon*			+	
Sambar *Cervus unicolor*				+
Père David's Deer *Elaphurus davidianus*			+(d)	
Moose *Alces alces*	+			
Reindeer *Rangifer tarandus*	+			
Roe Deer *Capreolus capreolus*	+	+	+	
Family Bovidae				
Wild Yak *Bos grunniens*				+
Persian Gazelle *Gazella subgutturosa*		+		
Tibetan Gazelle *Procapra picticaudata*				+
Mongolian Gazelle *Procapra gutturosa*		+		
Przewalski's Gazelle *Procapra przewalskii*		+(e)		
Tibetan Antelope *Pantholops hodgsoni*				+
Saiga *Saiga tatarica*		+(d)		
Goral *Nemorhaedus goral*			+	+
Red Goral *Nemorhaedus cranbrooki*				+
Serew *Capricornis sumatrensis*			+	
Takin *Budorcas taxicolor*			+	+
Himalayan Tahr *Hemitragus jemlahicus*				+
Ibex *Capra ibex*		+		
Blue Sheep *Pseudois nayaur*		+		+
Dwarf Blue Sheep *Pseudois schaeferi*				+
Argali Sheep *Ovis ammon*		+		+

A: Mountain-forest sub-region of frigid-temperate zone.
B: Desert and half-desert sub-region of temperate zone.
C: Mountain-forest-steppe sub-region of temperate zone.
D: Forest-meadow-steppe sub-region of highland frigid-desert zone.

d: Extinct.
e: Endangered.

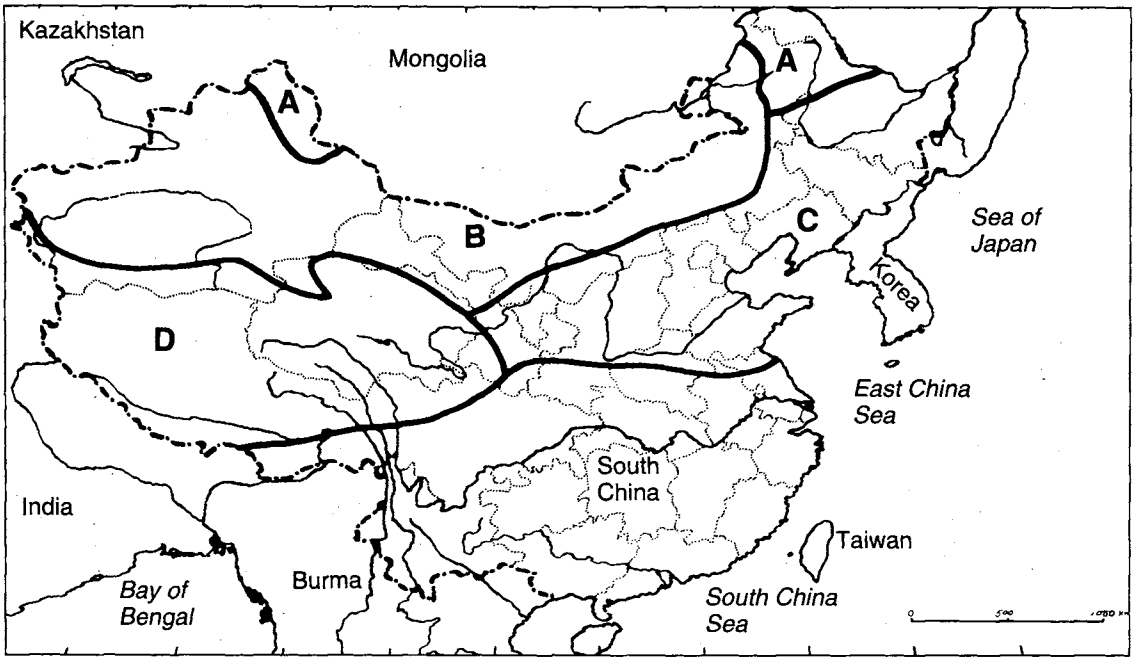

Fig. 1. The ecogeographical subregions of ungulates in North China.
A: Mountain-forest subregion of frigid temperature.
The cold-temperate mountain forests of Heilongjiang province and of Xinjiang province.

B: Desert and half-desert subregion of temperate zone.
The temperate desert and semi-desert of eastern Liaoning province, Jilin Province, inner Mongolia, northwestern Gansu province and centre of southern Xinjiang province.

C: Mountain-forest steppe subregion of temperate zone.
Western part of Liaoning, Jilin and Heilongjiang provinces, Hubei, Shandong, Shanxi three provinces to the northern part of Jiangsu, Anhui, Henan and Shaanxi four provinces and south eastern part of Gansu province.

D: Forest-meadow-steppe subregion of highland frigid-desert zone. Including Quinhai, Xizang (Tibet), western part of Sichuan and Kunlun and Altun mountain of Xinjiang province, this is a high plateau in China.

The purpose of this paper is to introduce the contemporary ungulates of northern China and their eco-geographical distribution.

Eco-geographical characteristics of ungulates

China is divided into three major natural geographical divisions: 1) the distinct monsoon area of the eastern part, 2) the desert and semi-desert region of Inner Mongolia and the Xinjiang province, 3) the mountain plateau of Tibet (Zhang *et al.*, 1985).

Table 1 lists the ungulates of northern China and shows their distribution to four subregions of the eco-geographical distribution of ungulates as follows:

1) *Cold temperate mountain forests* (A). The northern part of China is usually referred to as the «cold zone of China». It includes the mountain chains Da Hinggan Ling, Xiao Hinggan Ling of Heilongjiang Province and Altay Shan mountains of the Xinjiang province.

The predominate tree species in this region are *Larix dahurica*, which is mixed with some *Pinus sylvestris* var. *mongolica, Betula* spp., *Populus* spp., and *Quercus mongolica.* The dominant tree species of northern part of Xiao Hinggan Ling, is *Pinus koraiensis.* The ungulates are *Sus scrofa, Moschus moschiferus, Cervus elaphus, Alces alces, Capreolus capreolus,* and *Rangifer tarandus*, the latter being the only representative of the true Arctic fauna.

2) *Temperate desert and semi-desert* (B). This region stretches from the semi-arid steppes of the eastern part of Inner Mongolia to the deserts of the western part of Xinjiang province. This region includes Tarim and Qaidam Pendi basins and the mountains surrounding the basin of the Qinhai-Xizang (Tibet) plateau.

The characteristic grass species of the semi-arid steppe are *Stipa* spp., *Aneurolepidum chinensis, A. dasystachys, Agropyron cristatum, Achnatherum splendens and Artemisia* ssp. The two significant ungulate species are *Procapra gutturosa* and *Gazella subgutturosa.*

Dominant desert shrubs are *Nirtraria* ssp., *Haloxylon* ssp., *Alhagi sparsifolia, Reaumurea soongorica, Tamarix* spp., *Calligonus mongolicum, Ephedra* spp. and *Caragana* spp.

There are many species of ungulates in the desert, e.g. *Equus przewalskii* (on the verge of extinction), *E. hemionus, Camelus bactrianus* (endangered in China), *Cervus elaphus,* and *Capreolus capreolus* living at the border of the desert. *Procapra gutturosa, P. przewalskii, Gazella subgutturosa,* and *Saiga tatarica* all have the desert as their main habitat. The adjacent mountains hold *Capra ibex, Pseudois nayaur,* and *Ovis ammon.*

3) *Temperate mountain forest and steppe* (C), prevalent of the central and eastern region. On the steppes there are some isolated and forested mountain ranges with «insular» populations of ungulates.

These forests include coniferous, deciduous and mixed types, characterized by *Abies* spp., *Larix potaninii, Pinus* spp., *Betula* spp., *Tilia* spp., *Acer* spp., *Quercus* spp., *Popolus* spp. and *Sophora* spp.

These forest-steppes are inhabited by *Sus scrofa, Moschus moschiferus, M. berezovskii, Elaphodus cephalophus, Cervus nippon, Elaphurus davidianus, Nemorhaedus goral, Capreolus capreolus, Capricornis sumatraensis* and *Budorcas taxicolor.*

4) *Alpine forest-meadow-steppe ranges* (D); mainly of the Qinhai-Xizang (Tibet) plateau. It includes Pamir, Kunlun Shan mountains in the north and Himalaya mountains in the south. Usually, the altitude is from 4000–6000 meters.

In the high altitude forests *Larix, Abies, Betula, Populus, Quercus* are the dominant trees, whereas the high alpine meadows and steppes are characterized by *Kobresia stipa* and *Artemisia.* The cold desert of northwestern Tibet holds only a few species like *Stipa, Artemisia, Carex moocroftii,* and *Ceratoides compacta.*

The ungulates of the Qinhai-Xizang plateau has some endemic and rare species like *Equus kiang, Moschus chrysogaster, M. sifanicus, M. fuscus, Cervus albirostris, Bos grunniens, Procapra picticaudata, Pantholops hodgsonii, Nemorhaedus cranbrooki, Hemitragus jemlahicus, Pseudois schaeferi* and *Ovis ammon.*

Discussion

The fossil records reveal that many of the 53 discovered prehistoric species have relatives among the present ungulates in northern China (Table 2).

About half of the fossil species can be referred to Bovidae. The center of bovid evolution and differentiation was in Asia and Africa, but during lower pliocene Ovibovines with peculiarly shaped horns, including *Urmiatherium, Parurmiatherium, Criotherium* and *Tsaidamotherium* were not uncommon in Asia (Neas & Hoffmann, 1987).

As an example: Muskox (*Ovibos moschatus*) and takin (*Budorcas taxicolor*) are similar sized ungulate species living in different environments. The takin is distributed in Asia only, while the muskox is found in North America and Europe. Muskox and takin evolved from a common ancestor, as the soergelid goat can be considered a primitive muskox because of the structure of its horn cores, teeth, and metapodials. *Soergelia* may be more closely related to *Boopsis* from lower Pleistocene deposits of China (Harrington, 1989). On the other hand, Neas & Hoffmann (1987) also pointed out that the takin appears to be closely related to *Boopsis* from the upper Pliocene to lower Pleistocene in China and to such Pleistocene forms as the Nearctic shrub-oxen (*Euceratherium*) and the Holarctic steppe-goat (*Soergelia*).

Some ungulate species are currently found in both North America and Eurasia, *Rangifer tarandus, Alces alces,* and *Ovis dalli.* Genera as *Equus, Camelus, Bos,* and *Saiga* have become extinct in North America and Europe but still survive in Asia. The dramatic changes in mammalian distribution were brought about by geological causes and glaciations triggered by Pleistocene climatic changes (Tarling & Tarling, 1971; Guthrie, 1988). During the last ice age glaciers severed connections between Alaska

Table 2. Distribution and periods of occurence of some fossil ungulates in Northern China.

Fossil species	Distribution	Occuring in: Plio-cene	Pleisto-cene	Holo-cene
Family Equidae				
Genus *Equus*				
E. caballus	Henan, Northeast		+	+
E. hemionus	Henan, Shaanxi, Northeast		+	+
E. przewalskii	Inner Mongolia Ningxia, Northeast		+	+
E. sanmeniensis	Xinjiang, Central China		+	
E. huanghoensis	Shanxi		+	
E. beijiangensis	Beijiang		+	
Family Camelidae				
Genus *Camelus*				
C. knoblochi	Inner Mongolia		+	
Genus *Panacamelus*				
P. gigas	Shanxi, Henan, Hubei, Beijiang		+	
Family Cervidae				
Genus *Moschus*				
M. primaevus	Inner Mongolia	+		
M. grandaevus	Inner Mongolia	+		
M. moschiferus	Beijiang		+	
Genus *Elaphodus*				
E. cephalophus	Shaanxi		+	
Genus *Cervus*				
C. (Rusa) elegans	Shanxi, Shaanxi, Hebei		+	
C. (Rusa) unicolor	Henan		+	
C. (Epirusa) hilheimeri	Henan		+	
C. (Pseudoaxis) grayi	Shanxi		+	
C. (Pseudoaxis) magnus	Henan, Shandong		+	
C. (Pseudoaxis) hortulorum	Shaanxi, Henan, Beijiang, Shandong		+	+
C. (Deperetia) trassaerti	Shanxi		+	
C. elaphus canadensis	Inner Mognolia, Hebei, Shanxi, Shaanxi		+	
C. elaphus xanthopygus	Jilin		+	
Genus *Elaphurus*				
E. davidianus	Henan, Hebei, Shanxi		+	+
E. bifurcatus	Shanxi, Hebei		+	
Genus *Alces*				
A. alces	Jilin		+	
Genus *Capreolus*				
C. manchuricus	Jilin, Shaanxi		+	

Fossil species	Distribution	Occuring in: Plio-cene	Pleisto-cene	Holo-cene
Family Bovidae				
Genus *Gazella*				
G. gaudryi	Gansu, Henan, Shanxi	+		
G. paotehensis	Gansu, Henan	+		
G. blacki	Shaanxi	+		
G. sinensis	Shanxi, Hebei		+	
G. dorcadoides	Shanxi, Gansu, Shaanxi, Xinjiang	+		
G. subgutturosa	Inner Mongolia, Hebei, Northeast		+	
G. kueitensis	Qinhai		+	
G. paragutturosa	Hebei, Henan		+	
Genus *Pachygazella*				
P. grangeri	Shanxi	+		
Genus *Urmiatherium*				
U. intermedium	Shanxi, Gansu	+		
Genus *Tsaidamotherium*				
T. hedini	Qinhai	+		
Genus *Budorcas*				
B. taxicolor lichii	Henan			+
Genus *Boopsis*				
B. sinensis	Henan		+	
B. breviceps	Shanxi		+	
Genus *Capra*				
C. sp.	Henan			+
Genus *Ovis*				
O. ammon	Inner Mongolia, Hebei, Gansu, Shanxi, Shaanxi		+	
O. shangi	Henan			+
O. shantungensis	Henan, Shandong		+	
O. zdanskyi	Henan		+	
O. nahoor	Hebei, Inner Mongolia		+	
Genus *Pseudois*				
P. nayaur	Liaoning		+	
Genus *Bison*				
B. palaeoainensis	Hebei, Henan, Shaanxi, Shanxi		+	
B. (Parabison) exiguus	Henan		+	
B. (P.) e. exiguus	Jilin		+	
B. (P.) e. curvicornis	Jilin		+	
B. (P.) e. harbinensis	Jilin		+	
Genus *Bos*				
B. taurus	Jilin		+	
B. primigenius	Hebei, Henan, Shanxi, Jilin, Inner Mongolia		+	

and southern North America and also lowered sea level thereby opening the landbridge across the Bering Strait and linking Asia and Alaska.

Some important species were extinct or endangered because of the changing ecological environment in North China. Wild horse (*Equus przewalskii*), Père David's deer (*Elaphurus davidianus*) and saiga (*Saiga tatarica*) are extinct in the wild and camel (*Camelus bactrianus*) and Przewalski's gazelle (*Procapra przewalskii*) have become endangered.

The Przewalski's horse or the taki was discovered in the northeastern part of the Xinjiang province by Przewalski, but disappeared 20 years later from this region. It is now on the verge of extinction in Baytik Shan (Altai mountain) of Xinjiang and in neighbouring Mongolian Altai mountains.

The camel only inhabits the Loo-Nor region of the Xinjing province. At the end of the 19th century camels were found by a number of explorers. Nowadays, Chinese mammalogists report that the present distribution of camels in the Kong-Que River Delta was undoubtedly established only after the ancient city of Lo-Lan became a ruin (about 330 A.D.). Owing to human activity, a new local distribution has been formed at the mouth of the dry Kong-Que River.

The Père David's deer formerly occurred in lowland meadows of North and North Central China. Fossil and subfossil evidence shows that it never inhabited mountainous or forested regions. In 1865, Père David discovered a protected herd with about 120 deer in the Imperial Hunting Park, Nan Haizi, south of Beijing. It is believed that Père David's deer has been extinct in wild for about 1500 years.

The Przewalski's gazelle and the saiga have an unknown status between endangered and extinct. They are/were distributed in the Junggar (Dzungaria) basin of Xinjiang and the southern Ordos desert of Inner Mongolia and northern Gansu.

During recent decades, people are paying more attention to nature conservation. Governments of various countries as well as some international organizations have taken active management and conservation measures. In China, more than 370 protected areas have now been established. The Chinese Government passed a law in March 1989 banning hunting of protected species. About 80 varieties of mammals, among those 36 species of ungulates, were placed under first- or second-ranked protection. Some locally extinct species have been reintroduced to China. In 1985, a population of Père David's deer from Woburn Abby Park in England was introduced to Nan Haizi of southern Beijing. In 1988, 20 Przewalski horses were reintroduced into China from Germany and America. In 1990, nine Przewalski horses were released from the Jimsar Wild Horse Breeding Center into the Gobi Desert. A population of saiga from the earlier Soviet Union has been reintroduced to Gansu Province. It is of great significance to ensure the final protection of these rare elements of Chinese natural heritage.

However, many problems still remain concerning the classification, ecology and evolution of Chinese ungulates, and further studies on species and habitat protection are therefore needed.

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