



**CONVENTION ON
MIGRATORY
SPECIES**

Distribution: General

UNEP/CMS/ScC17/Inf.23
10 November 2011

Original: English

17TH MEETING OF THE
SCIENTIFIC COUNCIL
Bergen, 17-18 November 2011
Agenda Item 17.3.6

**BARRIERS TO MIGRATION.
CASE STUDY IN MONGOLIA**

**Analysing the Effects of Infrastructure on
Migratory Terrestrial Mammals in Mongolia**





BARRIERS TO MIGRATION: CASE STUDY IN MONGOLIA

Analysing the Effects of Infrastructure on Migratory Terrestrial Mammals in Mongolia

**Developed by: B.Lkhagvasuren, B.Chimeddorj and
D.Sanjmyatav**

Ulaanbaatar
August-October, 2011

Content

General Background	3
Aims and Objectives	5
Methods.....	5
Current Situation in Mongolia	6
I. Status of Migratory Ungulates in Mongolia	6
I.1 Asiatic Wild Ass (<i>Equus hemionus</i>).....	7
I.2 Mongolian Saiga (<i>Saiga borealis</i>).....	8
I.3 Mongolian Gazelle (<i>Procapra gutturosa</i>)	10
I.4 Goitered Gazzelle (<i>Gazella subgutturosa</i>)	12
II. Mining and Infrastructure Development in Mongolia.....	13
II.1 Major Ongoing Mining Projects.....	13
II.2. Proposed Mining Projects.....	14
II.3 Development of Infrastructure.....	15
III. Potential Impacts and Options for Prevention and Mitigation.....	18
III.1 Potential Negative Impacts to Migratory Ungulates.....	18
III.2 Measures to Mitigate Impacts and Recommendations from the Stakeholder Workshop.....	20
III.3 Guidelines on Urgent Response Measures	23
Conclusions.....	24
Acknowledgements.....	25
Reference Literature.....	26
Annexes I.-VII.	33

General Background

Many animal species all over the planet have habitats that are used for part of the year, because of seasonal climate changes or shifts in the food supply. Some species cope by travelling to a more hospitable place while others must migrate to mate and produce young (Berger, 2004). During the migration animals face countless obstacles losing numerous individuals.

Long-distance migration in terrestrial vertebrates is an ecological process that has operated globally for thousands, if not millions, of years (Berger et al., 2006). Most mass migrants track the seasonal and shifting patterns of greening vegetation over expanses of savannahs, steppes and grasslands (Harris et al., 2009).

Migration, the seasonal and round-trip movement of animals between discrete areas is a behaviour common to a diversity of taxa (Berger 2004). A few migrations are well known, such as the movements made by 1.3 million wildebeest *Connochaetes taurinus* in the Serengeti-Mara Ecosystem of Tanzania and Kenya. Other migrations are obscure, such as those carried out by eland *Tragelaphus oryx* in Botswana. Overall, our knowledge of migrations is low and human impact high; this jeopardizes the conservation of many migratory species (Berger 2004).

Animal species whose life histories entail long-distance movements may be especially sensitive to habitat fragmentation and associated human-generated barriers to movement (Berger, 2004). Effective conservation of such species will require integrative approaches that blend science and public policy, such as a willingness to accommodate trans-boundary animal movements (Bolger et al., 2008). Numerous species undergo impressive movements, but due to massive changes in land use, long distance migration in terrestrial vertebrates has become a highly fragile ecological phenomenon (Berger et al., 2006).

The world's great overland migrations are disappearing, truncating fundamental processes that have contributed to ecosystem function for millennia. With more people reliant on lands that were once remote, intact habitats are now replaced by livestock, fences and people (Wilcove, 2007, cited in Berger et al., 2008). Nevertheless, expansive grasslands and deserts in China, Mongolia, Kazakhstan and Russia still sustain extraordinary movements between winter and summer ranges, including those of chiru (*Pantholops hodgsonii*), white-(*Procapra gutturosa*) and black-tailed (*Gazella subgutturosa*) gazelles, khulan (*Equus hemionus*), saiga (*Saiga tatarica*), and Bactrian camels (*Camelus bactrianus*) (Schaller, 1998a; Berger, 2004; Olson et al., 2005). The last three species – all recognized as endangered by the IUCN – along with mammoths, *Panthera* lions, and wild horses (*Equus* spp.) once moved between Asia and North America using the Bering Land Bridge (Berger et al., 2008).

Impediments to movements of wide-ranging terrestrial mammals share common anthropogenic traits: railway lines for Mongolian gazelles (*Procapra gutturosa*) in Central Asia (Ito et al. 2005), highways for brown bears (*Ursus arctos*) in North America (McLellan & Shackleton 1988, cited in Berger et al., 2006). While species such as saiga (*Saiga tatarica*) or chiru (*Pantholops hodgsonii*) (Schaller 1998a; Milner-Gulland et al. 2001) are threatened by poaching, the overarching problem for effective conservation has been large-scale habitat change (Berger et al., 2006).

Conservation science overlooks numerous migrations; so many have already disappeared and continue to do so. When mass migrations decline, the numbers of migrants and the distances travelled often fall. Quantifying a threshold requires credible historic and current data, which are lacking for most species and systems (Harris et al., 2009).

Linear developments, such as railways, highways, and pipelines can have significant impacts on wildlife movement and survival. Habitat fragmentation increases the risk of extinction of local populations, because population size and genetic diversity decrease (Harris et al., 2009).

The Convention on Migratory Species (CMS) works internationally to conserve migrations across taxa (www.cms.int). CMS focuses on species threatened with extinction, but include other species whose migrations would significantly benefit from international cooperation, including strictly migratory and nomadic species. The Convention currently lists three large mammals that migrate(d) in aggregations, the scimitar-horned oryx (Extinct in the Wild), Saiga antelope (Critically Endangered), and the Mongolian gazelle (Least Concern) (IUCN 2008).

CMS has identified addressing barriers to migration as a key priority for the conservation of migratory species. In Central Asia, and in Mongolia in particular, the number of planned and constructed large infrastructure projects (including railways, mining sites, pipelines, border fences, roads, etc.) has increased rapidly over the last years. This emphasizes the urgent need to identify the effects of the current infrastructure developments in Mongolia through critical habitat and migration routes of major CMS listed migratory ungulates including Goitered gazelle (*Gazella subgutturosa*), Mongolian gazelle (*Procapra gutturosa*), Asiatic wild ass or Khulan (*Equus hemionus*), and Mongolia saiga (*Saiga borealis*) in order to develop recommendations and appropriate measures to avoid negative impact on these species.

UNEP/CMS agreed to cooperate with the WWF Mongolia Programme Office for the purpose of analyzing the effects of linear infrastructure on migratory terrestrial mammals using Mongolia as a case study and, based on this analysis, developing a report on “barriers to migration” in Mongolia. This will contribute to the Implementation of Recommendation 9.1, which requests that the Central Eurasian Aridland Concerted Action and associated Cooperative Action should be pursued, covering all threatened migratory large mammals of the temperate and cold deserts, semi-deserts, steppes and associated mountains of the larger Central Asian region. In addition, a Draft Resolution on the critical role ecological networks will be discussed at the 10th Conference of the Parties (COP10) in November 2011, and which recognizes "*that habitat destruction and fragmentation are among the primary threats to migratory species, and that the identification and conservation of habitats, in particular the critical sites and connecting corridors, are thus of paramount importance for the conservation of these species.*"

In Mongolia, a construction of major railway line from Ulaanbaatar, the capital city, to Dzamiin Uud, Dornogobi province, the southern border point (see map 1 in Annex I), was finished in the end of 1950s. This was the first tangible obstacle to migration of wild ungulates, such as Mongolian gazelle (Chagnaadorj, 1964; Sosorbaram, 1966; Eregdendagva & Sosorbaram, 1969; Tsagaan, 1980; Sokolov et al., 1982; Lhagvasuren, 1985; Tsagaan & Lhagvasuren, 1986; Lushekina et al., 1986; Eregdendagva, 1997; Lhagvasuren & Milner-Gulland, 1997; Kiriliuk, 1997; Sokolov & Lushekina, 1997; Milner-Gulland & Lhagvasuren, 1998; Schaller[b], 1998;

Lhagvasuren, 1999; Banzragch, 1999; Schaller & Lhagvasuren, 1999; Lhagvasuren et al., 1999; Lhagvasuren, 2000; Lhagvasuren et al., 2001; Ito et al., 2004; Ito et al., 2005a; Lhagvasuren et al., 2005; Ito et al., 2005b; Lhagvasuren B. 2005; Buuveibaatar et al., 2005; Lhagvasuren et al., 2006; Chimeddorj et al., 2006; Lhagvasuren et al., 2007; Ito et al., 2008; Buuveibaatar et al., 2008; Olson et al., 2009; Ito et al., 2009; Lhagvasuren et al., 2009; Lhagvasuren et al., 2010; Lhagvasuren B., 2011), goitered gazelle (Kaczensky et al., 2006; Assessment of the steppe and desert ungulates report, 2009), and khulan (Reading et al., 2001; Kaczensky et al., 2006; Assessment of the steppe and desert ungulates report, 2009).

Aims and Objectives

Given the number of infrastructure projects planned and currently being implemented in the open and still largely interconnected landscapes of Mongolia, a comprehensive assessment of the effects of these projects on migratory mammals is needed to inform relevant policy processes and ensure that fragmentation of habitat and migration routes is avoided and their integrity is maintained. Therefore, the main objectives of the study were to:

- review the existing literature on habitat fragmentation and migration routes due to infrastructure as well as on tools and measures to avoid negative impacts on habitat fragmentation and especially on migratory species.
- Assess the effects of both existing and planned infrastructure projects on migratory terrestrial mammals in Mongolia:
 - o What is the current situation in Mongolia in terms of planning and construction of new infrastructure?
 - o What are the effects of existing linear infrastructure on migratory species in Mongolia?
 - o What action is being taken or could be taken to ensure that the negative impacts of the infrastructure on migratory behaviour are minimized?
 - o To what extent have construction projects considered appropriate corrective measures to mitigate their environmental impact?
 - o What are the main stakeholders that have participated in the planning processes and what kind of stakeholder consultations or dialogues have been conducted?

Methods

Case study team included: Dr. B.Lkhagvasuren, team leader; B.Chimeddorj, in charge of large ungulate studies; D.Sanjmyatav, in charge of GIS based mapping and digital data processing and compilation.

a). Ecology of migratory species.

The team identified distribution areas of Mongolian wild migratory ungulates (e.g. wild ass - khulan, black-tailed gazelle, Mongolian gazelle and Mongolian saiga) by using additional GIS extensions such as ArcView GIS, ArcMap Kernel (95, 70, & 50) and MCP based data and

findings from previously conducted research and other related reference materials. The research and reference sources used are listed in reference literature.

b). Literature review on the effects of linear infrastructure projects on habitat fragmentation.

Literature addressing the questions on impact of linear infrastructures to migration of mammals in Mongolia is rare, and only a small number of articles was published mostly in national scientific papers before 2000, and some articles were published in international journals after 2000, so the team had an opportunity to review and incorporate the findings into this report. Beside this, related literature from international sources about migration, obstacles to migration and ways to mitigate these obstacles, was reviewed either from available database or from internet. Please see the list of articles reviewed for this report in reference literature.

c). Review of infrastructure development plans in Mongolia.

This review was possible mostly by physical meetings with related people and during the stakeholders' workshop. Some of sources were obtained from existing internet sites, but majority of them were incomprehensive or with limitations for access. Stakeholders' workshop was the main source to obtain relevant data on infrastructure development plans in Mongolia. For findings of this review, please, see related chapters of this report and annexed maps.

d). Field research trip.

After reviewing available documents on infrastructure projects, the team decided to make a field trip to the areas where the migration of the ungulates affected by international border fences and visit the main mining sites along the route. During the field trip, the team documented the findings and collected necessary information related to linear infrastructure and mining activities (see attached photos and discussions in the text).

e). Interviews and discussions with key stakeholders known to be involved in infrastructure development in Mongolia.

The team has contacted as many of the known stakeholders in Mongolia as possible to discuss the issue through meetings in our office, visiting their offices where appropriate, and via telephone conversations and e-mails. From these conversations and interviews, the team concluded that the workshop, where the stakeholders can come and share information about existing and planned infrastructure, mining operations and future plans, state policies on mining, infrastructure development, impacts on nature and the wildlife, with possible participation in development of recommendations, is the most appropriate way to collect needed information and to raise awareness on the problem among them.

Current Situation in Mongolia

I. Status of Migratory Ungulates in Mongolia

Mongolia, often called the “land without fences,” provides the last remaining refuge for a number of migratory species that require large areas of habitat (Kaczensky et al., 2006).

After joining the CMS in 1999, Mongolia initiated inclusion of 5 migratory ungulates species into CMS Appendices I and II: wild camel (*Camelus bactrianus*) in Appendix I, saiga antelope

(*Saiga borealis*) in Appendix II, and Mongolian- (*Procapra gutturosa*) and goitered (*Gazella subgutturosa*) gazelles and the wild ass or khulan (*Equus hemionus*) in Appendix II.

In this report, we excluded the discussion of the wild camel status in Mongolia due to several reasons, including (i) its range is fully protected, and (ii) the animal is not affected yet by any infrastructure developments and mining activities within the range, and (iii) there are no any major routes are going through its habitat. So we discussed only about the remaining four ungulate species.

I.1 Asiatic Wild Ass (*Equus hemionus*)

- Declining population
- Limited distribution
- Threatened species

Mongolia is an important stronghold of the Asiatic wild ass (*Equus hemionus*, khulan in Mongolian) and has a global responsibility to ensure its conservation (Kaczensky et al., 2009). The Asiatic wild ass is well adapted to live in arid deserts and semi-deserts of southern Mongolia, and regarded as threatened with extinction by IUCN, and as rare in Mongolian Law on Fauna (2000), and Mongolian Red Book (1998). It is included in Appendix I of CITES and Appendix II of CMS. About 30 per cent of the distribution area is protected (Clark et al., 2006) and hunting is prohibited.

Distribution. Historical evidence from Mongolia suggests that a dramatic decrease in the distribution range occurred during the 19th century, restricting khulan distribution to the Gobi areas in the south, southwest, and the depression of the great lakes in the Gobi-Altai and Khovd aimag (Bannikov, 1954 in Zevegmid and Dawaa, 1973, map 1 in annex I). By the 1970s, khulan had disappeared from the depression of the great lakes and were restricted to the main Gobi region (Zevegmid and Dawaa, 1973). Simultaneously, the population either expanded or shifted its main distribution area further eastwards. In the 1970s and 1980s, the south Gobi seems to have been the key khulan area; by the 1990s, the southeast Gobi became the key distribution range, which still appears to be the case today (Reading et al., 2001).

Population. The population of the wild ass in Mongolia is considered to be the largest in the world (Feh et al., 2002) and national and international researchers estimated there were about 3,500-5,000 individuals in Altai Uvur an Zuungaryn desert in middle of the 1990s, 1,000-2,500 individuals in the south Gobi, and 35,000 individuals recorded in Eastern Gobi in the last over decade (Reading et al., 2001). According to the study in 2007, there were 15,000-20,000 individuals recorded in Mongolia (Lkhagvasuren, 2007). The latest (2009) studies of steppe and desert ungulates, there were 14,000 individuals recorded (Assessment of the steppe and desert ungulates report, 2009).

Habitat. The species is found in the Gobi, desert low mountains and their foothills, hills, mountainous valleys, vicinity of swampy depressions and ponds, *Anabasis spp.*, *Reamuria songorica*, *Salsola passerina*, *Sympegma Regelii*, *Stipa spp.*, *Caragana spp.*, *Allium spp.*, *Artemisia spp.*, and *Nitraria spp.* and shrubby community dominant rocky overburden/covered desert and desert steppe. The species is also found in *Haloxylon ammodendron* dominant

depressed valleys. *Ulmus pumila* dominant wide ephemeral channels, natural springs, oasis, salty lakes and ponds are also suitable habitats and play important roles in stable existence of the species within the habitats. Asiatic Wild Ass seasonally moves and migrates depended on pastureland/rangeland yields. In autumn and winter, the species moves and migrated in herds that usually join each other constituting herds from several hundreds to more than a thousand individuals.

Causes of scarcity/rarity. The population is steadily declining due to harsh climatic conditions (continuous draughts and severe winters), poaching for meat - annually, it was reported that about 3,000 individuals were illegally hunted (Zahler, 2004), as well as competition with livestock on water and pasture resources, and highly affected by newly operating large mining developments in the Gobi region and associated linear infrastructures such as fences along a railway between Ulaanbaatar and Beijing and other human activities restrict the species movements, migration, access to grazing areas and water sources (Clark et al., 2006).

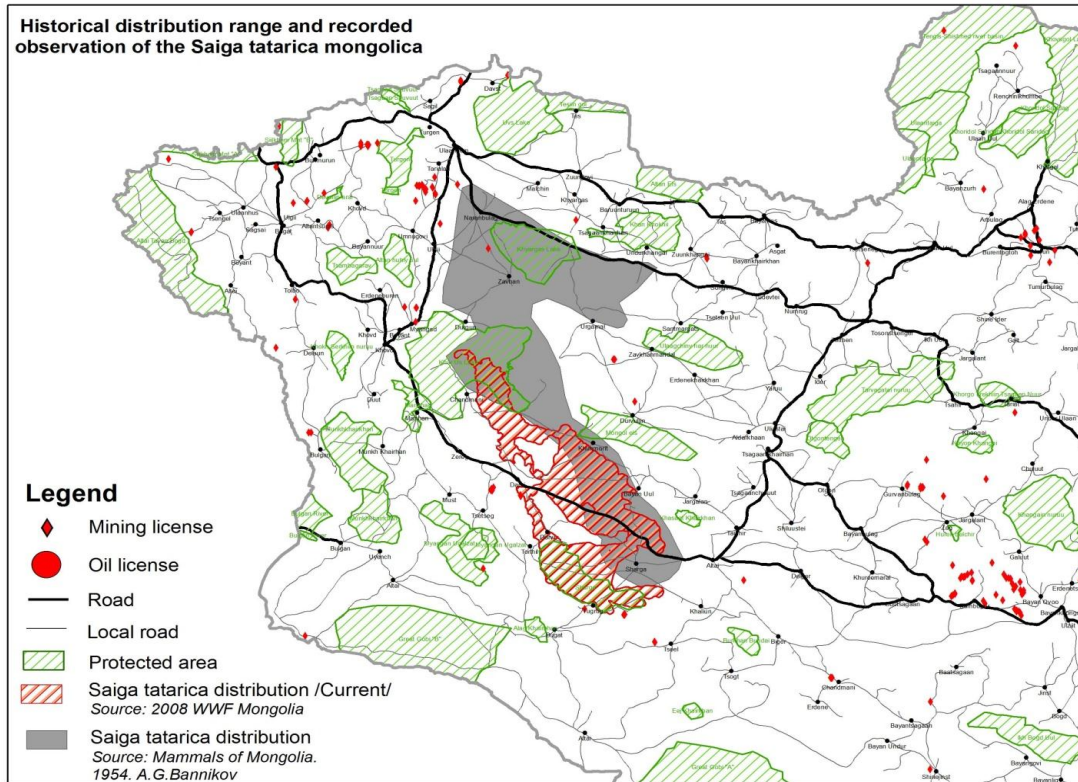
I.2 Mongolian Saiga (*Saiga borealis*)

- Declining population
- Limited distribution
- Glacier relict species
- Critically endangered species
- Endemic to Mongolia

According to the international and regional (Clark et al., 2006) assessments, the species is listed as critically endangered and endangered respectively. The Mongolian saiga is also included in CITES Appendix II (UNEP-WCMC, 2006), CMS Appendix II and in the List of globally endangered 100 species (Isaac et al., 2007). The species is legally protected by the Mongolian Laws on Fauna and Hunting, where its hunting is prohibited (Badam, Ariunzul, 2005) and listed as very rare species in the second edition of Mongolian Red Book (Shiirevdamba et al., 1997).

The Mongolian Saiga (*Saiga borealis mongolica*), a distinct endemic subspecies of *Saiga borealis* that once roamed from the British Isles through Central Asia and the Bering Strait into Alaska and the Yukon. *S. borealis* was a typical representative of the “mammoth biome” in the Pleistocene peri-glacial steppes and cryogenic savannahs. Two subspecies are recognized: *S. borealis borealis* Tschersky (Eastern Siberia and Alaska); and *S. b. prisca* Nehring, 1891 (Europe, Urals and Western Siberia). At the end of the Pleistocene, when the mammoths disappeared, the range of *S. borealis* was reduced. Today they live only in Western Mongolia (*S. borealis mongolica* Bannikov, 1946). *S. tatarica tatarica* was widely distributed in the other territories of the steppe and semi-desert zones of Eurasia and disappeared in Mongolia in late 1960s (Dulamtsuren, 1970).

Distribution: It has limited distribution and found in Uushiin Gobi, Durgun steppe, Khuisiin Gobi, and Shargiin Gobi in Great Lakes’ depression to the south of Khar Us Lake in Western Mongolia. About 80 per cent of its distribution areas and habitats that were recorded in the 1940s in the last century have been lost. There are two separate or fragmented populations in Mongolia (map 1).



Map 1. Historical and current distribution of Mongolian saiga.

Habitat: The Saiga antelope is the flagship species of the desert steppe in the Great Lake depression. Its suitable habitat includes Sharga and Khuisiin Gobi *Stipa glareosa* - *Allium polyrrhizum*, *Stipa glareosa* – *Cleistogenes squarrosa*, *Stipa glareosa* – *Artemisia spp*, *Stipa glareosa* – *Reaumuria songorica* and *Stipa glareosa* – *Anabasis brevifolia* community dominant rocky flat plain desert steppe. It avoids from mountainous and uneven/bumpy areas.

Population: Population sizes in Sharga and Khuisiin Gobi are quite changeable. According to the last decade research findings, there were about 5,200 heads recorded in 2000 (Dulamtsere, Amgalan, 2003), but they were reduced to about 3,200 in 2008 (Amgalan et.al, 2008). Small population in Mankhan was about 200 in 1975, but it was reduced to 35 heads (Mallon and Kingswood, eds., 2001) According to 2007 data, the population in Mankhan had 15 heads (Amgalan et.al., 2008).

WWF Mongolia programme Office in cooperation with the Institute of Biology and international scientists conducted annual assessment of the saiga population in 2010 using an aircraft and estimated that about 8000 saiga are distributed in Mongolia (Mongolian saiga assessment report, 2010).

Causes of scarcity/rarity: Population decrease is mostly impacted by harsh natural conditions of frequently occurred droughts and *dzud*, heavy snow falls and illegal hunting as well as attacks of predators/carnivores.

I.3 Mongolian Gazelle (*Procapra gutturosa* Pallas, 1777)

- Declining species throughout the range

The Mongolian Gazelle is listed as least concern species (IUCN, 2010) and as an endangered species according to the regional assessments (Clark et al., 2006). The species is also included in the Convention on Migratory Species (CMS) Appendix II.

Distribution: The northernmost edge of the Mongolian gazelle population's habitats in Eastern Mongolia includes territories of Darkhan and Bayanmunkh (Kherlen river), Bayan-ovoo, Dadal and Norovlin soums of Khentii aimag and Bayan-uul, Bayandun (southern part), Dashbalbar soums of Dornod aimag, Ulz river and southern steppe of Ereentzav, Bor-undur and eastern and southern edges (excluding Khalkh river and continued Khayngan mountains) to the State border and Ulaanbaatar-Zamyn Uud railway to the west. To the west of railway, namely territories of Ulaanbadrakh, Khovsgul, Khatanbulag, Mandakh, and Saikhandulaan soums of Dornogovi aimag and Undurshil, Gurvansaikhan, Ulziit, Khuld, and some parts of Delgerhangay soums of Dundgovi aimag, the Mongolian gazelle is found. There is a population of Mongolian Gazelle in Khom steppe in territory of Durvuljin soum of Zavkhan aimag (Lhagvasuren, 2000).

Habitat: Suitable habitat of Mongolian gazelle is the *Stippa spp.* steppe with low mountains and hills. The species usually move from place to place depending on the availabilities of water and grazing areas, migrating throughout the vast *Stipa* steppe in Eastern Mongolia. The Mongolian gazelle is the herbivore ungulate and ecosystem engineer species that restricts the plant competition and fosters plant diversity. Additionally, the Mongolian Gazelle is regarded as the indicator of *Stipa* steppe ecosystem health in Eastern Mongolia (Lhagvasuren, 2000).

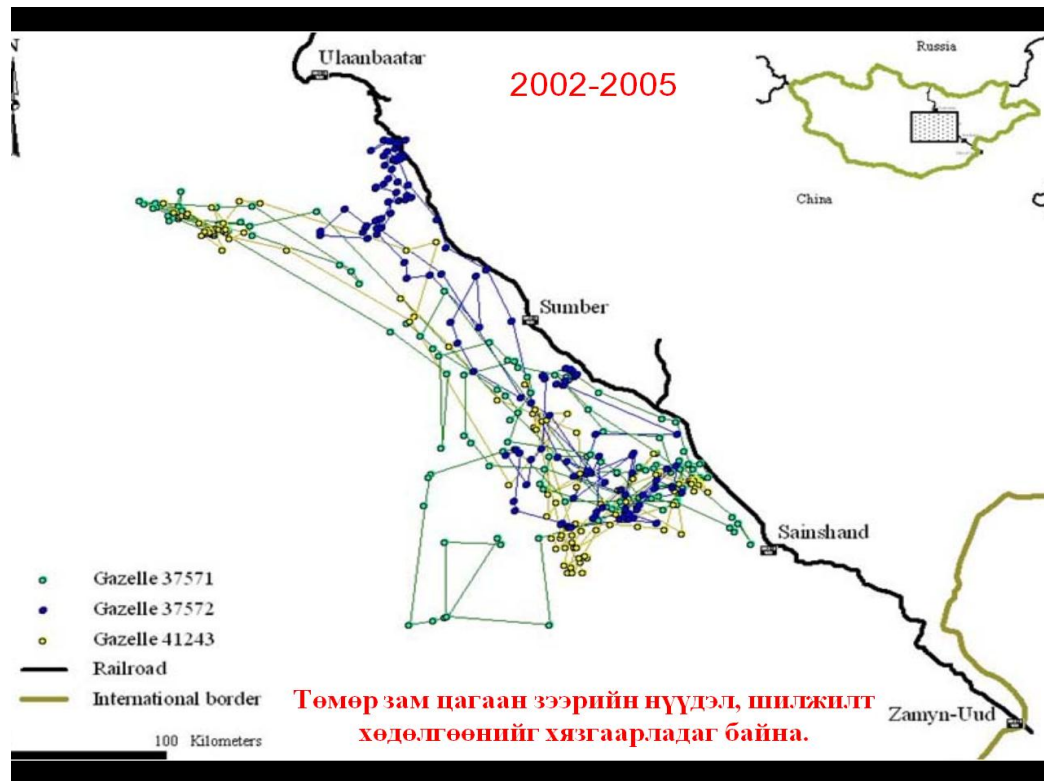
Population: The first scientific report on population numbers was mentioned by A.G. Bannikov, the Russian explorer, and there were about one million individuals of Mongolian gazelle in the territory of Mongolian People's Republic in 1950s (Bannikov, 1954). Since then, there have been several attempts to assess the population number of the Mongolian gazelle in Mongolia using different methodologies. The numbers vary from several hundred thousand to couple millions (Luschekina et al., 1986; Lhagvasuren, 2000; assessment report, 2009).

Causes of scarcity/rarity: Although harvesting in large numbers and mortality are high in Mongolian gazelle populations, a main cause of its population decrease is intensively developed livestock husbandry and unsustainable use of pastureland. Poaching and over-hunting of the species badly impacts the population (Lhagvasuren & Milner-Gulland, 1997; Reading et al., 1998).

The Ulaanbaatar-Beijing Railway that runs through the habitat of Mongolian gazelle has been fenced on both sides to prevent livestock straying onto the track. This has effectively divided Mongolian gazelle range in Mongolia, preventing movement between populations and hindering recolonization of former range to the west (Lhagvasuren et al., 2001).

Some satellite-tracked gazelles could not cross the railroad despite they seem to try to cross it from west to east in their autumn migration. If the barrier effect is strong, and many gazelles cannot migrate to traditional winter ranges in the eastern side of the railroad, their mortality in

the western side is higher. Lhagvasuren et al. (2005) conducted a carcass census along the railroad for 570 km in June 2005. They found 241 gazelle carcasses had died within one year, in which 166 were in the western and 75 were in the eastern side. When we divide into five zones of about 100 km long, carcass numbers were higher in the western side in northern three zones. However, carcasses were found only in the eastern side in the most southern zone although the carcass density was low. These facts suggest that the railroad has one-sided barrier effect on gazelle movements, and the directions are from west to east and from east to west in the northern and southern part, respectively (Ito et al. 2005, picture 1).



Picture 1. Railways are a barrier to the movement of collared gazelles (Ito et al. 2005).

Some years, hundreds of Mongolian gazelles try to cross the barbed fences along the Mongolian-Russian border and die hanged on fences (Kiriliy, 1997, picture 2).



Picture 2. Border fences are the barrier to movement of the Mongolian gazelle.

I.4 Goitered Gazelle (*Gazella subgutturosa* Gueldenstaedt, 1780)

- Declining species
- Globally rare
- Widespread distribution
- Vulnerable species

According to the international and regional (Clark et al., 2006) assessments, the Goitered gazelle is listed as a vulnerable species. The species is also listed in the CMS Appendix II. The species is legally protected by the Mongolian Laws on Fauna and Hunting, where its hunting is prohibited, and listed as very rare species in the second edition of Mongolian Red Book (Shiirevdamba et.al., 1997).

Distribution: In Eurasia, the Goitered gazelle *Gazella subgutturosa* ranges from Mongolia and northwestern China to Israel and the Arabian Peninsula, and is highly nomadic throughout this range. The species is found in the Jungaryn Gobi (desert) and Altai Uvur Gobi (desert) in the south-west of Mongolia, Dornod/Eastern Steppe Gobi, Alashani Gobi (desert), Great Lake Depressions, Olon Lake valley, and the northern Gobi that belong to the Central Asian desert. The distribution areas and habitats recorded in the 1940s of the last century have been substantially reduced (Maps 5 & 6 in annex I).

Habitat: the Goitered gazelle is flagship species of the Central Asian desert and among desert steppe hoofed animal. The species is found in desert and desert steppe of Central Asian dry and arid regions in Mongolia and sometimes in mountain steppe. Suitable habitats include the Gobi and low desert mountain foothills, rolling hills, mountainous valleys, around marshy depressions and ponds, and flat plains that are distributed by *Anabasis brevifolia*, *Reaumuria songorica*, *Salsola passerina*, *Sympegma Regelii*, *Stipa spp.*, *Caragana spp.*, *Allium spp.*, *Artemisia spp.*, and *Nitraria spp.* and shrubby rocky desert and desert steppe habitats. Additionally, the species is found in *Haloxylon ammodendron* depressed areas. *Ulmus pumila* dominant wide shingle, natural springs, oases, salty lakes and ponds play important role in existence within the habitats providing important water access. Population movement and migration is depended on seasonal and pastureland conditions. In autumn and winter time, herds of populations join each other constituting herds from several dozens up to a hundred.

Population: Due to illegal hunting or harvesting and loss of herd structure, the species has become extinct in some parts of its range. There were totally 60,000 individuals throughout the populations in the 1990 (Amgalan, 2000). There were 11,978 individuals recorded by an inventory on steppe ungulates conducted in 2009 (assessment of the steppe and desert ungulates report, 2009).

Causes of scarcity/rarity: Illegal hunting is the main cause of decrease in population numbers. Use of natural resources (mining), presence of human and livestock in critical habitats (occupancy of oases and open water sources e.g. natural spring), fence along a railway between Ulaanbaatar and Beijing and other human activities result in restriction in their movement, migration, access to grazing areas and water sources (Clark et al., 2006). Once livestock is increasing within the habitats and distribution areas, the overgrazing, pastureland deterioration and competition have become a big concern.

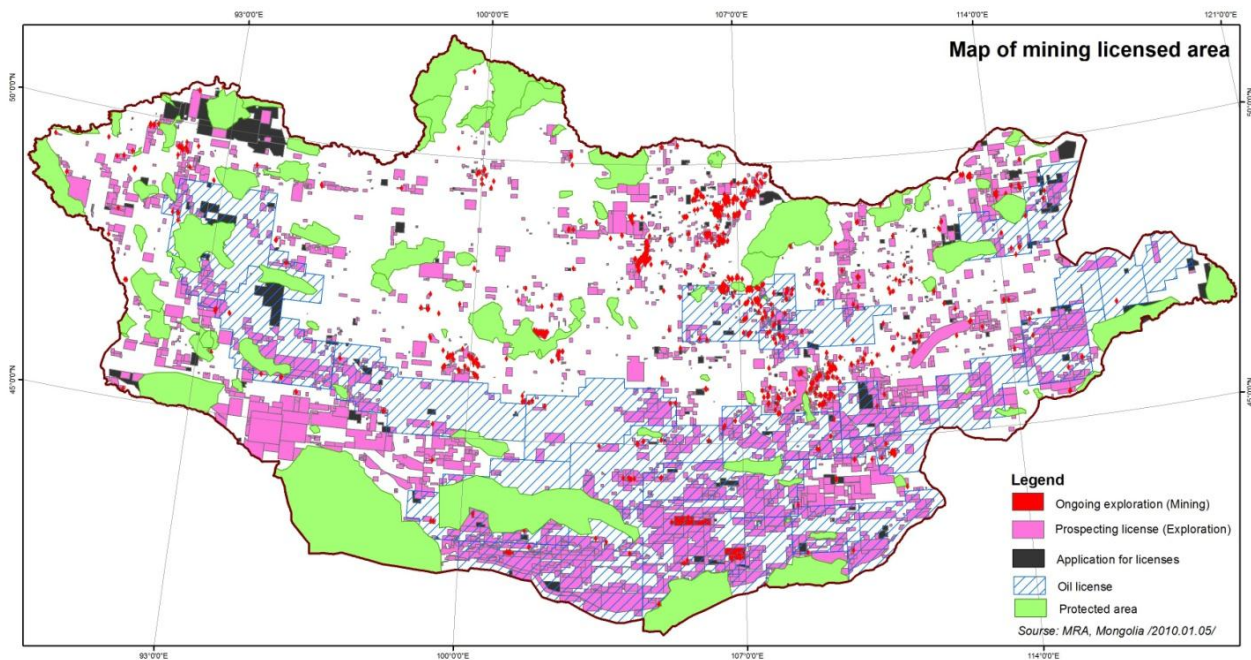
II. Mining and Infrastructure Development in Mongolia

II.1 Major Ongoing Mining Projects

The Southern and eastern parts of Mongolia are rich in underground natural resources. Thus, a number of mining projects and along with much intensive infrastructure development are being proposed and some of them have already started. The table below gives a brief introduction to the mine deposits (Table 1, maps 3 & 4) in use and their project intervention inception phases:

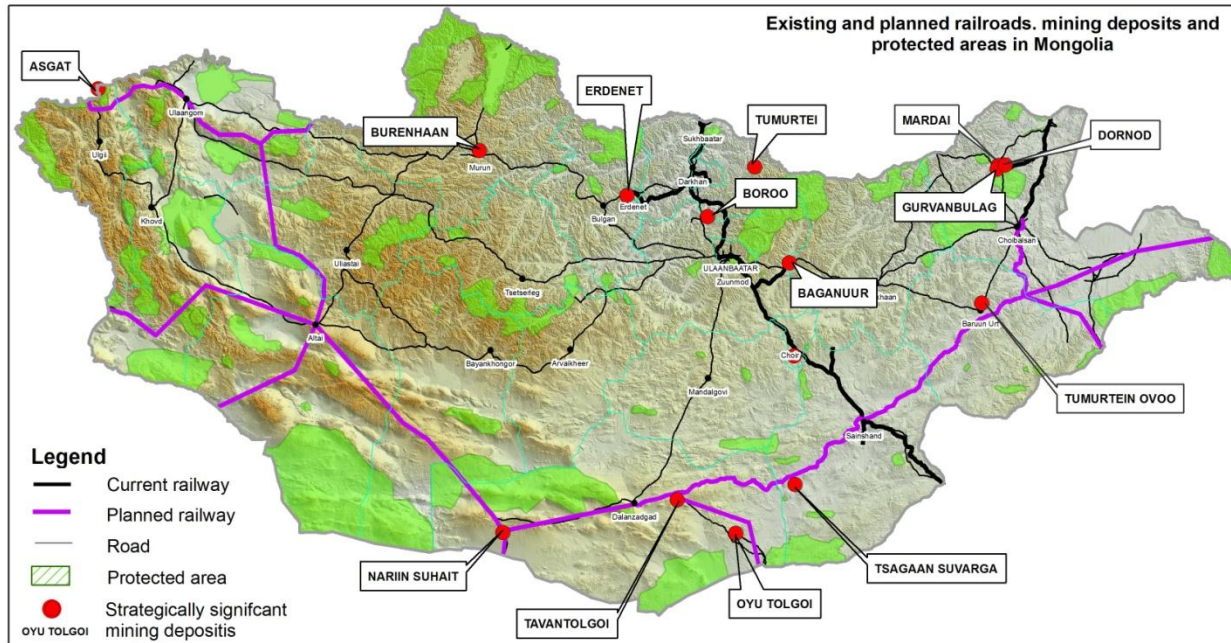
Tab. 1. Strategically significant mineral deposits of Mongolia. (Source: World Bank, 2008)

Deposit	Types of minerals	Mine life	Annual production (million, tons)	Dates of full scale capacity operations:		
				Prior to 2008	2009-2013	Starting from 2014
Tavan Tolgoi	coal	More than 100 years	15		+	
Ukhaa Khudag	coal	10-30	10		+	
Nariin Sukhait	coal	40	2	+		
Ovoot Tolgoi	coal	50	5		+	
Baruun Naran	coal	20	6		+	
Tsagaan Tolgoi	coal	20	2		+	
Oyu Tolgoi	copper & gold	15-50	1		+	
Tsagaan Suvraga	copper	30	0.15			+
Sumber	coal	50	5			+



Map 3. Major mining licensed areas of Mongolia

Most of mineral resources are mined for exporting. Exports of coal and other mineral resources are expected to reach 25 million tons in 2015 and will be doubled in 2025 (World Bank, 2010).



Map 4. Location of strategically significant mining deposits of Mongolia. (Source: Mining authority of Mongolia, 2011, WWF Mongolia, 2011)

II.2. Proposed Mining Projects

There are many mining deposits in Mongolia (maps 3 & 4 above). Map 4 shows the strategically significant mining deposits, according to Mongolian government mining classification. Many of these deposits are already in use, while others will be developed from 2012 and onward.

If in western Mongolia there is one large argentiferous deposit Asgat (proposed), then northern Mongolia contains one of world's largest phosphoric Burenkhaan deposit (proposed) near Khuvsgul lake, iron-ore Tumurtei deposit (ongoing). Significant uranium (Mardai and Dornod – in preparation), iron Tumurtein Ovoo (proposed), coal Baganuur (ongoing) and non-ferrous metals Gurvanbulag (in preparation) deposits are located in Eastern Mongolia, whereas southern Mongolia contains magnificent coal Tavantolgoi, Nariin Sukhait (ongoing), gold and non-ferrous Oyu Tolgoi (ongoing) and Tsagaan Suvarga (proposed) deposits respectively. Mining deposits at Mardai, Gurvanbulag, Dornod, and Tumurtein Ovoo are located in the main habitats of the Mongolian gazelle, while the Tsagaan Suvarga deposit covers habitats of the both Mongolian and Goitered gazelle species and the Khulan.

Mining sites in Mongolia generate direct and indirect threats to the wildlife in surrounding areas. They create better access to the area by establishing roads, which can be used by different people including the poachers. Miners sometimes turn to poaching, hunting wild animals for meat and/or just for leisure. Heavy machines create dust, noise and pollution, which disturb animals

and block their movement. Large mining sites attract small-scaled illegal miners, who, in turn, threatening the wildlife by poaching and polluting the area.

II.3 Development of Infrastructure

According to the economic survey previously conducted (World Bank, 2008), the railway business will be profitable when annual freight turnover is more than 5 million tons. For all the mining companies running their operations in the region, one of the optimal gateways to improve coal export volumes is the construction of railways. Thus, planning and designs of the Nariin Sukhait-Shivee Khuren and Ukhaa Khudag-Gashuun Sukhait railway (map 4) are already developed. A decision over Tavan Tolgoi-Tsagaan Suvraga-Sainshand-Choibalsan railway and starting its physical construction in 2011 has been made by the government and the State policy on railway has been approved by Parliament of Mongolia. Thus, the mining companies are planning to start the following road and facility constructions for coal transporting in the nearest future:

Paved road projects

Major existing roads of Mongolia are dirt (pic. 3). The government is planning to construct paved roads connecting major provincial towns and mining sites by 2016 (pic. 4). The roads mentioned below are planned to transport mining products to border points with China and will go right through the critical habitats of migratory ungulates.

Ovoot Tolgoi – Shivee Khuren paved road

Construction of a 45 km long and 17 m wide paved road from Ovoot Tolgoi to the coal point beyond the border point “Shivee Khuren” has commenced. When this road is opened, 20 million tons of coal will be exported annually (<http://www.minegolia.com/?p=430>).

Ukhaa Khudag- Gashuun Sukhait paved road

Construction of Ukhaa Khudag – Gashuun Sukhait paved road has been started by Energy Resources LLC and is in its final stage. When this road is opened, 18 million tons of coal will be exported annually. Currently, coal from Ukhaa Khudag mine is transported by over 500 heavy trucks (pic. 5 in annex III). As the road is opened, the number of trucks and automobiles commuting will be increased (<http://www.mmc.mn/projects-road.html>). Currently, there are no specific data and statistics on amount of coal extracted and number of trucks used for transporting. Miners and border officers witness at least 500 trucks transporting coal daily. In our assumption, amount of coal being extracted from small Tavan Tolgoi mine is not less than that extracted by Ukhaa Khudag coal mine.

Oyu Tolgoi-Gashuun Sukhait paved road

It has been planned to construct 80 km long and 12.5 m wide paved road from Oyu Tolgoi to Gashuun Sukhait and its construction has started. This road is planned to transport mining equipment and machinery imported to be used in mining operations and to transport the copper concentrates (by 80 ton capacity trucks) to the city of Wuyuan, China during the first three years of mining operations at full capacity. Intensity of transport per day will be 50 and more trucks as proposed. In order to ensure road and transport security, this road has been designed separately from the Tavan Tolgoi road and the roads are to be built in parallel. According to Mr. Mark Newby’s (Principal Advisor – Water Management, Oyu Tolgoi LLC) personal comments, the

company is planning to consider the construction of wildlife and livestock friendly underpasses every 8 kilometres.



Pic. 3. Existing road network of Mongolia (Source: Mongolian Road authority, 2011)



Pic. 4. Planned road network for 2016 (Source: Mongolian Road authority, 2011)

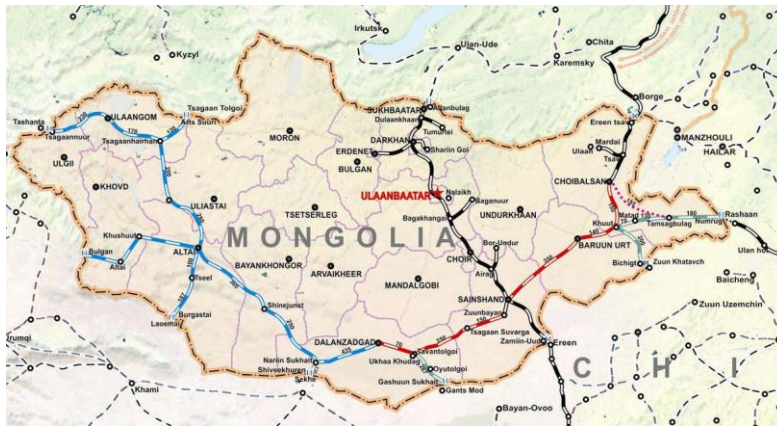
Railway construction projects

Since mining deposits of Mongolia are large and can be extracted for several decades and the principal exports will start from next 2-3 years, the government made a decision to construct the railway from major mining sites of southern Mongolia to China and Russia (pic. 5).

Tavan Tolgoi-Manlai-Mandakh-Sainshand-Choibalsan railway

The Government of Mongolia recently issued a decision on the railway construction, approved the railway trace (route) design and decided to start its physical construction in 2011. However,

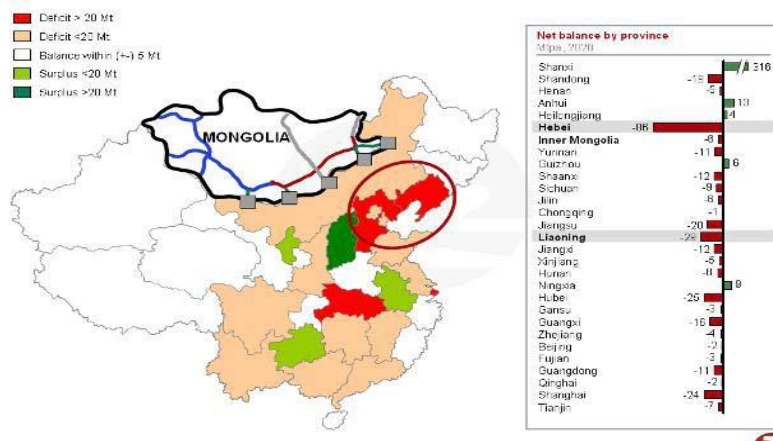
comprehensive studies and survey findings on its investments, schedules to put the railway in use, the actual railway workloads, and its economic efficiency are still not available. During the workshop, an official representative from Mongolian Railway Company introduced the Government’s Railway Policy stating that the company will finish the route’s technical design at the end of 2011, the main construction company will be selected in the first quarter of 2012, and associated legal documentation and contracts will be developed and signed in the second half of 2012. This company should start the construction from the second half of 2012 aiming to finish the entire work in 2015.



Pic. 5. Planned railway network of Mongolia in 2020. (Source: Mongolian Railway Company, 2011)

Tavan Tolgoi-Gashuun Sukhait railway

In order to export Tavan Tolgoi coal and Oyu Tolgoi copper and gold concentrate to the world market through China (Pic.6), the Energy Resources LLC planned to construct the railway in 2011-2012 and developed its design <http://www.mmc.mn/projects-road.html>. However, it has been postponed due to the State policy on railway approved by the Parliament. Thus, the implementation of this highly economically efficient option has been put on hold, because Oyu Tolgoi LLC is also planning to transport the products by railway starting from its fourth year’s operation, when the amounts of concentrate produced will exceed the road transportation capacity.



Pic. 6. Planned Mongolian railway will supply coals and other minerals to “energy-hungry” South-East Asian countries (Source: Mongolian Railway Company, 2011)

III. Potential Impacts and Options for Prevention and Mitigation

III.1 Potential Negative Impacts to Migratory Ungulates

Identification of combined threats and pressure (impacts) of major mining projects and infrastructure development in the region and their impacts on specific and vulnerable desert and steppe ecosystems and their wildlife species, including the migratory species has become a concern not only for the Mongolia but also for the international community. When migrants are denied access to forage and water resources, their numbers plummet and migrations disappear. Migrants remain at low population levels in small areas that have enough resources to maintain them (Harris et al., 2009). The highly mobile and migratory lifestyle of the far-ranging large herbivore wildlife makes them highly sensitive to fragmentation of the landscape.

Often mining areas and associated infrastructures attract poachers not only living in nearby communities, but even from villages and towns far away, and those who just visit the mining sites due to improved road access and increased traffic volume. Many Mongolians carry weapons such as rifles and guns when travelling through the countryside and often law enforcement in such remote areas is weak. In addition, small-scale miners very often hunt wildlife in areas surrounding the mines. Additional impacts include pollution of nearby water sources and living areas.

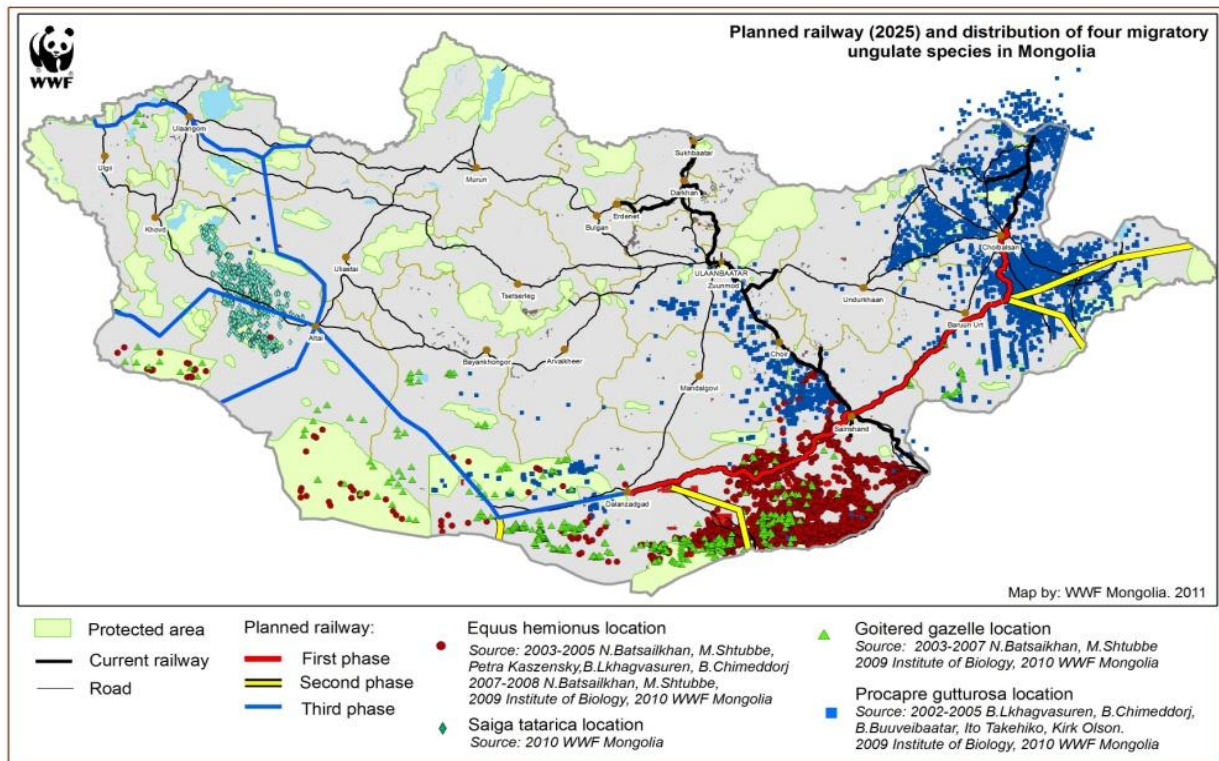
Busy transportation routes and long fences impede movement of large herbivore wildlife by creating access barriers to important resources or by forcing them to make large detours to gain access. The barrier effect of the fenced Trans-Mongolia railroad between Ulaanbaatar and Beijing has already been demonstrated for the Mongolian gazelle (Ito et al., 2005a,b; 2006; 2008; 2009). Studies done by Kaczensky et al., (2006) indicate that the railway is a barrier to the Khulan, as well as the gazelle. The fenced border between Mongolia and China, which forms the southern boundary of the Gobi region, including the Small Gobi SPA, also prevents access of Khulan and other large herbivore wildlife to habitat in the Inner Mongolian Autonomous Region of China (Picture 1 in annex III). Fragmentation of habitat into small, and often non-contiguous patches, decreases capacity of large wild herbivores to escape locally poor habitat conditions.

The Gobi region is predisposed to large environmental fluctuations and catastrophic events that can cause large fluctuations in wildlife and livestock population numbers. Fencing, and other changes in land use, reduces the capacity of wildlife populations to “outrun” droughts or harsh winters by moving to better areas. Without this escape option, intra- and inter-specific competition will be high, resulting in poor body condition, poor recruitment and high mortality. Numbers may regionally drop below a critical threshold and may eventually result in regional extirpation (Kaczensky et al., 2006).

Re-establishment of regional populations will be slow or impossible due to fragmentation. The fact that Khulan populations no longer exist east of the Trans-Mongolia railroad - despite the presence of large areas of suitable habitat - is a warning that should not be ignored. Development of fences and other linear or large-scale infrastructure would break the habitat into smaller, often non-contiguous patches, which would decrease the capacity of large wild herbivores to escape (Map 2 below) locally poor habitat conditions (Kaczensky et al., 2006).

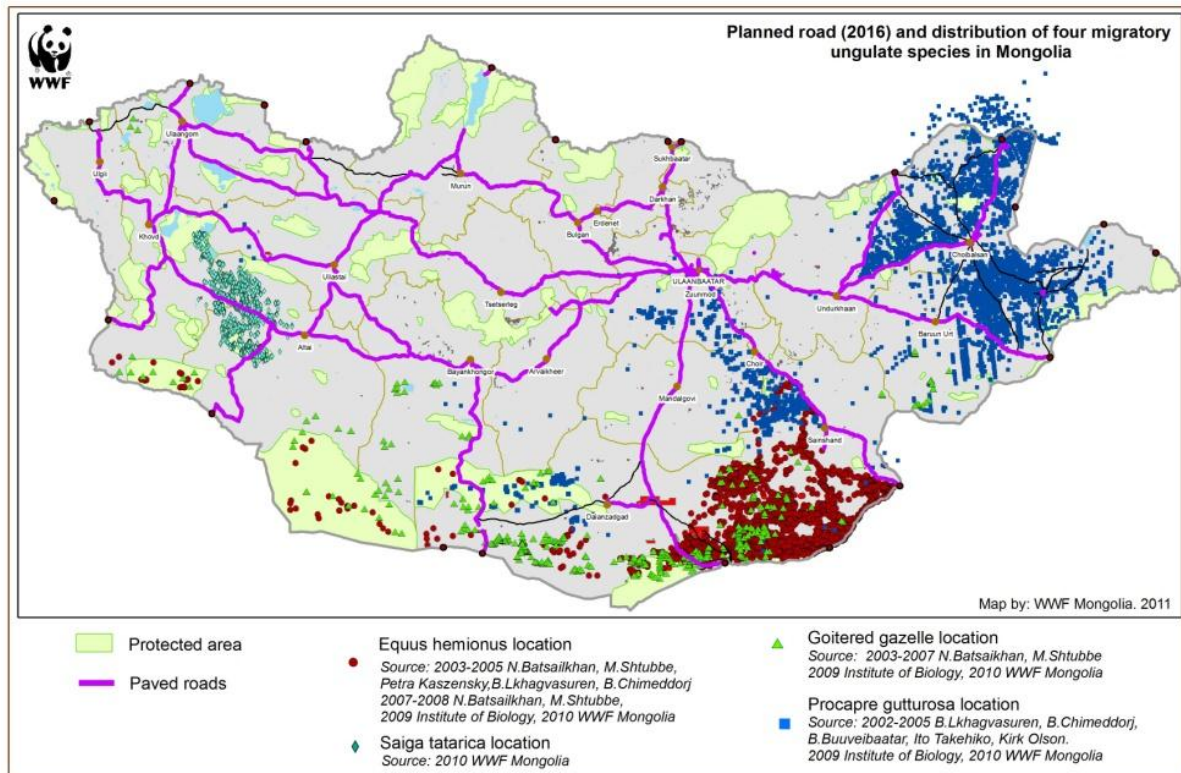
In order to allow transport from the *Tavan Tolgoi* coal mine, a paved road is constructed and will be opened soon, and railway track is planned into China. This track will cut through prime Khulan and black-tailed gazelle habitat and, without mitigation measures, will provide a major migration barrier for Khulan, black-tailed gazelle and Mongolian gazelle. There is a high probability that the western part of the current Khulan range in Omnogovi province will be separated from the Khulan range in Dornogovi province. Particularly, the migration of core population of the species located in the south east coal transporting road would be blocked by railway in the west, north and east and by the Mongolian and Chinese border fences in the south. Consequently, the Khulan and Goitered gazelle core population movements and grazing will be restricted, domestic livestock and the species would compete for grazing areas, and their populations would drastically decrease and be threatened with extinction. Without imposition of appropriate mitigation measures, the planned traffic corridors from Oyu Tolgoi and Tavan Tolgoi mines will result in the ecological separation of the Small Gobi A from the Small Gobi B SPA. Additional mining concessions are held by smaller companies. Small scale miners engaged in placer gold mining - nicknamed “ninjas” for their habit of carrying a green plastic bowl for panning strapped on their backs, thus resembling the ninja turtles of the television series - also operate in and around the Small Gobi SPAs (World Bank, 2006, cited in Kaczensky et al., 2006).

The maps below (map 5 and 6) and in annexes (planned railway and roads) show the potential division of habitats and migrations of the ungulates in Mongolia.



Map 5. Existing and planned railways through the habitats of migratory ungulates in Mongolia will divide the populations of ungulates into small and isolated populations. (Source: Mongolian Railway Company, 2011 & WWF Mongolia, 2011)

Why are the railway and road constructions in Mongolia so important for the wildlife and for migratory species, in particular? After construction of the planned railroad in 2025, the Mongolian gazelle populations will be divided into **nine isolated populations separated by railway and border fences**, while the Khulan populations and goitered gazelle will be divided into five and **seven populations** respectively. The Mongolian saiga population will be isolated **as two separate populations**. The planned road constructions (map 6 below) will be in parallel with railroads in critical habitats, and will go right through the Mongolian saiga and gazelle, as well as the Khulan and Goitered gazelle’s populations.



Map 6. Planned road constructions will affect habitats and migration routes of ungulates in Mongolia. (Source: Mongolian Road Authority, 2011; & WWF Mongolia, 2011)

III.2 Measures to Mitigate Impacts and Recommendations from the Stakeholder Workshop

Key principles for conserving migrants include securing seasonal ranges, resource protection, government support and minimizing fences. Conserving mass migrants means preserving animals’ freedom of movement in response to the temporal aspects of forage across seasonal extremes. This requires understanding basic parameters of the migration (e.g. location, numbers, routes, distances traveled), ecological drivers, habitat needs and threats (Harris et al., 2009).

Mongolia is facing a period of rapid change, resulting from the need to strengthen its economy, provide services to its population, and create new infrastructure. Meeting these needs will require

sound planning and effective management if adverse environmental impacts - such as overgrazing and the degradation of pastures, pollution and the fragmentation and clearing of natural habitats for roads or mining activities—are to be avoided (Kaczensky et al., 2006).

Striking a balance between the needs of human populations and the protection of wildlife and their habitat can be difficult and contentious, with perceptions of human-wildlife conflict often as important a factor in development decisions as the conflict itself. The importance of rigorous, high-quality scientific research cannot be underestimated in informing development decisions, as the consequences can be far-reaching, and in some cases irreversible. The current situation would lead to vague or unclear state how the biodiversity particularly the Khulan, Goitered and Mongolian gazelle populations will survive in the future (Kaczensky et al., 2006).

When addressed, proven methods such as protecting seasonal ranges, removing barriers, promoting ecotourism, securing long-term support from governments and NGOs, mitigating incompatible land uses and garnering conservation easements, can preserve the ecological, economic and aesthetic values of aggregated migrations (Harris et al., 2009). A strategy should be prepared for infrastructure development that gives attention to conservation issues, in particular the barrier effect that fences, roads, and open-pit and strip mines can create (Kaczensky et al., 2006).

One of main events within this case study was the workshop, where stakeholders and decision makers came together to discuss existing mining and infrastructure situation in Mongolia as well as to hear the future government's plans on mining and infrastructure developments (annex IV). Participants were asked to discuss to what extent construction projects have considered appropriate corrective measures to mitigate their environmental impact, and what actions could be taken to ensure that the negative impacts of the infrastructure on migratory species are avoided and/or mitigated.

From the presentations and discussions it was noted that the major railroad and road constructions are not started yet, thus EAs are planned or not have being done yet, while existing mining and road projects within critical habitats of migratory species are not considered impact issues in their development. It was common understanding among all participants, especially decision makers, that EIAs must be done prior to any developments, monitoring of wildlife movements and identification of critical habitats and seasonal ranges are critical for development planning, and in general, the workshop itself, which raised issues of wildlife freedom for movement is a critical first step to raise awareness among stakeholders and decision makers.

In order to prevent and reduce these potential impacts, the proposals e.g. remote sensing wildlife movements and migrations, building wildlife crossings underneath auto roads (pictures 3 & 4 in annex III and pic. 7 below) and railways where appropriate, dealing with biodiversity offset actions were suggested in the meeting recommendations.

Below is a list of recommendations from the workshop.

I. Recommendations related to the railway

1.1. What should be done on existing railway fences?

- ✓ Remove existing fences along existing railway;
- ✓ If this is impossible or not allowed, then change the design of existing barbed fences in both sides of the railway by removing barbs from upper and bottom wires;
- ✓ Remove the bottom strand of the wire to allow the gazelles to pass under the fences;
- ✓ Remove fences in areas where the wildlife frequently tries to cross the railway, and leave the fences as they are in areas where the human and livestock densities are high;
- ✓ Make existing tunnels or underpasses wider and higher where appropriate.

1.2. Recommendations for future railway designs:

- ✓ No fences at all;
- ✓ Establish main routes of migrations and movements of ungulates e.g. Khulan, Mongolian gazelle, and Goitered gazelle that seasonally move within vast areas depending on water and rangeland conditions and accurately design and construct engineering and infrastructure facilities without hindering or blocking their movements and migrations;
- ✓ Take immediate actions of biodiversity offset in the region;
- ✓ Identify key biodiversity areas and have them included into national Protected Area network by releasing the areas from licenses;
- ✓ Conduct detailed biodiversity analysis/assessments in the region;
- ✓ Develop and implement long term biodiversity monitoring programme based on the analysis/assessment findings
- ✓ If fences are mandatory, then establish non-fenced areas where the wildlife frequently tries to cross the railway, and construct fences in areas where the human and livestock densities are high;
- ✓ If fences are constructed - no barbs on upper and bottom wires of fences.
- ✓ Develop guidelines, in which appropriate measures to mitigate negative impacts, such as development of under- and/or overpasses in critical migration points, suitable design of railway fences are addressed.

2. Recommendations regarding the roads:

- ✓ Urgent need to construct paved roads instead of existing dirt roads along wildlife critical habitats in strategically significant mining sites e.g. Oyu Tolgoi, Tavan Tolgoi and Ovoot that create noises, dust, coal dust, lights at night etc.
- ✓ Developments should be preceded by an environmental assessment (EA);
- ✓ Where appropriate, wildlife friendly under- and overpasses should be considered.
- ✓ Put wildlife friendly road signs along the roads, where necessary.



Pic. 7. Suggested wildlife friendly underpasses underneath road.

3. Recommendations regarding the border fences.

- ✓ In the otherwise continuous expanse of the Mongolian steppes, fences constitute death traps for nomadic gazelles, and unhindered movement for gazelles between these areas should be one of several conservation priorities. Last year, Russian border guards temporarily removed fences in a good-will gesture that allowed passage for some gazelles. However, for a long-term solution, relatively minor changes to existing fences, such as the removal of the bottom strand of wire, may be sufficient to allow Mongolian gazelles to pass under the fence and avoid lethal entanglement. Similar fence modifications have been successfully used for pronghorn (*Antilocapra americana*) conservation in North America, and we suggest that fences within the range of the Mongolian gazelle should be examined to see if they can be adjusted in a similar fashion (Olson K., personal communication).
- ✓ Issues regarding the border fences are coordinated by bilateral agreements of the countries involved, and if needed, one of countries can put this issue on the table during next meeting of bilateral commission, which needs time, scientifically sound and legally correctly prepared documents and an agreement that this issue will be discussed during the meeting. In short, this is rather political and security issues that should be discussed at senior level. However, we should not ignore existing possibilities for these discussions.

III.3 Guidelines on Urgent Response Measures

During the preparation of this report and organization of the workshop, we were informed that some other organizations are working to develop guidelines and recommendations on mitigation measures of the impacts of mining activities and associated infrastructure development in Mongolia.

The Netherlands-Mongolia II project, funded by World Bank, has hired an expert, Dr. Kirk Olson, to make an assessment of impacts to the wildlife from existing infrastructure developments and make recommendations for future appropriate measures to mitigate these impacts. Dr. Olson actively participated in our workshop and shared his preliminary findings and

recommendations from the study. WB is going to organize the similar workshop discussing the findings of his study late October, 2011.

The Nature Conservancy (TNC) Mongolia Office is going to introduce the projects “Development by Design for Mongolian Gobi region”, and “Development by Design for Mongolia Eastern Steppes” in October of this year as well, which will also deal with sustainable development of mining projects in a Gobi and Eastern Steppe regions of Mongolia, including infrastructure developments and guidelines on mitigation and preventive measures.

Oyu Tolgoi LLC and Energy Resources LLC, two major mining companies operating in the south Gobi region, have hired EIA companies to develop recommendations and guidelines for their activities on environmental issues, including wildlife friendly designs and operating options.

All above mentioned activities have indicated that the efforts should be shared and the common guideline for mitigation measures should be developed to address appropriate measures to mitigate negative impacts, such as development of under- and/or overpasses in critical migration points, suitable design of railway fences that allows animals to pass these infrastructure barriers. Participants of our workshop have agreed that recommendations from this report and the workshop, as well as recommendations from coming workshops (TNC and WB) should be incorporated into this guideline, and should be acknowledged by relevant decision makers.

The challenge is for the Government of Mongolia and partners to take the results and recommendations of this and other studies and act appropriately to ensure that development and livelihood improvement go together with the needs of Mongolia’s wildlife.

Conclusions

This “barriers to migration” case study project funded by CMS Secretariat and implemented by WWF Mongolia Programme Office was the first attempt to summarize existing literature on habitat fragmentation and migration routes due to linear infrastructure as well as an important event to gather together main stakeholders and decision-makers involved in this process to discuss current mining and infrastructure development situations in Mongolia and make recommendations on tools and measures to avoid negative impacts on habitat fragmentation and specially on migratory species.

The study showed that the most affected migratory ungulates to these developments in Mongolia are the Mongolian- and Goitered gazelles, and Asiatic wild ass or Khulan. Currently, the Mongolian saiga population is still not affected by infrastructure developments within its range, although the plans to construct paved roads and railroads through its range around 2025 are on the agenda of Mongolian decision-makers.

Stakeholders and decision-makers involved in this study highly appreciated and acknowledged this initiative and recommended to continue the process of discussion, awareness raising, and implementation of recommendations from this study by related government bodies, mining and constructing companies. It was recommended as well that other governmental and non-

governmental organizations, national and international bodies involved in mining and infrastructure developments in Mongolia should take into account wildlife-friendly options in their construction and development projects and plans not to repeat mistakes and mismanagement that occurred in the recent history of Mongolia.

Several TV channels (TV9, Parliament TV, C1 Channel, TV25 Channel, Education Channel and Mining Journal TV Channel), Mongolian National Radio, daily newspapers (Century News, Daily News) and journals (Mining Journal) were invited to the stakeholders' workshop and broadcast and delivered the recommendations and findings of this workshop to Mongolian audience.

Acknowledgements

WWF Mongolia Programme Office is grateful to CMS Secretariat for funding this case study in Mongolia and its technical assistance and advice. Also we would like to acknowledge people who were involved in implementation of this study, and those who provided their valuable data and time and shared their knowledge and experience.

Reference Literature

Amgalan L. 2008. Assessment of the Mongolian saiga populations. Institute of Biology. (Unpublished report). Ulaanbaatar, Mongolia.

Amgalan L., 2000. “Conservation and ecology of the goitered gazelle (*Gazella subgutturosa*) of Mongolia”. PhD dissertation. (In Mongolian).

Assessment of steppe and desert ungulates of Mongolia & data on Khulan, 2003, 2009. Institute of Biology and Ministry of Environment and Tourism. Ulaanbaatar. Mongolia.

Assessment of steppe and desert ungulates of Mongolia & data on Mongolian gazelle. 2000-2008, 2009. Institute of Biology and Ministry of Environment and Tourism. Ulaanbaatar. Mongolia.

Assessment of steppe and desert ungulates of Mongolia & data on Black-tailed gazelle. 2009, Institute of Biology and Ministry of Environment and Tourism. Ulaanbaatar. Mongolia.

Assessment of the saiga antelope populations in Mongolia, 2000-2009. Institute of Biology, WWF-Mongolia Programme Office.

Badam Kh., Ariunzul Ya. 2005. Explanations to the Mongolian Laws on Fauna and Hunting. Ulaanbaatar, Mongolia.

Bannikov A.G. (1954). Mammals of the People’s Republic of Mongolia. Publishing house of Academy of Sciences, USSR, Moscow, 669 pp (In Russian);

Banzragch S. 1999. “Where the gazelles go?” Interview in “Daily News” newspaper.¹ 32. Page 3.

Berger, J. 2004. The last mile: How to sustain long-distance migration in mammals. *Cons. Biol.* 18: 320-331.

Berger J., Steven L. Cain & Berger M. 2006. Connecting the dots: an invariant migration corridor links the Holocene to the present. *Biol. Lett.* (2006) 2, 528–531

Berger J., Berger K.M., Bergen S., Buuveibaatar B., Fine A., Lkhagvasuren B., Young J. & Zahler P. 2008. Migration bottlenecks, climate, and the conservation of Pleistocene relicts in Central Asia. *The Open Conservation Biology Journal*, 2, 9-10.

Bolger, D.T., Newmark W.D. et al. 2008. The need for integrative approaches to understand and conserve migratory ungulates. *Ecol. Lett.* 11: 63–77.

Buuveibaatar B., Ito T., Lhagvasuren B., Chimeddorj B., Takatsuki S. 2005. Satellite tracking of Mongolian gazelles (*Procapra gutturosa*) in Dornod aimag in Eastern Mongolia. *Proceedings of International conference “Ecosystems of Mongolia and frontier areas of adjacent countries: natural resources, biodiversity and ecological prospects”*. Sept. 5-9, Ulaanbaatar, Mongolia.

Buuveibaatar.B, Ito Takehiko, B.Lhagvasuren, B.Chimeddorj, Seiki Takatsuki, Atsushi Tsunekawa. 2008. “Effect of railroad on migration and mortality of Mongolian Gazelle in Central Mongolia”. *Student Conference on Conservation Science*. University of Cambridge, UK.

Chagnaadorj B. 1964. Mongolian gazelle resources and their significance. Ulaanbaatar. Mongolia.

Chimeddorj B., Lhagvasuren B., Buuveibaatar B. 2006. Mongolian gazelle habitat selection in semi-desert zones of Mongolia. *Proceedings of Inner Mongolia Pedagogical University*. Vol. 27. No. 4. Pp.: 27-31. Inner Mongolia China.

Chimed-Ochir B., Hertzman T., Batsaikhan N., Batbold D., Sanjmyatav D., Onon Yo. & Munkhchuluun B. 2010. “Filling the gaps to protect the biodiversity of Mongolia”, GAP analysis report. Ulaanbaatar, Mongolia. (In English).

Clark, E. L., Munkhbat, J., Dulamtseren, S., Baillie, J. E. M., Batsaikhan, N., King, S. R. B., Samiya, R. and Stubbe, M. (compilers and editors). 2006. *Mongolian Red List of Mammals*. Zoological Society of London, London. (In English and Mongolian).

Clark, E. L., Munkhbat, J., Dulamtseren, S., Baillie, J. E. M., Batsaikhan, N., King, S. R. B., Samiya, R. and Stubbe, M. (compilers and editors) (2006). *Summary Conservation Action Plans for Mongolian Mammals*. Regional Red List Series Vol. 2. Zoological Society of London, London. (In English and Mongolian).

Dulamtseren S. 1970. Key book to the Mongolian Mammals. Ulaanbaatar, Mongolia.

Dulamtseren S., Amgalan L. 2003. Mongolian saiga assessment report. Institute of Biology. (Unpublished report). Ulaanbaatar, Mongolia.

Eregdendagva D. 1997. Mongolian gazelle. *Ulaanbaatar*. Pp.: 68.

Eregdendagva D. & Sosorbaram J. 1969. Distribution of the Mongolian gazelle in Eastern steppes. *Proceedings of the Institute of General and Experimental Biology*. 14. 131-135.

European Bank for Reconstruction and Development, 2003, *The Environmental policy*
IFC, 2006, *International Finance Corporation’s Performance Standards on Social & Environmental Sustainability*;

Feh, C., N. Shah, M. Rowen, R. P. Reading, and S. P. Goyal. 2002. “Status and action plan for the Asiatic wild ass (*Equus hemionus*).” In P.D. Moehlman, ed. *Equids: Zebras, Asses and Horses*. Cambridge, UK: IUCN Publication Services Unit. [Available from: <http://iucn.org>].

Harris G., Thirgood S., Hopcraft J., Cromsigt J., Berger J. 2009. Global decline in aggregated migrations of large terrestrial mammals. *Endangered species research*. Vol. 7: 55–76, 2009.

Isaac NJ, Turvey ST, Collen B, Waterman C, Baillie JE. 2007. Mammals on the EDGE: Conservation Priorities Based on Threat and Phylogeny. PLoS ONE 2(3): e296. doi:10.1371/journal.pone.0000296

Ito T, Naoko Miura, Badamjav Lhagvasuren, Dulamtserengin Enkhbileg, Seiki Takatsuki, Atsushi Tsunekawa, and Zhaowen Jiang. 2004. Satellite tracking of Mongolian gazelle and habitat evaluation using NDVI. *Ecological Research*. 17, Japan.

Ito Takehiko and Lhagvasuren Badamjav. 2004. Mongolian gazelle migration study in Southern Gobi, Mongolia. International Symposium on Mongolian Gazelle Management. Ulaanbaatar. 25-27 October.

Ito, T. Y., N. Mura, B. Lhagvasuren, D. Enkhbileg, S. Takasuki, A. Tsunekawa, and Z. Jiang. 2005a. "Preliminary evidence of a barrier effect of a railroad on the migration of Mongolian gazelles." *Conservation Biology* 19(3):945–948.

Ito Takehiko, Naoko Miura, B.Lhagvasuren, D.Enkhbileg, Atsushi Tsunekawa, Seiki Takatsuki, Zhaowen Jiang. 2005b. Analyses using satellite technologies on relationship between migration routes of Mongolian gazelle and relative primary productivity in their habitat. International conference, Seoul, South Korea.

Ito T., Ayumi Okada, Bayarbaatar Buuveibaatar, Badamjav Lhagvasuren, Seiki Takatsuki, Atsushi Tsunekawa. 2008. One sided barrier impact of an International railroad on Mongolian gazelles. *Journal of Wildlife Management*. 72(4): 940-943

Ito T., A.Tsunekawa, B.Lkhagvasuren. 2009. Monitoring movements and habitat of Mongolian gazelles using satellite technologies. Proceedings of the International Congress for Conservation Biology, 13 JUL 2009, Beijing.

Kaczensky P., D.P. Sheehy, C. Walzer, D.E. Johnson, D. Lhkagvasuren and C.M. Sheehy. 2006. *Room to Roam? The Threat to Khulan (Wild Ass) from Human Intrusion*. Mongolia Discussion Papers, East Asia and Pacific Environment and Social Development Department. Washington, D.C.: World Bank.

Kaczensky P., V.Dresley, D.Vetter, H.Otgonbayar and C.Walzer (2010). Water use of Asiatic wild asses in the Mongolian Gobi. Exploration into the Biological Resources of Mongolia, Volume 11, pp. 291-298;

Kazensky P. & Waltzer K. 2009. Landscape level research for the conservation of Asiatic wild ass in Mongolia. Research activities in Great Gobi B SPA. Report to Austrian Science Foundation (project P18624).

Kaczensky P., R. Kuehn, B. Lhagvasuren, S. Pietsch, W. Yang, and Chris Walzer. 2008. Connectivity of the Asiatic wild ass population in the Mongolian Gobi. Proceedings of Society for Conservation Biology International Conference. Beijing. China

Kiriliuk V.E. 1997. Rare species of South-Eastern Zabaikaliye (Biological prospects for conservation). Thesis of PhD dissertation. Moscow.

Lhagvasuren B. 1985. Current status and dynamics of the Mongolian gazelle populations. Series in Science and Youth-1. Ulaanbaatar.

Lhagvasuren B., E.J. Milner-Gulland. 1997. The status and management of the Mongolian Gazelle (*Procapra gutturosa*) population. "Oryx", Vol.31, No 2. April, 127-134.

Lhagvasuren B., S. Dulamtseren, L. Amgalan, D. Mallon, G. Schaller, R. Reading, H. Mix. 1999. Status and conservation of antelopes in Mongolia. *Works of Institute of Biology. 1.* 96-107.

Lhagvasuren B. 1999. Status of the Mongolian gazelle population in Mongolia. *Mongolian Gazelles: Steppes for survival.* An International meeting to assess the threats to the species and to propose effective solutions. Choibalsan. Mongolia 6-8 April.

Lhagvasuren B., 2000. "Conservation and analysis of factors affecting the area of distribution and number of the Mongolian gazelle (*Procapra gutturosa*, Pallas, 1777)". PhD dissertation. (In Mongolian).

Lhagvasuren B., S. Dulamtseren, L. Amgalan. Status of Mongolian antelopes. Mallon D.P. and

Kingswood S.C. (compilers). 2001. *Antelopes. Part 4: North Africa, the Middle East, and Asia. Chapter 32: Mongolia. Global Survey and Regional Action Plans.* SSC Antelope Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Lhagvasuren B., Chimeddorj B., Buuveibaatar B. 2005. Density of gazelle carcasses along the railway. *Proceedings of the Institute of Biology* 1 25, õ. 96-101.

B. Lhagvasuren. 2005. History of range and population of the Mongolian gazelle in Mongolia. *Proceedings of the International Mammalogical Congress – 9.* Sapporo, Hokkaido, Japan. July 31 – August 5. p.96.

Lhagvasuren B., B.Chimeddorj, B.Buuveibaatar. 2006. Conservation ecology of the Mongolian gazelles: problems of overgrazing and railroad. "Pro Natura Fund" Proceedings, Vol.15, Pp.: 125-135, Japan (2006)

Lhagvasuren B. 2007. Population assessment of Khulan (*Equus hemionus*) in Mongolia. *Enforshung biologischer ressourcen der Mongolei.* (Halle/Saale) Vol.10., pp. 45-48 (in English). Germany.

Lkhagvasuren B., K.Olson, T.Mueller, P. Leimgruber, W.Fagan, T. Ito, C.Nicolson, A.Fine, T.Fuller. 2009. Distribution and movement patterns of Mongolian gazelle. *Proceedings of the International Congress for Conservation Biology, 13 JUL 2009, Beijing*

Lhagvasuren B., S.Strindberg, et al. Current Status of Steppe and Desert Ungulates and Conservation Priorities. International conference on Mongolian wildlife conservation. Ulaanbaatar. 2010.

Lhagvasuren B. 2011. Distribution, movement patterns and threats to Mongolian gazelle. 2011. Daurian steppe transboundary conservation cooperation workshop. Mongolian gazelle. 25-26 April. Ulaanbaatar. Mongolia.

Luschekina A.A., Neronov V.M., Ogureeva G.N., Sokolova A.L. 1986. Distribution, ecology, conservation and questions of rational use of the Mongolian gazelle in Mongolia. Bulletin Mosk. Ob-va Ispit. Prirodi. Series in Biology. 91(5): 73-82.

Mallon, D.P. and Kingswood, S.C. (compilers). (2001). *Antelopes. Part 4: North Africa, the Middle East, and Asia. Global Survey and Regional Action Plans*. SSC Antelope Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. viii + 260pp

Milner-Gulland EJ, Kholodova MV, Bekenov A, et al. Dramatic decline in saiga populations. *Oryx* 2001; 35: 340-5.

Milner-Gulland E.J., B. Lhagvasuren. 1998. Population dynamics of the Mongolian Gazelle *Procapra guttuosa*: an historical analysis. *The Journal of Applied Ecology*. 35, 240-251.

Mongolia-China Railway Project. Pre-Feasibility study. 1998. Final report by *Swede Rail, Sweden*. Monconsulting Ulaanbaatar, Unirine Institute of Economics, 14. Beijing. September. Mongolian saiga assessment report. 2010. WWF Mongolia Programme Office. (Unpublished report). Ulaanbaatar, Mongolia.

Olson KA, Fuller TK, Schaller GB, Odonkhoo D, Murray MG. Estimating the population density of Mongolian gazelles *Procapra guttuosa* by driving long-distance transects. *Oryx* 2005; 39: 164-9.

Olson K., Thomas Mueller, Peter Leimgruber, Craig Nicolson, Todd K., Fuller, S. Bolortsetseg, Amanda E. Fine, B. Lhagvasuren, and William F. Fagan. 2009. Fences impede long-distance gazelle movements in drought-stricken landscapes. *Oryx*.

Reading R., H. Mix, B. Lhagvasuren, N. Õseveenmyadag. The Commercial harvest of wildlife in Dornod aimag, Mongolia. *Journal of Wildlife Management*. 1998. N62 (1):59-71. USA.

Reading, R. P., D. J. Bedunah, and S. Amgalanbaatar. 2006. "Conserving biodiversity on Mongolian rangeland: Implications for protected area development and pastoral use." USDA Forest Service Proceedings RMRS-P-39 [Available at: http://www.fs.fed.us/rm/pubs/rmrs_p039/rmrs_p039_001_017.pdf]

Reading, R. P., H. M. Mix, B. Lhagvasuren, C. Feh, D. P. Kane, S. Dulamtseren, and S. Enkbold. 2001. "Status and distribution of Khulan (*Equus hemionus*) in Mongolia." *Journal of Zoology* 254:381-389.

Richard Bullock, the World Bank Consultant Ulaanbaatar, 30 September 2008, Presentation on “Transport infrastructure in South Gobi” in workshop on infrastructure PPPs in South Gobi;

Schaller GB. 1998a. Wildlife of the Tibetan steppe. Chicago: University of Chicago Press.

Schaller G.B. 1998b. Mongolia's Golden Horde: million of migrating gazelle. *Wildlife Conservation*. 101 (6): 35-41.

Schaller G. B. & B. Lhagvasuren. 1999. Death and Life on the Steppes. *Wildlife Conservation*. November/December, 12.

Shiirevdamba Ts., Shagdarsuren O., Erdenejav G., Amgalan L., Tsetsegmaa Ts. (eds.). 1997. Mongolian Red Book. Ulaanbaatar, Mongolia.

Sokolov V. E., Ya. Dash, A. A. Luschekina & V. M. Neronov. 1982. Modern geographic range and quantitative distribution of Mongolian gazelles in Mongolian People's Republic. *Zoological investigations in the Mongolian People's Republic*. Moscow, 259.

Sokolov V.E., A.A. Luschekina. 1997. *Procapra gutturosa*. *Mammalian species*. 571: 1-5.

Sosorbaram J. 1966. Population status of the Mongolian gazelle as a criterion of its importance. *Proceedings of the Institute of Biology*. 11. 39-42.

Stubbe A., Stubbe M., Batsaikhan N., Samiya R. and Dorjderem S. (2005) First results of Wild Ass research in the South Gobi aymag/ Mongolia in 2003 and 2004. Exploration into the Biological Resources of Mongolia, Volume 9, pp.107-120;

Stubbe A., M.Stubbe, N.Batsaikhan (2007). Morphology, reproduction and mortality of *Equus hemionus hemionus* in Mongolia. Exploration into the Biological Resources of Mongolia, Volume 10, pp. 117-132;

Tsagaan S. & Lhagvasuren B. 1986. Current distribution and population status of the Mongolian gazelle and issues on conservation and sustainable use. *Proceedings of conference “Nature and Zoology”*. Ulaanbaatar, Mongolia

Tsagaan S. 1980. Distribution, habitat, migration, herd structure and population status of the Mongolian gazelle. *Proceedings of the Institute of General and Experimental Biology*. 15. 128-139.

Wilcove D. 2008. No way home: the decline of the world's great migrations. A Shearwater Book. Island Press.

World Bank. 2006. *A Review of Environmental and Social Impacts in the Mining Sector*. Mongolia Discussion Papers, East Asia and Pacific Environment and Social Development Department. Washington, D.C.: World Bank. [Available at: www.worldbank.org/eapenvironment].

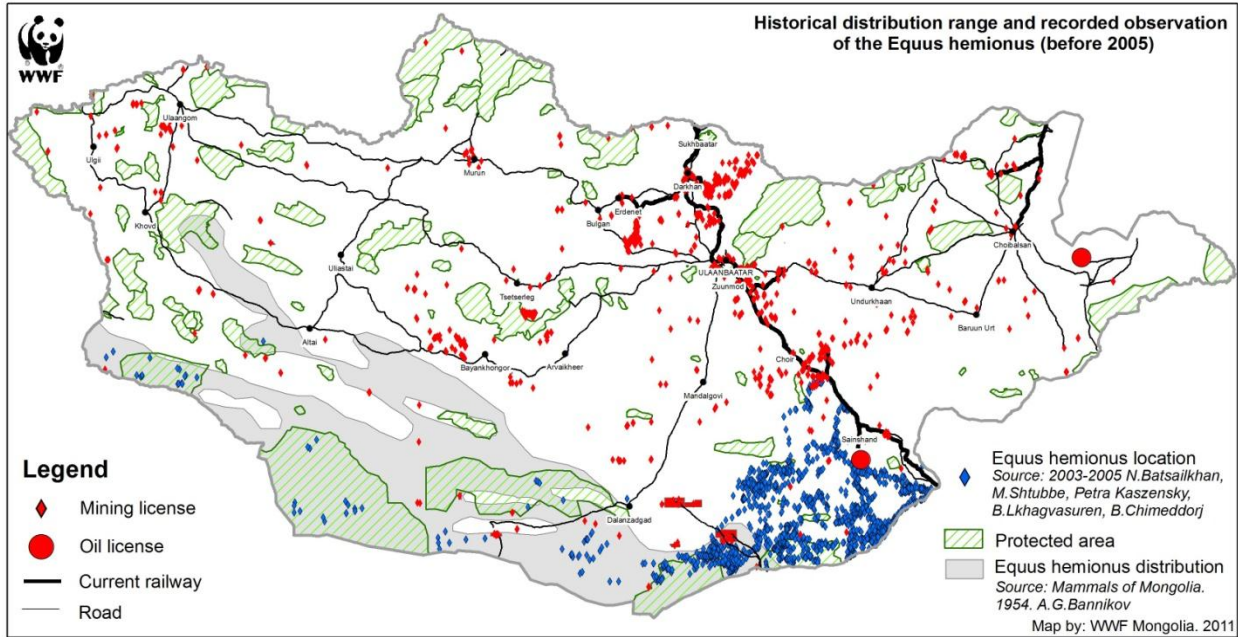
World Bank, January 2010, Southern Gobi Regional Environmental Assessment

World Bank, Final Draft Report 25/01/2009, Groundwater Assessment in the Gobi Region;

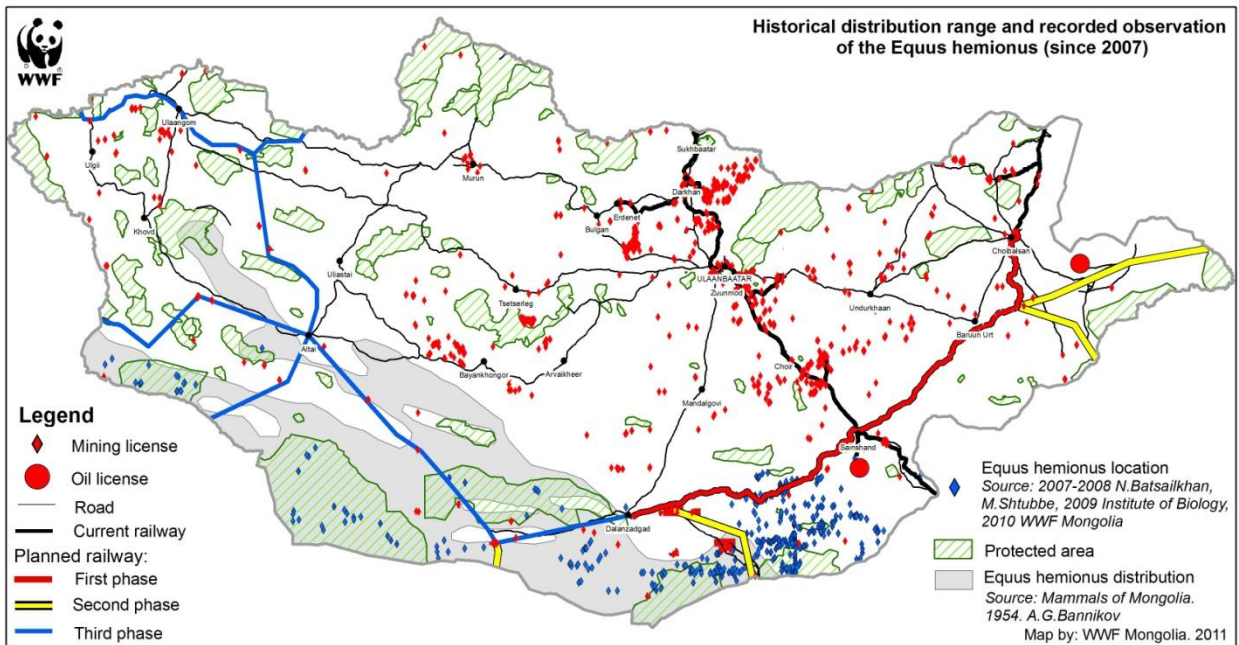
Zahler P., B.Lhagvasuren, R.P.Reading, J.R.Wingard, S.Amgalanbaatar, S.Gombobaatar, N.W.H.Barton, Yo.Onon. 2004. Illegal and unsustainable wildlife hunting and trade in Mongolia. *Mongolian Journal of Biological Sciences*. Vol.2, Number 2.

Zevegmid, D. and N. Dawaa. 1973. Die seltenen Großsäuger der Mongolischen Volksrepublik und ihr Schutz. *Archiv für Naturschutz und Landschaftsforschung* 13(2):87–106. [In German]

Annex I. Historical and Current Distribution of Asiatic Wild Ass

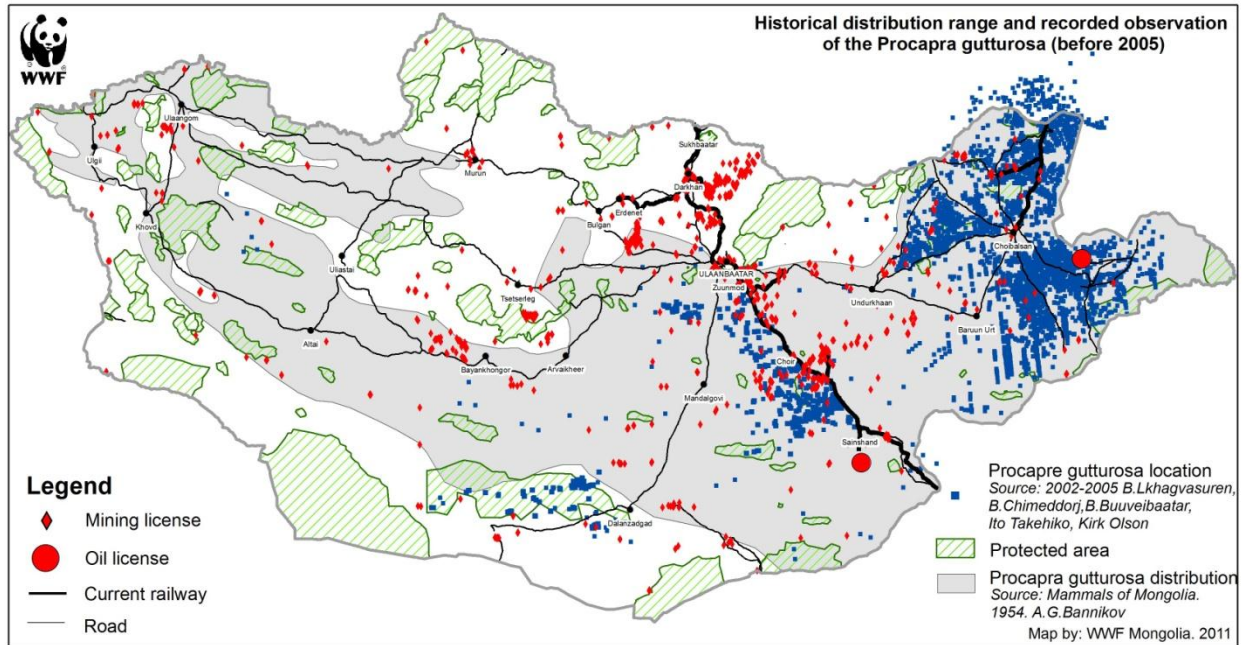


Map1. Distribution and point locations of the Khulan before 2005.

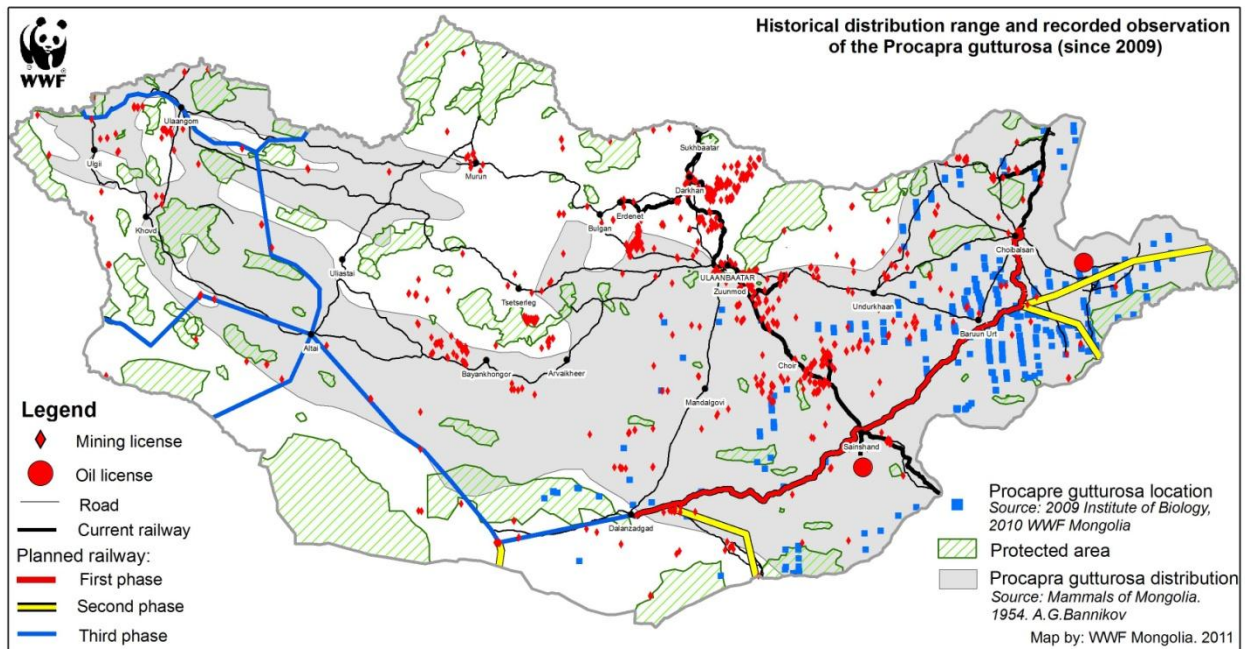


Map 2. Distribution and point locations of the Khulan after 2007.

Annex II. Historical and Current Distribution of Mongolian Gazelle

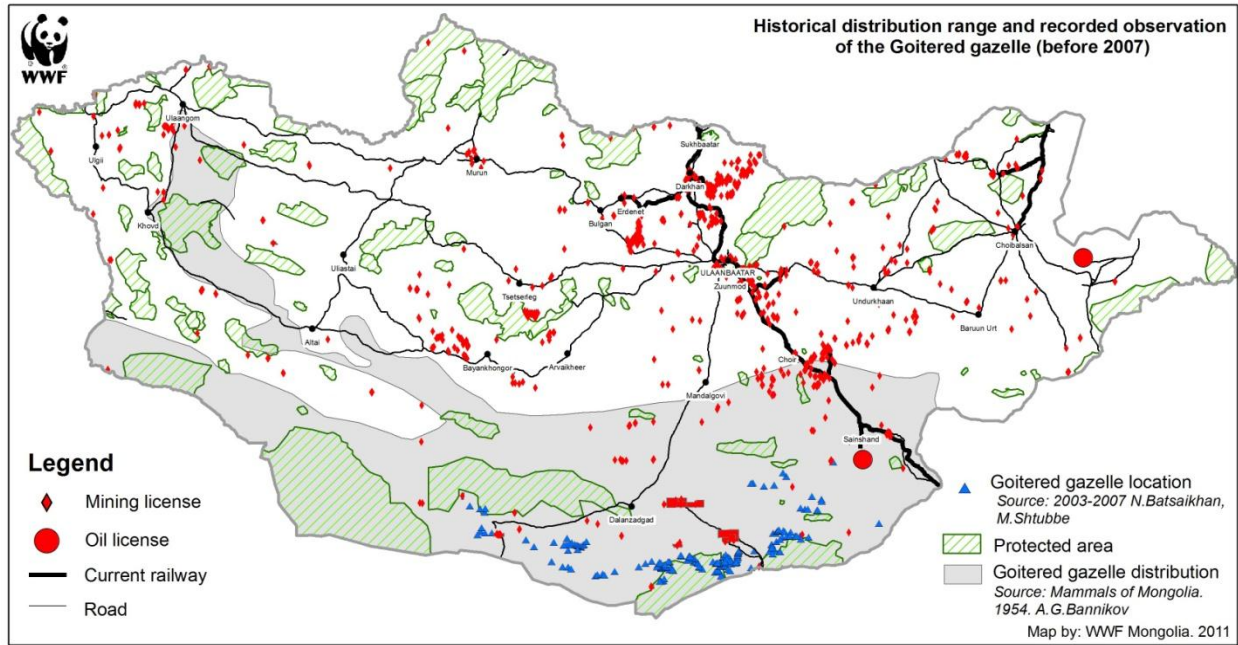


Map 3. Distribution and point locations of the Mongolian gazelle before 2005.

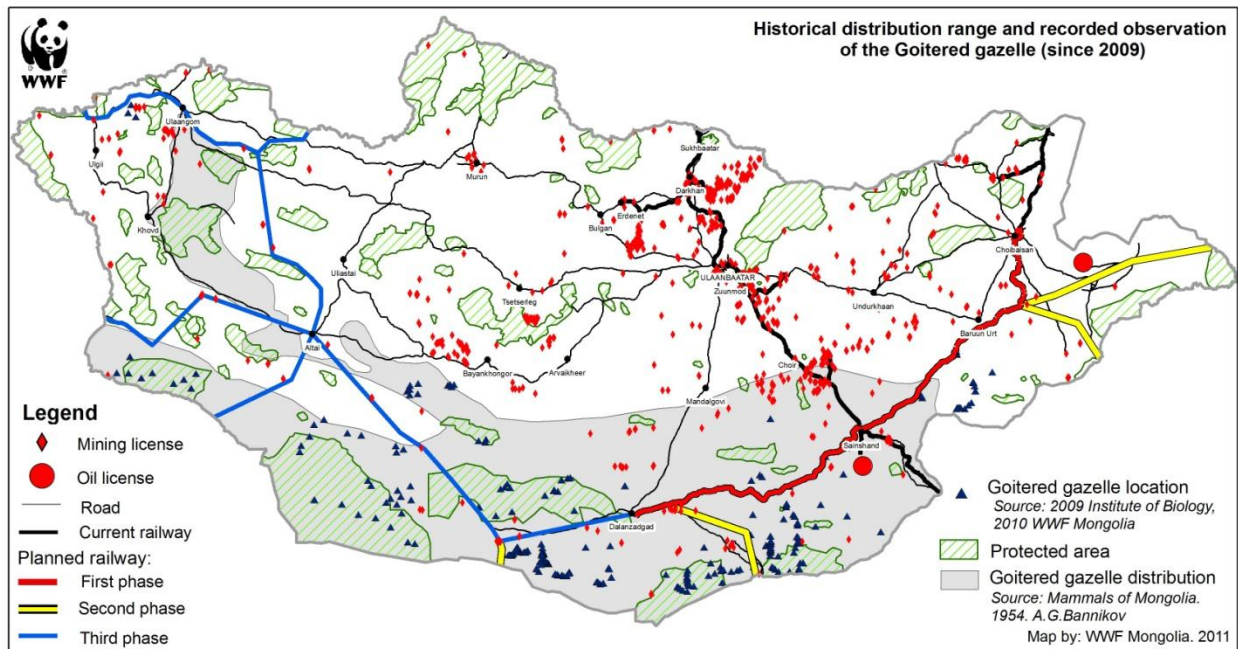


Map 4. Distribution and point locations of the Mongolian gazelle after 2009.

Annex III. Historical and Current Distribution of Goitered Gazelle

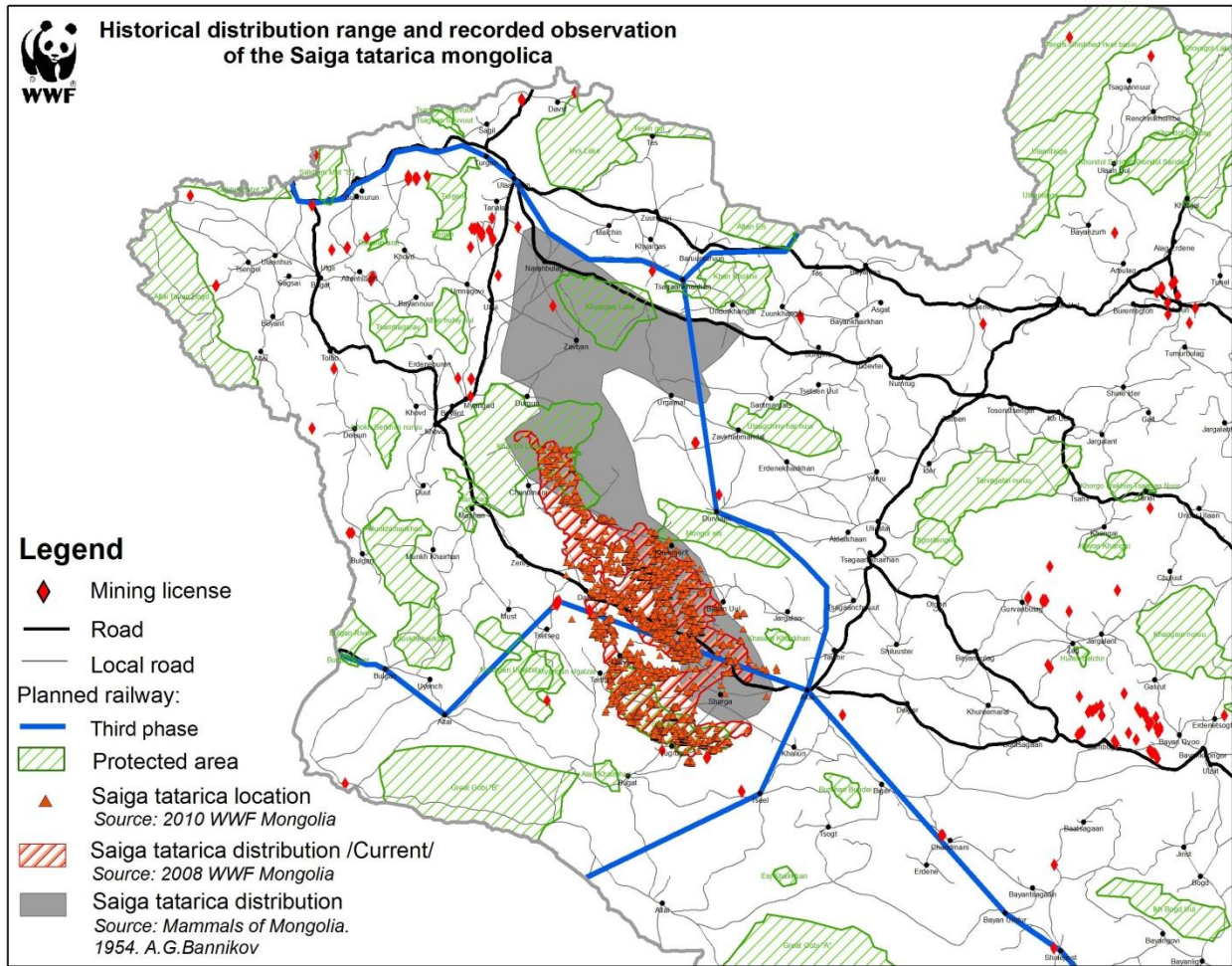


Map 5. Distribution and point locations of the Goitered gazelle before 2007.



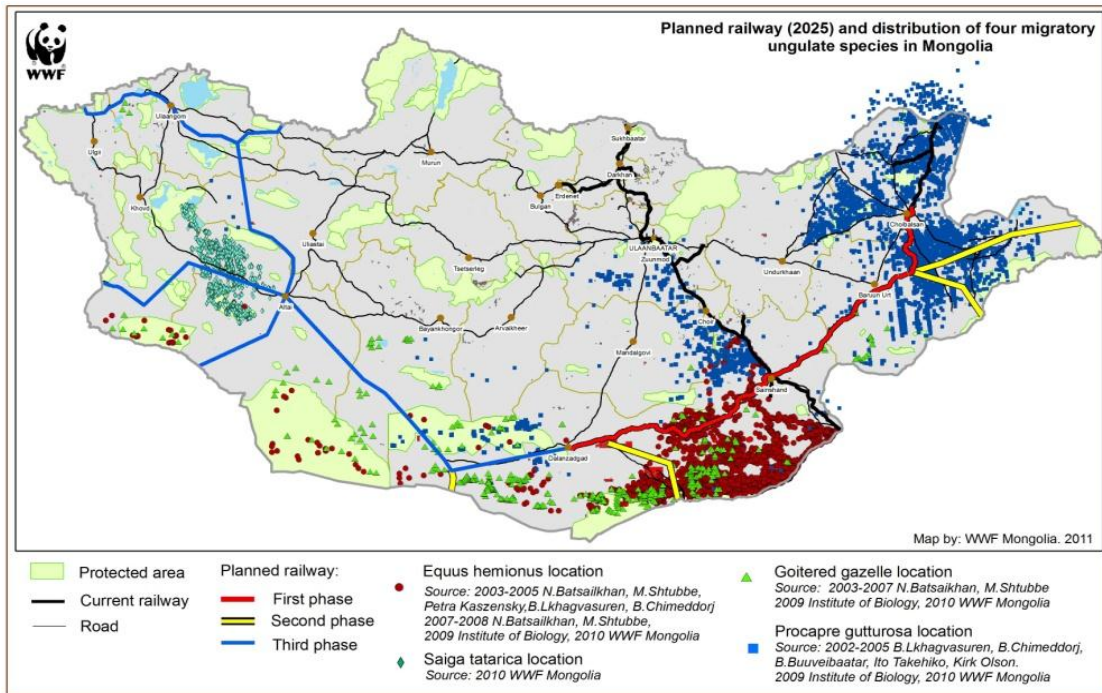
Map 6. Distribution and point locations of the Goitered gazelle after 2009.

Annex III. Historical and Current Distribution of Mongolian Saiga

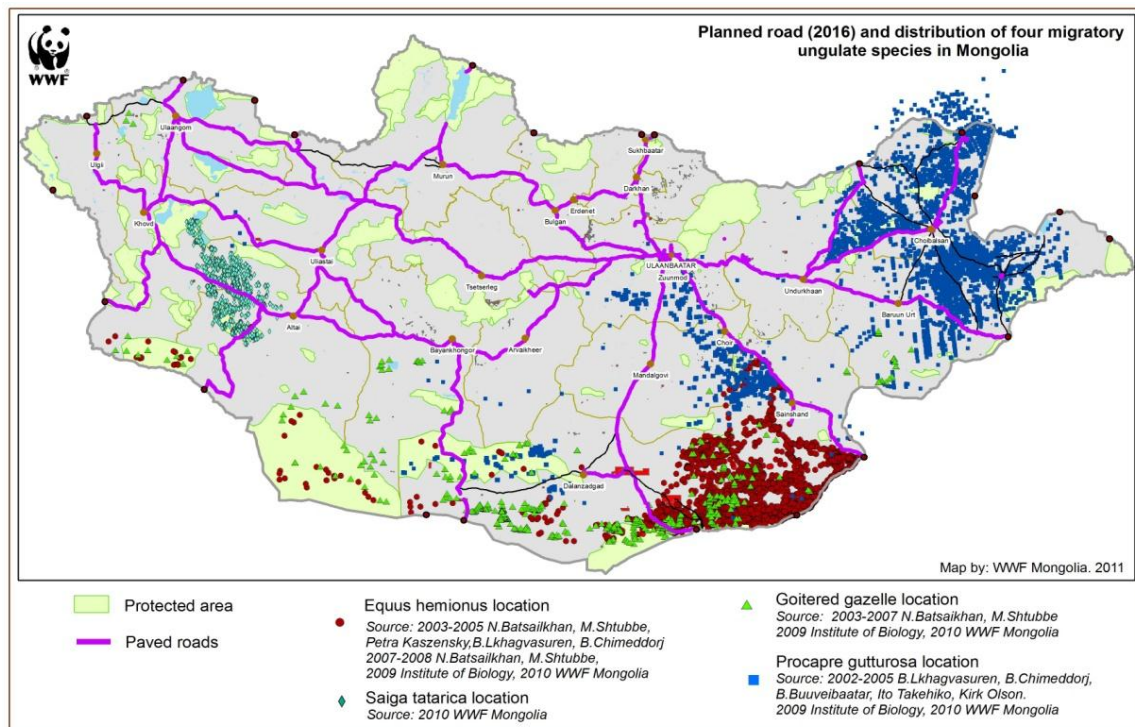


Map 7. Historical and current distribution and point locations of the Mongolian saiga. (Developed by WWF Mongolia, 2011)

Annex IV. Planned railways and road constructions in Mongolia

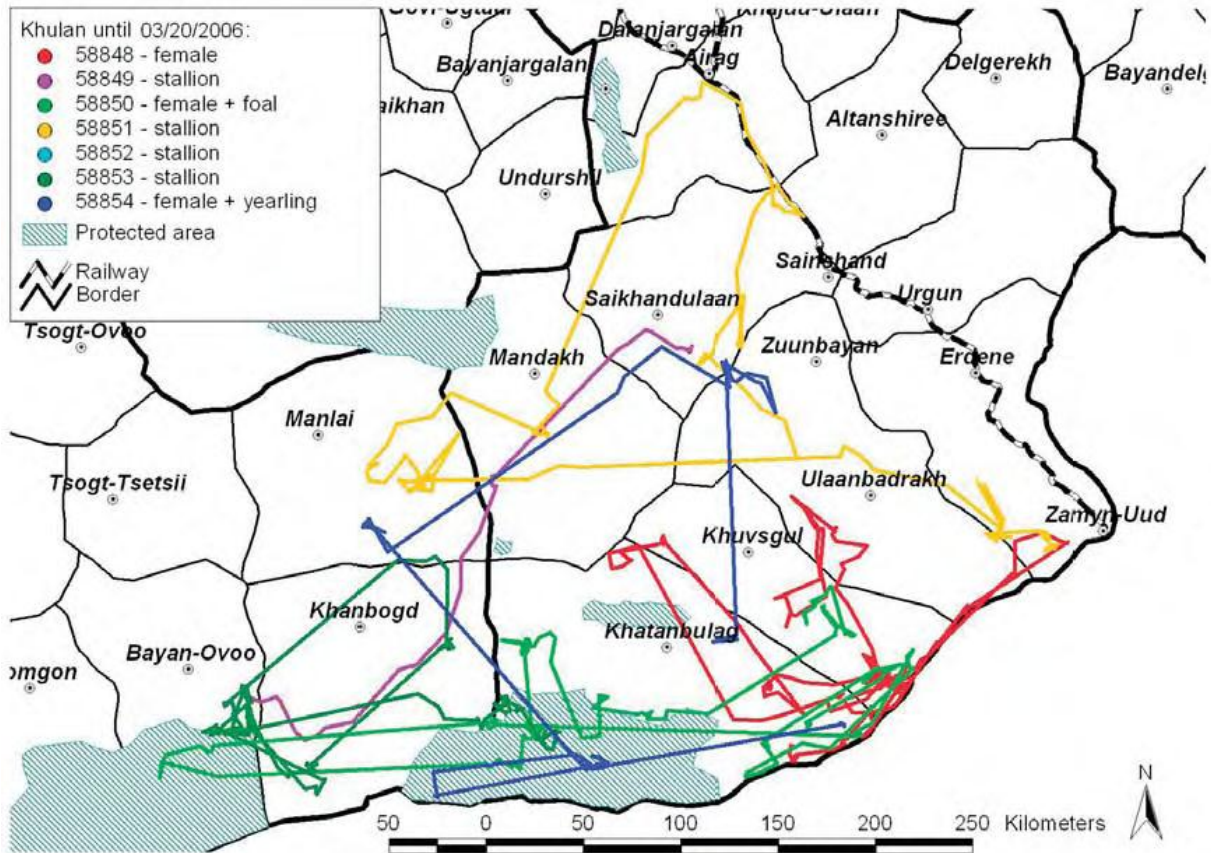


Map 8. Planned railways will go through critical habitats of the Mongolian ungulates



Map 9. Planned road constructions of Mongolia

Annex V. Movement Paths of Individual Khulan (July 2005 to February 2006) by Kaczensky et al., 2006



Pic. 1. The movement pattern of the young stallion 58851 and observation of a group of Khulan along the Trans-Mongolia railway fence suggests that this traffic axis poses a serious barrier for Khulan movements. Furthermore, clumped locations along the border fence during the winter support the impression that fences severely inhibit Khulan movements (Kaczensky et al., 2006).



Pic. 2. Group of nine Khulan (including one foal) walking on the west side of railway along the railway fence (near Airag soum on 07/17/2005). Image: P. Kaczensky (from Kaczensky et al., 2006)

Annex VI. Pictures



Picture 3 . Road underpass in USA



Picture 4. Road signs in Europe for the wildlife



Picture 5. Heavy trucks carry coal from Mongolia into China. ©WWF Mongolia



Pic. 6. Existing international border fences are the barriers to migratory ungulates.
©B.Lhagvasuren & V.Kiriliuk

Annex VII. Agenda and List of Participants of the Stakeholder Meeting



“Infrastructure development is a barrier to migration of wild ungulates?

Strategies to mitigate the obstacles”

Stakeholders’ consultative workshop

Date: September 23, 2011

Time : 9:00-18:00

Venue: Urguu Hall, Ulaanbaatar Hotel

Agenda

September 23, 2011	
08:40-09:00	“Registration” in Urguu Hall, Ulaanbaatar Hotel
09:00-09:10	“Opening remarks, objectives and introduction of participants” by Mr. B.Chimed-Ochir, WWF Mongolia
09:10-09:20	“Environmental policies regarding mining and associated linear infrastructures” by Mr. D.Banzragch, Department of Sustainable Development & Strategic Planning, MNET
09:20-09:50	“Key note speech: Migratory ungulates of Mongolia and current threats: is there any space left?” by Dr. B.Lhagvasuren, CMS Scientific Councillor for Mongolia
09:50-10:10	“Strategically significant mineral deposits of Mongolia” by Ts. Otgonbayar, Mineral resources agency of MMRE.
10:10-10:30	“Mongolian roads: current situation and planned projects” by Ya. Bayarkhuu, Road Authority of Mongolia
10:30-10:50	“New railways project” by B. Batzaya, Executive Director, Mongolian Railway SOSC

10:50-11:10	“Economic development of the Eastern region” by Mr.Ts. Janlav, Governor of Dornod Province
11:10-11:30	Coffee and tea break
11:30-11:50	“Criteria for EIA for linear infrastructures” by D. Enkhbat, Department of Environment and Nature resource, MNET
11:50-12:10	“WB project findings” by Dr. Kirk Olson
12:10-12:50	Panel discussion with presenters
12:50-13:00	Summary of the morning session by a facilitator
13:00-14:00	Lunch break
14:00-16:00	Working group to develop recommendations to mitigate the impact of linear infrastructure to ungulates migrations
16:00-16:20	Tea break
16:20-17:50	Summary of working group recommendations with additional comments
17:50-18:00	Closing remarks

List of Participants:

No	Name	Organization	Position	Remarks
1	Zorigt	President’s Office	Advisor to the President of Mongolia	Not attended (n/a)
2	Myagmarsuren D.	Parliament	Advisor to the Standing Committee	
3	Batbold D.	MNET & CMS Focal Point Mongolia	Head of Department	
4	Banzragch D.	MNET	Head of Department	Made presentation
5	Enkhbat D.	MNET	Head of Department	n/a
6	Dorjgotov B.	MNET	Senior officer	
7	Tsogtsaikhan P.	MNET	Senior officer	Made presentation on behalf of Mr.D.Enkhbat
8	Bayarkhuu Ya.	Department of Road (MRTCUD)	Head of Department	Made presentation
9	B. Batzaya	Mongolian Railroad LLC	Executive Director	Made presentation
10	Ts. Otgonbayar	Mineral Resources Authority	Head of Department	Made presentation

		(MMRE)		
11	???	Petroleum Authority (MMRE)		n/a
12	Ts. Janlav	Dornod Province	Governor	Mr. Ganbat, Head of Environment Protection and Tourism Department made presentation on behalf of Mr. Janlav
13	Alгаа	Mining Association –		
14	Bakey	Responsible Mining Initiative -	Steering Committee member	
15	J. Oyunsuvd	Oyu Tolgoy		
16	Sh.O’Neill	Oyu Tolgoy LLC		
17	Munkhzorig S.	Energy Resources LLC		
18	Baigalmaa	Energy Resources		
19	Olson K	Expert		Made presentation
20	Enkhtsetseg	World Bank		
21	Bayarmaa B.	ADB		
22	Regdel D.	Mongolian Academy of Sciences	Deputy Vice-President	
23	Damdinsuren Ch.	Colonel, General Authority for Border Guarding		
24	Janchivdorj L.	“ECOTRADE” EIA LLC	Director	
25	Tuvaasuren E.	“SATUU” EIA LLC	Director	
26	Gankhuyag	“Natural Sustainability” EIA LLC	Director	
27	Chimed-Ochir B.	WWF MPO	Director	
28	Lhagvasuren B.	WWF MPO & CMS Scientific Councillor for Mongolia		
29	Onon Yo.	WWF MPO		
30	Chimeddorj B.	WWF MPO		
31	Sanjmyatav D.	WWF MPO		
32	A.Fine	WCS Mongolia	Director	

33	Ochirkhuyag	WCS Mongolia		
34	Buuveibaatar B.	WCS Mongolia		
35	Galbadrakh D.	TNC Mongolia		
36	Enkhtuya O.	TNC Mongolia	Director	n/a
37	Heiner M.	TNC Mongolia		
38	Regdel D.	MAS		
39	Adiya Ya.	IoB, MAS	Head of MEL	
40	Munkhtsog B.	IoB, MAS		
41	Amgalan L.	IoB, MAS		
42		Media ~10 pers.		