Flora and Fauna of Mongolia

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Introduction

Don't expect any strange looking completely unfamiliar plants! The area we will visit is actually not more exotic than a part of the Mediterranean Flora Region, even though the Central Asian subregion of Mediterranean is the eastern-most. This means that we will be able to recognice all (or at least most) plant families and many genera, but few species although they may resemble species we are familiar with. The nothern boundary to the Eurasian forest subregion of the Holarctic (i.e., the same subregion as Scandinavia) is found in Mongolia, more or less tracking the line of the world watershed.

Mongolian Division of the Mongolian Province

The northern parts of Mongolia (i.e., north of the World Water Divide) fall in the Eurasian subregion of the Holarctic and is not considered as a part of the Mongolian Province. This include, i.a., Ulaanbaatar, Tsetserleg and the Khangayn Nuruu mountains, Uliastay, and Bayankhongor. The vegetation here will be a taiga vegetation. Large part of our travel will however be in the Mongolian Division; this division can be subdivided into 13 districts:

1. Khobdo (mountain steppe, barren). Northern part of Mongolian Altai in the basins of Khovd Gol and Üüreg Nuur. Not visited by us.

2. Mongolian Altay (mountain steppe). All the mountain ranges of Mongolian Altay (Mongol Altayn Nuruu), also including Tayshiryn Uul and Adzhi-Bogdo of Tabyn-Bogdo Ol, and extending far into the Gobi. The climate is extremely cold and dry. Annual mean temperature is -4 to -6 °C,

with a January mean temperature at -24 °C and in July +12 °C. The average annual precipitation is 250 to 400 mm. The city Altay is in this area (Tayshiryn Uul), and the road to Eej Khayrkhan NR crossess Mongol Altayn Nuruu (although the Eej Khayrkhan itself is in the Western Gobi).

The highermost parts (west of the areas we will visit) dominates of numerous species in common with the adjoining Altay flora (*Deschampsia koelerioides*, *Trollius altaicus*, *Aconitum altaicum*, *Draba altaica*, *Sanguisorba alpina*, *Astragalus altaicus*, *Astragalus schanginianus*, *Astragalus sphaerocystis*, *Oxytropis altaica*, *Oxytropis ladyginii*, *Oxytropis martjanovii*, *Euphorbia alpina*, *Pedicularis altaica*, *Campanula altaica*, *Artemisia altaiensis* and many others). Some of these species might be found on lower altitudes to the east. Also some species more characteristic of the Tien Shan (of the Junggar-Turanian Province) may be found (*Dianthus hoeltzeri*, *Chorispora bungeana*, *Potentilla imbricata*, *Biebersteinia odora*, *Scaligeria setacea*, *Ferula teterrima*, *Gentiana turkestanorum*, *Phlomis oreophila*, *Pyrethrum alatavicum*, *Doronicum turkestanicum*, *Echinops integrifolius*). Foreststs are restricted, but we might pass through some herbaceous larch (Larix spp.) groves in narrow inner valleys of, e.g., Tayshiryn Uul. The south-eastern corner of Mongolian Altay is extremely barren, but here some Mongolian Gobi species can be found (feather grasses *Stipa*, onions *Allium polyrrhizum*, *Anabasis brevifolia*, wormwood *Artemisia frigida*). The Altay mountains exhibits a high degree of endemism (12%), and is considered "the center of origin" for montane vegetation in north Asia.

Mammals found in the Altay include the rodents Grey Marmot (*Marmota baibacina*) and Tarbagan Marmot (*Marmota sibirica*, the one most likely encountered by us; please also note that Marmots can be infected by burbonic plague!), the lagomorph Alpine Pika (*Ochotona alpina*, related to rabbits and hares), Siberian Roe Deer (*Capreolus pygargus*, forests), Red Deer (*Cervus elaphus*, forests), Argail or Mountain Sheep (*Ovis ammon*, mountains), Siberian Ibex (*Capra sibirica*, mountains); carnivores in the mountains, valleys and steppes includes Gray Wolf (*Canis lupus*), Red Fox (*Vulpes vulpes*), Corsac Fox (*Vulpes corsac*), Manul or Pallas' Cat (*Felis manul*, syn. *Otocolobus manul*), in the forests Eurasian lynx (*Lynx lynx*, syn. *Felis lynx*), in rugged areas Wolverine (*Gulo gulo*), and in forest steppes Eurasian Badger (*Meles meles*). Small carnivores in mountains and steppes include Ermine (*Mustela erminea*), Steppe Polecat (*Mustela eversmannii*) and Least Weasel (*Mustela nivalis*). Snow leopard (*Panthera uncia*) in the higher altitudes. Kozlov's Pygmy Jerboa (*Salpingotus kozlovi*) is endemic to the desert steppe.

Birds in wetlands include Ruddy Shelduck (*Tadorna ferruginea*) and the familiar Mallard (*Anas platyrhynchos*), in forests Great Spotted Woodpecker (*Dendrocopos major*), more or less everywhere Great Tit (*Parus major*), Grey Wegtail (*Motacilla cinerea*), European Skylark (*Alauda arvensis*), Olive-backed Pipit (*Anthus hodgsoni*), Brown Shrike (*Lanius cristatus*), Black Kite

(*Milvus migrans*) and Common Raven (*Corvus corax*) may be found. House Sparrow (*Passer domesticus*) are common in urban areas. Reptiles include Toad-headed Agama (*Phrynocephalus versicolor*), Pallas' Colubo (*Elaphe dione*, ratsnake), and Asian Pit Viper (*Gloydius halys*, syn. *Agkistrodon halys*).

The area is threatened by illegal logging, increasing problems with desertification. The turn to market economy has increased the number of people living on livestock agriculture, thus causing pasture degradation, overgrazing, and desertification.

Milvus migrans

3. Cis-Hinggan (mountain steppe). Western slopes of the western slope and foothills of the Large Hinggan and will not be visited by us.

4. Middle Khalkha (arid steppe). A flat and hilly-ridgy expanse with granite outliers and bald peaks in the midsection of the northern rim of Mongolia, south of Ulaanbaatar. We will at least drive throught this district (part of the road Tsetserleg - Ulaanbaatar; Ulaanbaatar - Arvaykheer; most of the road Ulaanbaatar - Öndörkhaan - Baruun Urt; also part of the railway to Saynshand). In the elevated rocky regions, arid feather grass steppes prevail: *Stipa krylovii* (syn. *Stipa decipiens*) with *Cleistogenes squarrosa*, or *Artemisia frigida* and *Artemisia adamsii* in depressions, *Elymus chinensis* (syn. *Aneurolepidium pseudagropyrum*), in the eastern part a sedge-feather grass stepp with *Allium anisopodium* and *Allium polyrrhizum*. Large areas covered with a sandy herbaceous-pea shrub and herbaceous-wormwood-pea shrub steppes (*Agropyron cristatum*, *Koeleria gracilis*, *Artemisia frigida*, less often *Artemisia arenaria* s.l., *Caragana microphyllum*, in the south *Caragana pygmaea*). Along lowland lakes and along river valleys (in the solonchak soils, i.e., salty

soils): chee grass thickets with weatgrass and synosias of saltbush (species of *Suaeda* and *Atriplex*), less often lyme grasses (*Elymus dasystachys* and *Elymus chinensis*) and sedge (*Carex enervis*) solonchak meadows and iris thickets (*Iris biglumis*). In the southern and eastern parts, Gobi species may be found in the solonchaks and solonchak lowlands (*Kalidium gracile*, *Reaumuria soongorica*, *Salsola passerina*, *Anabasis brevifolia*), along the rubbly trails feather grasses (*Stipa glaerosa*, *Stipa gobica*), onion-feather grass, saltwort-feather grass desert steppes. Here species of the Daur steppe flora dominate (e.g., *Stipa grandis*, *Polygonum divaricatum*, *Silene jenisseensis*, *Euphorbia discolor*, *Cymbaria dahurica*). The large granite outliers and the bald peaks (e.g., Sorgol-Khairkhan, Choiren Ul) are occupied by mesophytic mountain-forest species (*Lilium tenuifolium*, *Delphinium cheilanthum, Ribes pulchellum*, *Spiraea flexuosa, Peucedanum baicalense*, *Scutellaria scordifolia*).

5. Eastern Mongolia (flat arid steppe). Taliyn Agui is in the northwestern part of this district. Numerous fairly uniform, predominantly grass steppes with few species (*Stipa sibirica, Stipa krylovii*, *Elymus chinensis, Cleistogenes squarrosa*, *Koeleria gracilis*, *Fesctuca sulcata*, *Poa attenuata*). In the north and east the dominant species are wormwood-herbs and tansy (*Filifolium sibiricum*) steppes. Chee grass thickets common along lake boundaries and the lowland floors. In the extreme north and in the south-eastern part along the foothills of the Large Hinggan and the scattered outliers and bald peak groups (Naiman Ul, Khadain-Sume etc) portions with true herbaceous steppes containing species of Manchurian flora can be found (*Stipa sibirica*, *Melica scabrosa*, *Melica virgata*, *Allium odorum*, *Lilium tenuifolium*, *Hemerocallis minor*, *Thalictrum squarrosum*, *Paeonia lactiflora*, with thickets of *Salix*, *Caragana*, *Rosa* etc., and birch-aspen grooves with *Betula dahurica*, *Betula manschurica*, *Populus tremula*). In the north Daur steppe species may be found. In the south Gobi groups can be found: onion-*Stipa sareptana* desert steppes (*Allium polyrrhizum*, *Allium mongolicum*), reaumuria deserts (*Reaumuria soongorica*), solonchaks with potash plants (*Kalidium gracile*, *Kalidium foliatum*), annual saltwort. On sand dunes can be found open pine groves with undergrowth of Siberian crabapple (*Malus baccata*), bird-cherry (*Padus asiatica*), hawthorn (*Crataegus dahurica*), meadowsweet (*Spiraea trilobata, Spiraea hailarensis*), spindletree (*Euonymus maackii*), willow (*Salix mongolica*) with small reed grass (*Calamagrostis epigeios*) and other grass species. Also found here in the sand are Siberian elm (*Ulmus pumila*), *Caragana microphylla, Artemisia halodendron*. Same species can be found on the sands south of Artsagain Nuur and Dalai Nuur, but also true desert psammophytes as *Artemisia ordosica*, *Psammochloa villosa*, *Agriophyllum arenarium*, *Pugionium cornutum* and others (psammo from the greek word for sand...).

6. The Great Lakes Depression (desert-steppe). A huge depression of complex topography, surrounded by the Mongolian Altay, Tannu Ol and Hinggan upland, including the lakes Uvs Nuur (Ubsu Nur), Khyargas Nuur (Khirgis Nur), Khar-Us Nuur (Khara-Us Nur), Khar Nuur (Khara Nur), and Dorgoon Nuur (Durge Nur). The basin is 600-650 km in lenght, and 200-250 km wide in the north and 60-100 km wide in the south; it belongs to the Central Asia Internal Drainage Basin. The average elevation on the Shargyun Nuur depression is 948-1700 m (at Khar-Us Nuur it is 1153 m, at Khyargas Nuur 1028 m, and at Uvs Nuur 759 m). The climate is generally arid, characterized by extremely low temperatures and low, erratic rainfall. Winters are long and cold, spring is dry and windy, while summers are warm to hot. Annual mean temperature is -2 °C, with monthly mean temperatures ranging from -24 °C in January to +20 °C in July. Average annual precipitation is 50-150 mm.We will not visit this area (but Altay and Uliastay is not very far from its east part), except for the margin of Shargyn Govi (Shargain Gobi; the road Altay - Tsagaanchuluut, and perhaps also short stretches of the road Tsagaanchuluut - Uliastay).

The Shargyn Govi is a barren area, consisting of a small but deep basin. The upper parts of the trails are covered with desert steppe onion-feather grass and partly *Anabasis brevifolia*-feather grass with *Stipa glareosa* and *Hyppolitia achilleoide*. The lower parts by typical *Anabasis brevifolia* desert and *Caragana lecucophloea* communities. In the central part of the basin, species like *Anabasis brevifolia, Nitraria sibirica, Caragana leucophloea, Asterothamnus centraliasiaticus, Kalidium gracile, Reaumuria soongorica, Kalidium foliatum, Caragana spinosa, Halimodendron halodendron, Lycium ruthenicum* may be found. Much of the semi-desert (desert steppe) has three major plant communities: the *Oxytropis aciphylla-Caragana leucophloea*, the *Artemisia rutifolia-Caragana leucophloea*, and the *Amygdalus pedunculata-Caragana leucophloea* communities. The grass *Achnatherum splendens* community occupies the transition zone between the semi-desert and the grazing pastures in the river valleys, with shrubs of *Caragana spinosa* and *Halimodendron halodendron*. These bushes may form dense stands or long bands in the river valleys. The degraded grazing ground now harbor species like *Potentilla anserina*. In the Shargyn communities with *Haloxylon ammodendron* dominate.

Animals are mostly species adapted to desert or semi-desert habitats and wetlands. Rodents in the Basin include Mongolian Gerbil or Mongolian Jird (*Meriones unguiculatus*), Northern Three-toed Jerboa (*Dipus sagitta*), *Citellus erithrogenus*(?), and Desert Hamster or Roborovski's Hamster (*Phodopus roborovskii*). In mountain areas Mountain Sheep (*Ovis ammon*) and Siberia Ibex (*Capra sibirica*) may be found. On lower steppes Mongolian Gazelle (*Procapra guttorosa*) and Black-tailed or Goitered Gazelle (*Gazella subgutturosa*). Predators include Grey Wolf (*Canis lupus*), Red Fox (*Vulpes vulpes*), Corsac Fox (*Vulpes corsac*), Manul or Pallas' Cat (*Felis manul*, syn. *Otocolobus*

manul), Mountain Weasel (*Mustela altaica*), Ermine (*Mustela erminea*), Steppe Polecat (*Mustela eversmannii*), and Beech Marten (*Martes foina*). Among birds, Black Kite (*Milvus migrans*) and Desert Wheatear (*Oenanthe deserti*) are found throughout the region, with House Sparrow (*Passer domesticus*) in urban areas. Coomon reptiles include Toad-headed Agama (*Phrynocephalus versicolor*), Pallas' Colubo (*Elaphe dione*, ratsnake), and Asian Pit Viper (*Gloydius halys*, syn. *Agkistrodon halys*). Part of the lake sytems are very important reedbeds and harbor many threatened and globally endangered species, e.g., one of the two populations of the Mongolian Saiga (*Saiga tatarica mongolica*), but also Dalmatian Pelican (*Pelecanus cripsus*) and Snow Leopard (*Panthera uncia*). The Uvs Nuur Basin is designated one of ten sites in the world selected for a global climate change study as part of the International Geosphere and Biosphere programs.

The area is seriously threatened by overgrazing, population growth, deforestation of riparian areas (ie., the area between the land and a stream), and hydroelectric development. The turn into market economy in the 1990's lead to an increas in the number of people living on livestock agriculture (resulting in increased overgrazing, pasture degradation, and potential desertification).

Protected areas include Uvs Lake Basin Strictly Protected Area (SPA, 7,125,000 ha), Khar Us Nuur (8,503,000 ha), and Khyargas Nuur (c. 3,200,000 ha) National Parks.

Gerbillinae

7. Valley of lakes (almost flat desert-steppe district). Separating Khangayn Nuruu in the north from Mongolia Altay in the south, with the lakes Boor Tsagaan Nuur, Orog Nuur, and "Beger Nur". the valley is about 500 km long (open to the southeast, meeting the Eastern Gobi plain), 150 km wide, and at an elevation of about 1000 to 1400 m. We may travel through its nothern limits (part of the way Bayankhongor - Altay); its northern flank is formed of gradually (over 100 km) descending foothills and trails of Khangayn Nuruu. Summers are arid and hot, with a strong prevailing wind from northwest. The annual mean temperature is +2 to +6 °C, but the monthly mean vary from -16 °C in January to +20 °C in July. Average annual precipitation is 50 to 200 mm.

Barren rubbly steppes predominate with different forms of feather grass steppes (as S*tipa pennata-Allium polyrrhizum, Stipa pennata-Cleistogenes* spp., *Stipa pennata-Allium polyrrhizum-Anabasis* spp., *Caragana* spp.-*Stipa pennata* associations), dominated by *Stipa gobica, Stipa glareosa, Allium polyrrhizum, Cleistogenes mutica, Cleistogenes soongorica, Cleistogenes squarrosa, Hippolytia achilleoides, Caragana pygmaea.* Desert associations can be found along the lower parts of the trails and in the lake depressions (*Anabasis brevifolia,* saltwort like *Salsola passerina,* also on solonchak floors together with potash plant *Kalidium gracile, Reaumuria soongorica,* or associations of *Anabasis brevifolia*, *Salsola passerina*, *Salsola abrotanoides, Kalidium gracile*), sometimes also sparse saxaul thickets. The Khangayn foothills (where we will pass) bear a transitional vegetation, mostly a barren (impoverished and sparse) arid steppe vegetation consisting of feather grass (*Stipa krylovii*), *Cleiostogenes squarrosa, Artemisia frigida* and sometimes also *Caragana pygmaea*. The lakes harbor different species, but we will not visit them

The fauna consists of species adapted to desert or semi-desert habitats and wetlands. Mammal species include Midday Gerbil or Midday Jird (*Meriones meridianus*), Gobi Jerboa (*Allactaga bullata*), Siberian or Dwarf Hamster (*Phodopus sungorus*), species of Pika (*Ochotona* spp.), Long-eared Hedgehog (*Hemiechinus auritus*, syn. *Erinaceus auritus*), and Tibetan or Desert Hare (*Lepus tibetanus*). On the lower steppe (not visited by us?) Black-tailed or Goitered Gazelle (*Gazella subgutturosa*) and Mongolian Gazelle (*Procapra guttorosa*) can be found. In the mountains can Mountain Sheep (*Ovis ammon*) and Siberian Ibex (*Capra sibirica*) be found. Predators include Gray Wolf (*Canis lupus*), Red Fox (*Vulpes vulpes*), Corsac Fox (*Vulpes corsac*), and Manul or Pallas' Cat (*Felis manul*, syn. *Otocolobus manul*). At lower elevations common predators include Mountain Weasel (*Mustela altaica*), Ermine (*Mustela erminea*), Steppe Polecat (*Mustela eversmannii*), and Least Weasel (*Mustela nivalis*). Apart from the water bird species, also Black Kite (*Milvus migrans*), Desert Wheatear (*Oenanthe deserti*), European Skylark (*Alauda arvensis*), Shore Lark (*Eremophila alpestris*), and Common Raven (*Corvus corax*) are found throughout the region. Common amphibians and reptiles are the Mongolian Toad (Siberian Sand Toad or Radde's Toad; *Pseudepidalea raddei*, syn. *Bufo raddei*), Toad-headed agama (*Phrynocephalus versicolor*), Racerunners (*Eremias przewalskii*; wall lizard), Pallas' Coluber (*Elaphe dione*; ratsnake), and the Asian Pit Viper (*Gloydius halys*, syn. *Agkistrodon halys*).

The soil is extremely vulnerable to desertification through overgrazing. The risk of overgrazing has increased since the turn to market economy, that led to an increased number of people living on livestock.

There is no adequate protection in this area at present.

8. Gobi Altay (hilly barren steppe). We will not visit this area, more or less consisting of the continuation of the Mongolian Altay.

9. Eastern Gobi (desert-steppe). Predominantly hillocky-flat with dispersed and relatively small portions with low conical mounds on an elevation of about 1000 to 1500 m. Saynshand is in this district. The climate is continental, with warm to hot summers and intensely cold winters. The mean annual temperature is -2 to -6 °C (January mean -20 to -20 °C). Annual precipitation is about 100 to 150 mm, but with large variations from year to year.

The vegetation is predominantly thin and sparse, with feather grass, onion, tansy, *Cleiostogenes squarrosa*, and *Hippolytia*; in clayey-rubbly basins and trails of knolls *Anabasis brevifolia* and *Salsola passerina* deserts may be found. In the southern part of the region, on rubbly-sandy soils, *Potaninia mongolica, Brachanthemum gobicum, Salsola arbuscula* and *Eurotia ceratoides* deserts are common (this area will not be visited). The clayey solonchak floors of basins are covered with associations of potash plants (*Kalidium gracile*), reaumuria (*Reaumuria soongorica*) or annual saltworts. In this district, dominating shrubs include *Caragana bungei* and *Caragana leucocephala* (these two shrubs are also dominant on the Tibetan Plateau). Also *Artemisia xerophytica* and *Nitraria sibirica* can be found here, as well as the low grasses *Stipa gobica, Stipa glareosa* and *Cleistogenes soongorica*.

Mammals include the endangered Khulan or Mongolian Wild Ass (*Equus hemionus hemionus*, subspecies of the Onager), Mongolian Saiga Antelope (*Saiga tatarica mongolica*), Black-tailed or Goitered Gazelle (*Gazella subgutturosa*), and several species of the small jumping desert rodents Jerboa (family Dipodidae), including the very rare and little-known Long-eared Jerboa (*Euchoreutes naso*), Kozlov's Pygmy Jerboa (*Salpingotus kozlovi*), Andrews' Three-toad Jerboa or Mongolian Jerboa (*Stylodipus andrewsi*), and Gobi Jerboa (*Allactaga bullata*).

Characteristic birds include Houbara Bustard (*Chlamydotis undulata*), Pallas' Sandgrouse (*Syrrhaptes paradoxus*), Henderson's Ground Jay (*Podoces hendersoni*), Greater Sand Plover (*Charadrius lechenaultii*), Mongolian Desert Finch, or Mongolian Trumpet Finch, or just Mongolian Finch (*Rhodopechys mongolicus*, syn. *Bucanetes mongolicus*), Chukar (*Alectoris chukar*), Lammergeier or Bearded Vulture (*Gypaetus barbatus*), and Eurosian Black Vulture (aka Black Vulture, Monk Vulture, or Cinereous Vulture; *Aegypius monachus*).

The production of cashmere wool has considerably increased the number of goats on the grasslands, increasing the degradation of the grassland, with overgrazing. The desert vegetation is sensitive to trampling (both livestock and off-road vehicles) and overgrazing.

This area is not adequately protected at the moment.

Syrrhaptes paradoxus

10. Western Gobi (sandy-pebbly and rocky-rubbly desert, a hammada)."This district is the most inhospitable desert in Mongolia with extremely sparse vegetation comprising fine xerophytic shrubs." Northernmost part of the Alashan Plateau semi-desert. Eej Khayrkhan Nature Reserve is in this district (although on the very border to the Junggar Gobi of Junggar-Turanian Province). The climate is harsh, with large seasonal and diurnal temperature variations, and an annual precipitation rarely exceeding 150 mm per year (some parts of the Gobi desert may not have any measurable precipitation for several years).

The vegetation consists mostly of typical Central Asian desert species. Vegetation found here consists of sparse dwarf saxaul thickets with panicle-shaped saxaul bushes (*Haloxylon ammodendron*) rising up to 1 m in height, or nitraria (*Nitraria sphaerocarpa*) and ephedra (*Ephedra przewalskii*) sandy-pebbly deserts, bean capers (*Zygophyllum xanthoxylon* and *Zygophyllum kaschgaricum*) deserts on rubbly-rocky mountain trails, and mixed small scrub formations of *Sympegma regelii,Anabasis brevifolia, Stipa gobica, Reaumuria soongorica* and *Iljina regelii* on rubbly-rocky slopes of small mounds and low hills. Somewhat less arid areas support a shrub semi-desert vegetation of wormwoods (*Artemisia salsaloids, Artemisia ordosica*), beancaper (*Zygophyllum xanthoxylon*) and *Calligonum mongolicum*. Oases can be found in the submontane springs and at the ends of large gorges, with tugais (i.e., vegetation-covered bottomland) of *Populus diversifolia, Elaeagnus moorcroftii, Tamarix ramosissima, Salix caspica, Caragana leucophloea, Calligonum mongolicum, Lycium ruthenicum* and *Nitraria sibirica*, and meadow-solonchak vegetation (*Phragmites communis, Lasiagrostis splendens, Sophora alopecuroides, Glycyrrhiza*

uralensis, *Alhagi sparsifolia* and *Poacynum hendersonii*).

Much of the biodiversity is protected in the Great Gobi Protected Area (located south of Eej Kharyrkhan NR). Mammals found here include the endemic Przewalski's gerbil (*Brachiones przewalskii*), the endangered Khulan or Mongolian Wild Ass (*Equus hemionus hemionus*, subspecies of the Onager), Gobi Brown Bear (*Ursus arctos gobiensis*), Black-tailed or Goitered Gazelle (*Gazella subgutturosa*). Reptiles include the Gobi or Yengisar Gecko (*Cyrtopodion elongatus*) and Tatar Sand Boa (*Eryx tataricus*). Mountainous areas in the northern part support populations of Snow Leopards (*Panthera uncia*), Brown Bears (*Ursus arctos*), and Grey Wolves (*Canis lupus*).

11. Alashan Gobi (mostly sandy desert). Mostly in Inner Mongolia, and will not be visited by us.

12. Ordos (sandy, partly sandy-pebbly desert). Only in Inner Mongolia, and will not be visited by us.

13. Khesi. The "corridor" along Nanshan in China and will not be visited by us.

Anthropoides virgo

Ecoregions

Mongolian-Manchurian Grassland (temperate grassland). This area streches partly over Middle Khalkha (4) and Eastern Mongolia (5) above, continuing to the upper Selenga River Basin and Lake Baykal. Ulaanbaatar is at least close (if not included?) in this ecoregion. This extensive grassland

stretches from the northeastern China's coastal hills, and continues until it meets the boreal forests of southern Siberia, covering an area of more than one million square kilometers. Average elevation is 1000 to 1300 m. Climate is temperate, with a January mean temperature of -9 °C or less. Annual precipitation (concentrated to a weak summer monsoon) is on average 400 to 450 mm in the east, and 150 to 200 mm in the west.

Forest vegetation in the ecoregion includes Mongolian oak (*Quercus mongolica*), poplar (*Populus davidiana*, *Populus suaveolens*), birch (*Betula platyphylla*), and willow (*Salix rorida*). Shrubs include *Rhododendron macromulata*, *Rhododendron dahurica*, *Rhododendron tomentosa* (syn. *Ledum palustre*), and *Vaccinium vitis-idaea*. Higher altitudes have spruces (*Picea obovata*, *Picea microsperma*), larch (*Larix dahurica*) and pine (*Pinus sylvestris* and *Pinus pumila*). The grass areas are dominated by feathergrasses (*Stipa baicalensis*, *Stipa capillata*, *Stipa grandis*), *Festuca ovina*, *Aneurolepidium chinense*, *Filifolium sibiricum*, and *Cleistogenes squarrosa*. The desert steppes close to the Gobi Desert is less productive, with drought-resistant grasses (*Stipa gobica*, *Stipa breviflora*, *Stipa glareosa*), forbs (*Reaumuria soongorica*, *Hippolytia trifida*, *Ajania fruticosa*), and small, spiny shrubs (*Caragana microphylla*, *Ephedra equisetina*, *Ephedra sinica*). In areas of saline soils communities with *Kalidium gracile* are found, and in salt marshes communities dominated by *Scirpus rufus*, *Scirpus planifolium*, *Ranunculus cymbalaria*, and *Phragmites communis*.

Several fragmented and endangered populations of threatened mammals may occure on the Mongolian-Manchurian Grassland, including Khulan or Mongolian Wild Ass (*Equus hemionus hemionus*, subspecies of the Onager) and Sonw leopards (*Panthera uncia*). Previous populations of Bactrian Camel (*Camelus bactrianus*, syn. *Camelus ferus*), Przewalski's Gazelle (*Procapra przewalskii*), and Przewalski's Horse (*Equus przewalskii*) have been hunted to extinction from the region (and from the wild in the case of Przewalski's Horse).

The area is threatened from overgrazing by sheeps and goats. Cashmer wool production has increased the number of goats in recent years. The collapse of the urban economy in Mongolia together with the market economy, have tripled the number of herdsmen in the past decade to more than 450,000 while the number of livestock has increased by 30%.

The Taiga (more or less)

This area of northern Mongolia (including Ulaanbaatar and the Khangayn Nuruu) is not part of the Mongolian Province of the Mediterranean Flora Region, but rather part of the Eurasian forest region.

1. Selenge-Orkhon Forest Steppe (open forest steppe). North and northeast of the Khangayn Nuur, including most of the river basins of Selenge Gol and Orkhon Gol, in the north replaced by taiga, and in the south of steppes. The mean altitude is 800 to 1200 m, but the average altitude of the mountains are 1500 to 2000 masl. The climate is dry. The winter season is from mid-October to late March or early April; summer season starts in mid-June and lasts 80-90 days. Average temperature in January is -20 to -25 °C. Summer precipitation is 250 to 300 mm, while winter and fall precipitation is 150 to 200 mm. Ulaanbaatar is more or less within this area.

The vegetation is a compination of pine (Pinus sylvestris) and aspen (Populus tremula). The lower altitude forests are dominated by Rosa acicularis (with some Cotoneaster melanocarpa). Nearly 90 % of the total area is covered by dry steppe vegetation with *Stipa cleiostogenes* in lower areas, and *Cleistogenes* spp. in higher altitudes. *Caragana-Stipa* patches are distributed throughout the region. Sand areas are characterized by trees such as *Ulmus pumila, Populus tremula, Padus asiatica*, and several willows (*Salix pentandra, Salix tenuifolia*) in wetter locations.

The fauna is especially diverse on the steppe areas, with numerous rodent species, e.g., Tolai Hare (*Lepus tolai*), Korean Field Mouse (*Apodemus peninsulae*), Eurasian Red Squirrel (*Sciurus vulgaris*), and Tundra or Root Vole (*Microtus oeconomus*). Other mammal species are Siberian Chipmunk (*Tamias sibiricus*), Wild Boar (*Sus scrofa*), Grey Wolf (*Canis lupus*) and Brown Bear (*Ursus arctos*).

The streams and rivers are threatened by the widely practiced gold panning. The area is also heavily settled by herders, and animal husbandry is widely practiced. The valleys of the Selenge River Basin are arid and fertile, and used extensively for agriculture, hay making, and livestock harvesting. The human population centers bring associated industrial threats, and pressures from railways, roads, and processing industries as copper and cement are perhaps the most significant threat to this ecoregion. Few areas are protected.


Anser indicus

2. Khangayn Nuur Conifer Forests (taiga). The northern, lower parts of the Khangayn mountain range; we will cross it on some occasions, and drive close to it on other. The Khangayn Nuur is over 750 km long, with peaks up to 3905 masl (see next section). The ecoregion is surrounded by Selenge-Orkhon Forest Steppe in the north, and meet the Khangayn Nuur Alpine Meadows in the south. The highest peak in the ecoregion is Zurhiin Hunh Mountain (3227 masl?).

The vegetation consists of a cool but dense, humid coniferous forest, with a high diversity of flora and fauna. Here we may encounter Elk (*Alces alces*, cedar forests), Musk Deer (*Moschus moschiferus*, cedar forests), Wild Boar (*Sus scofra*, cedar, cedar-larch, and larch forests), Red Deer (*Cervus elaphus*, cedar, cedar-larch, and larch forests), Grey Wolf (*Canis lupus*), and Brown Bear (*Ursus arctos*, cedar forests) but also Eurasian Red Squirrel (*Sciurus vulgaris*, cedar forests), Siberian Chipmunk (*Tamias sibiricus*, cedar, cedar-larch, and larch forests), Mountain Hare (*Lepus timidus*, cedar forests), Sable (*Martes zibellina*, cedar forests), Siberian Roe Deer (*Capreolus pygargus*, larch and cedar-larch forests), Grey Red-backed or Grey-sided Vole (*Myodes rufocanus*, syn. *Clethrionomys rufocanus*, larch and cedar-larch forests), Smaller or Siberian Flying Squirrel (*Pteromys volans*, larch and cedar-larch forests), Narrow-headed Vole (*Microtus gregalis*, larch and cedar-larch forests), and Wood Lemming (*Myopus schisticolor*, larch and cedar-larch forests).

The forests may consist of Poplar (*Populus* spp.) or Larch (*Larix* spp.) species or a mixed forst of Larch and Cedars, sometimes also with Birch (*Betula* spp.). There are also mountain tundra areas (with no or few trees, or only a low and sparse larch forest). The larch forests may be divided into the following areas: a) Central Khangayn (taiga lake larch forest, cedar larch, sole larch, and sparse areas of sub-alpine forest), b) Western Khangayn (taiga larch forest, subalpine taiga larch, and cedar larch forest), c) Northeastern Khangayn (taiga-like forest, steppe forest), and d) Southeastern Khangayn (taiga-like forest).

The increased logging (by a large number of timber enterprises) has led to reduced river outflows and other alterations.

Protected areas include the recent (2000) Tarvagatai Nuruu National Park (2,254,000 ha).

3. Khangayn Nuur Alpine Meadow (alpine meadow). High mountain meadows above the treeline in the top part of the Khangayn Nuur at 2350-2800 masl. The average altitude is 2000 to 2500 masl, with peaks at 3200 to 3500 masl; the highest peak is the sacred mountain Otgon Tenger Uul (3905 masl; home of the deity Orchirvaani). Average January and July temperatures are cooler than -20 °C and +10 °C, respectively. Annual precipitation is over 400 mm. The area is modified by at least five past glaciation events (i.e., morrains and landslips are present). We may pass this area briefly? Many streams and springs.

Vegetation of short bushes and thickets and tundra with lichen and mosses. Taiga plants like pine (*Pinus sylvestris*), aspen (*Populus tremula*), and even edelweiss (*Leontopodium ochroleucum*) may be found in lower parts. Higher up species of Himalayan affinity can be found, e.g., milkwort (*Lancea tibetica*) and "Kobresia moujr" (whatever that is...); on even higher altitudes are marshy meadows with *Kobresia* spp., *Carex kobresia* (i.e., *Kobresia caricina*) and various herbs. The fauna is sparse, but the Altai Pika (*Ochotona alpina*), Siberian Ibex (*Capra sibirica*), Mountain Hare (*Lepus timidus*), and some small rodents may be found. Birds include Altai Snowcock (*Tetraogallus altaicus*) and Eurasian Dotterel (*Charadrius morinellus*, syn. *Eudromias morinellus*).

Overgrazing is a potential threat. The number of livestock is increasing in surrounding areas. Logging and the development of a gold mining industry are also potential serious threats.

The area is protected by the Khangai Nuruu National Park (8,885,000 ha).

Falco cherrug

Species	Family	2	4	5	6	7	9	10
Allium anisopodium	Alliaceae		X					
Allium mongolicum	Alliaceae			X				
Allium odorum	Alliaceae			X				
Allium polyrrhizum	Alliaceae	X	X	X		X		
Agriophyllum arenarium	Amaranthaceae			X				
Anabasis brevifolia	Amaranthaceae	X	X		X	X	X	X
Atriplex spp.	Amaranthaceae		X					
Eurotia ceratoides (=Axyris ceraoides)	Amaranthaceae						X	
Haloxylon ammodendron	Amaranthaceae				X			X
Iljina regelii	Amaranthaceae							X
Kalidium foliatum	Amaranthaceae			X	X			
Kalidium gracile	Amaranthaceae		X	X	X	X	X	
Salsola abrotanoides	Amaranthaceae					X		
Salsola arbuscula	Amaranthaceae						X	
Salsola passerina	Amaranthaceae		X			X	X	
Suaeda spp.	Amaranthaceae		X					
Sympegma regelii	Amaranthaceae							X
Poacynum hendersonii (=Apocynum pictum)	Apocynaceae							X
Betula dahurica	Betulaceae			X				
Betula manschurica	Betulaceae			X				
Biebersteinia odora	Biebersteiniaceae	X						
Campanula altaica	Campanulaceae	X						
Dianthus hoeltzeri	Caryophyllaceae	X						
Silene jenisseensis	Caryophyllaceae		X					
Euonymus maackii	Celastraceae			X				
Artemisia adamsii	Compositae		X					
Artemisia altaiensis	Compositae	X						
Artemisia arenaria s.l.	Compositae		X					
Artemisia frigida	Compositae	X	X			X		
Artemisia halodendron	Compositae			X				
Artemisia ordosica	Compositae			X				X
Artemisia rutifolia	Compositae				X			
Artemisia xerophytica	Compositae						X	
Asterothamnus centraliasiaticus	Compositae				X			
Brachanthemum gobicum	Compositae						X	
Doronicum turkestanicum	Compositae	X						
Echinops integrifolius	Compositae	X						
Filifolium sibiricum (=Artemisia ...)	Compositae			X				
Hippolytia achilleoides (syn. Ajania achilleoides)	Compositae				X	X		
Hippolytia spp.	Compositae						X	

Pyrethrum alatavicum (=Tanacetum alatavicum)	Compositae	X						
Chorispora bungeana	Cruciferae	X						
Draba altaica	Cruciferae	X						
Pugionium cornutum	Cruciferae			X				
Carex enervis	Cyperaceae		X					
Elaeagnus moorcroftii	Elaeagnaceae							X
Ephedra przewalskii	Ephedraceae							X
Euphorbia alpina	Euphorbiaceae	X						
Euphorbia discolor	Euphorbiaceae		X					
Gentiana turkestanicum	Gentianaceae	X						
Achnatherum splendens	Gramineae				X			
Agropyron cristatum	Gramineae		X					
Calamagrostis epigeios	Gramineae			X				
Cleistogenes mutica	Gramineae					X		
Cleistogenes soongorica	Gramineae					X	X	
Cleistogenes squarrosa	Gramineae		X	X		X	X	
Deschampsia koelerioides	Gramineae	X						
Elymus chinensis (Aneurolepidium pseudagropyrum)	Gramineae		X	X				
Elymus dasystachys	Gramineae		X					
Festuca sulcata	Gramineae			X				
Koeleria gracilis	Gramineae		X	X				
Lasiagrostis splendens (=Stipa ...)	Gramineae							X
Melica scabrosa	Gramineae			X				
Melica virgata	Gramineae			X				
Phragmites communis	Gramineae							X
Poa attenuata	Gramineae			X				
Psammochloa villosa	Gramineae			X				
Stipa glaerosa	Gramineae		X		X	X	X	
Stipa gobica	Gramineae		X			X	X	X
Stipa grandis	Gramineae		X					
Stipa krylovii (Stipa decipiens)	Gramineae		X	X		X		
Stipa pennata	Gramineae					X		
Stipa sareptana	Gramineae			X				
Stipa sibirica	Gramineae			X				
Ribes pulchellum	Grossulariaceae		X					
Hemerocallis minor	Hemerocallidaceae			X				
Iris biglumis	Iridaceae		X					
Phlomis oreophila	Labiatae	X						
Scutellaria scordifolia	Labiatae		X					
Alhagi sparsifolia	Leguminosae							X
Astragalus altaicus	Leguminosae	X						

Astragalus schanginianus	Leguminosae	X						
Astragalus sphaerocystis	Leguminosae	X						
Caragana bungei	Leguminosae						X	
Caragana leucocephala	Leguminosae						X	
Caragana leucophloea	Leguminosae				X			X
Caragana microphylla	Leguminosae		X	X				
Caragana pygmaea	Leguminosae		X			X		
Caragana spinosa	Leguminosae				X			
Caragana spinosa	Leguminosae				X			
Caragana spp.	Leguminosae			X				
Glycyrrhiza uralensis	Leguminosae							X
Halimodendron halodendron	Leguminosae				X			
Halimodendron halodendron	Leguminosae				X			
Oxytropis aciphylla	Leguminosae				X			
Oxytropis altaica	Leguminosae	X						
Oxytropis ladyginii	Leguminosae	X						
Oxytropis martjanovii	Leguminosae	X						
Sophora alopecuroides	Leguminosae							X
Lilium tenuifolium	Liliaceae		X	X				
Nitraria sibirica	**Nitrariaceae**				**X**		**X**	**X**
Nitraria sphaerocarpa	**Nitrariaceae**							**X**
Cymbaria dahurica	Orobanchaceae		X					
Pedicularis altaica	Orobanchaceae	X						
Paeonia lactiflora	Paeoniaceae			X				
Calligonum mongolicum	Polygonaceae							X
Polygonum divaricatum	Polygonaceae		X					
Aconitum altaicum	Ranunculaceae	X						
Delphinium cheilanthum	Ranunculaceae		X					
Thalictrum squarrosum	Ranunculaceae			X				
Trollius altaicus	Ranunculaceae	X						
Amygdalus pedunculata	Rosaceae				X			
Crataegus dahurica	Rosaceae			X				
Malus baccata	Rosaceae			X				
Padus asiatica (=Prunus ...)	Rosaceae			X				
Potaninia mongolica	**Rosaceae**						**X**	
Potentilla anserina	Rosaceae				X			
Potentilla imbricata	Rosaceae	X						
Rosa spp.	Rosaceae			X				
Sanguisorba alpina	Rosaceae	X						
Spiraea flexuosa	Rosaceae		X					
Spiraea hailarensis	Rosaceae			X				

Spiraea trilobata	Rosaceae			X				
Populus diversifolia	Salicaceae							X
Populus tremula	Salicaceae			X				
Salix caspica	Salicaceae							X
Salix mongolica	Salicaceae			X				
Salix spp.	Salicaceae			X				
Lycium ruthenicum	Solanaceae				X			X
Reaumuria soongorica	Tamaricaceae		X	X	X	X	X	X
Tamarix ramosissima	Tamaricaceae							X
Ulmus pumila	Ulmaceae			X				
Ferula teterrima	Umbelliferae	X						
Peucedanum baicalense	Umbelliferae		X					
Scaligeria setacea	Umbelliferae	X						
Zygophyllum kaschgaricum	Zygophyllaceae							X
Zygophyllum xanthoxylon	Zygophyllaceae							X

Illustrations from X. Noguès