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# BIOLOGICAL DIVERSITY IN MONGOLIA

## (FIRST NATIONAL REPORT)

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## Members of the First National Report on Biodiversity working group


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|---|---|
| Editors: | Z.Batjargal |
| | A.Enkhbat |
| Author: | Ts.Shiirevdamba, Doctor of Science |
| Assistant authors: | Ya.Adya, Ph.D., Institute of Biology |
| | Ts.Adyasuren, Ph.D., Ministry for Nature and the Environment |
| | B.Avirmed, Ph.D., National Committee of Endangered Species |
| | Z.Batjargal, Ph. D., Hydro- Meteorology and Environmental Monitoring Agency |
| | A.Bold, Doctor of Science, Institute of Biology |
| | M.Bulgan, Central Laboratory of Environmental Monitoring |
| | Kh.Buyan-Orshikh, Doctor of Science, Institute of Biology |
| | B.Choitsamts, Doctor of Science, Institute of Biology |
| | G.Danzan, Doctor of Science, Professor, State Pedagogical University of Mongolia |
| | D.Dorjsuren, Ph.D., EcoTrade Co. Ltd. |
| | Ch.Dugarjav, Doctor of Science, Institute of Biology |
| | A.Dulmaa, Doctor of Science, Professor, Institute of Biology |
| | S.Dulamtseren, Ph.D., Institute of Biology |
| | D.Enkhsaikhan, Ph.D., Forest Survey Center |
| | M.Erdenebat, Institute of Geo-Ecology |
| | J.Gal, Ph.D., Institute of Biology |
| | Ts.Janchiv, Doctor of Science, Professor, Institute of Biology |
| | D.Myagmarsuren, Protected Area Bureau, EPA |
| | Kh.Munkhbayar, Professor, State Pedagogical University of Mongolia |
| | L.Natsagdorj, Ph.D., Institute of Hydro-Meteorology |
| | G.Ochirbat, Doctor of Science, Institute of Biology |
| | Ch.Sanchir, Doctor of Science, Institute of Biology |
| | H.Terbish, Ph.D., State University of Mongolia |
| | Ts.Tsegmid, Ph.D., Institute of Biology |
| | G.Tserenbaljid, Doctor of Science, Institute of Biology |
| | L.Tserennadmid, Ph.D. Institute of Biology |
| | V.Tsetseg, Ph.D., Institute of Biology |
| | D.Tsetsegmaa, Institute of Biology |
| | N.Ulziikhutag, Doctor of Science, Professor, Government Secretariat |
| | K.Ulipkhan, Doctor of Science, State University of Mongolia |
| Translators: | O.Byambaa, A. Gerel, Ts. Temuulen, B. Undral |
| English editors: | Z.Batjargal, A.Enkhbat, IS. Femandez, J.Heikkila |
| Support staff: | S.Batgerel, Yu.Bayarjargal, N.Lhamsuren, L.Surmaa |


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# FOREWORD

Mongolians have a proud history regarding nature conservation because industrial development has been preserved in balance with Mongolia's ecological capacity, resulting in its unspoiled natural environment.

The State of Mongolia, in ancient times, conducted a policy, aimed at nature conservation and the proper use of natural resources, which has been passed down to the modern generation and has become more comprehensive, today, with the introduction of new concepts.

"Nature worship" was important in environmental conservation when the first tribes and aimags in Mongolian history decided on a state policy to protect certain areas. For instance, Khaan Tooril of the ancient Khereid aimag put the Bogdkhan Mountain, located in the south of Ulaanbaatar, under protection in the 12th and 13th centuries; this paved the way for other Khaans, including Chinggis Khan, to approve laws like the "Ikh Tsaaz" (Great Law) to legalize nature conservation issues. Currently, there are 38 protected areas in Mongolia which cover 11 per cent of the total area.

The Great Hural of Mongolia has passed, and started the enforcement of, over 20 laws which reflect the state policy on nature conservation. Mongolia was the thirtieth country to sign the Biodiversity Convention and has since made considerable efforts to carry out its duties. When the Mongolian government approved the Biodiversity Action Plan, certain activities were included in its annual Action Plan every year to implement the plan sequentially.

The Mongolian Biodiversity project has been ongoing for three years with support from the UNDP and GEF and its activities have gained the appreciation of the public in the areas of the formation of a legal basis on nature conservation and of the national carrying capacity, expansion of the protected areas network and endangered species conservation. The Biodiversity Project continues its activities in the Biodiversity Conservation and Sustainable Livelihood Options in the Grasslands of Eastern Steppe Project, which has already begun. This project will be responsible for maintaining the balance of ecosystems, which are composed of unique species of fauna and flora.

The Mongolian government recently re-published the Mongolian Red Book which has strongly supported the protection of biodiversity. The "Mongolian Trust Fund" has been established with the aim of providing long-term financing for nature conservation, sustainable use of natural resources and the restoration of the environment. Mongolia has been actively participating in the multi-lateral meetings of the Biodiversity Convention and other similar activities. The first national report, "Biological Diversity in Mongolia" for the COP-4 meeting under the Convention on Biological Diversity to be held in Bratislav this year, has been completed.

We would like to express our deepest gratitude for the financial support provided by GEF for the preparation of this report.

**Borjigd Ts. ADYASUREN**

Member of the Mongolian Government,
Minister for Nature and the Environment

# PREFACE

As the global environmental ecology deteriorates each year, the loss of biodiversity becomes increasingly more evident in Mongolia, influencing the environmental and ecological equilibrium of certain areas in the country.

Mongolia has a severe continental climate and an ecologically vulnerable environment. There is a definite need to protect, increase and sustain natural resources in the face of increasing urbanization, concentration of human populations in specific areas, over-indulgence in the use of the natural resources and negative climate changes.

The Mongolian government is determined to take integrated measures to preserve the country's fauna and flora, and to use sustainably, all natural resources.

With this purpose in mind, Mongolia joined the "Convention on Biodiversity" in 1993 and formulated the National Biodiversity Action Plan which is widely implemented throughout the country. I wish to note here that this Report was made possible through the cooperative effort of Mongolian scientists and experts; for the first time, we have translated the National Biodiversity Report in English and copies are currently being made available to the world community.

Chapters I and II contain subjects dealing with Mongolian socio-economic development trends, environmental status, specific features regarding climate and negative impacts on the environment. Chapter III contains brief descriptions of the current state of Mongolian flora and fauna, as well as, their protection, use and restoration.

The decline of biological resources, deterioration of the environment, government action and supervision, institutional strengthening, establishment of legal and economic bases, extension of the protected areas network, improvement of management skills, scientific studies, training, information distribution and monitoring are covered in Chapter IV.

Because of time constraints, we could not use all the invaluable data available in Mongolia that have been collected by both European and Mongolian researchers since the start of the 19th century. In order to give a clear picture of Mongolian biodiversity, maps, tables and figures have been included in this report.

We would like to extend our sincerest thanks to all scientists, experts, translators and support staff, who assisted in the production of this report.

Finally, we would greatly appreciate any comments or suggestions on improving the content of this report.

**Dr. Ts. Shiirevdamba**

Author, Doctor of Science

# CHAPTER I

# The Trends and Impacts of Socio-Economic Development on the Mongolian Natural Environment

## 1.1 Socio- Economic Trends of Mongolia

As a result of the National Liberation Movement in 1911 and the victory of People's Revolution in 1921, a new era began in Mongolian socio-economic development. In the beginning of the 20th century, the economy of Mongolia was largely based on traditional nomadic livestock husbandry but it has since been developed according to the emerging needs of new industries related to agriculture, construction, mining, transportation and communication systems, for example. As a consequence, the traditional Mongolian economy turned into a multi-faceted, integrated and sectorial economy; a change which could be considered the main achievement of that period.

In the process of improving the standard of living, remarkable success has been noted in the health, culture and education sectors of Mongolia. Despite such positive achievements in the general development of Mongolia, the economy of the country was seriously damaged by the rigid structure of production sectors which were mainly oriented towards the trading of raw materials. Consequently, during that time, the standard of living of the population was lower than that of many other developing countries. One can now see this situation as a consequence of the inefficiency of a centrally planned economy set up some 70 years ago in this country.

The legitimatization of the transition to a democratic system of government initiated a market economy in 1990 by adoption of the new Constitution of Mongolia; the initial implementation of some of its ideas into practice resulted in an historically important event which in turn, started a new chapter in the development of the country. At the same time, Mongolia has intensively undertaken measures to re-structure its economy and to establish its legal basis, to develop and complete the country's infrastructure and its macro-level management systems, as stated in the New Constitution.

After adoption of the long-term national development policy focusing on the transition towards a market economy in order to develop the country's economy and to improve the living standard of the population by rational use of both domestic and foreign resources, Mongolia has achieved considerable success.

## 1.2 Mongolian Environmental Status

Although the pristine natural environment of Mongolia has been comparatively well preserved, some changes can be seen in the socio-economical and environmental balance of the country due to destructive human activities and climate change. During the last 40 years, almost half of the more than one million hectares of arable land has eroded and the soil fertility in this area has decreased by about 20 per cent. About one third of 128 million hectares of pasturage has been overgrazed and 5 million hectares of arid areas in the desert zone have constantly been threatened by moving sands. In addition, in more than 300 lakes, rivers, streams and springs, the water level has decreased significantly, causing total dryness in some of these bodies of water.

During this same 40 year period, more than 100 animal and plant species have become threatened by extinction, and approximately more than 350 000 people have been forced to drink water which contains an excessively high amount of minerals and this constitutes a health hazard. About 27 000 000 cubic meters of sewage is released into the environment annually. The air, water and soil have been polluted by more than 50 tons of chemical substances every year and it has been recorded that air pollution in some cities and settlements have exceeded permitted levels up to 5 times. In addition, during the last 40 years, about 5 000 000 hectares of forest have been destroyed by forest fires and insects.

Since 1980, global warming has become increasingly evident also in Mongolia. During the last 50 years, the average annual temperature in Mongolia has increased approximately by 0.7°C. Consequently, noticeable changes have taken place in the length of cold and warm seasons. This development may have had negative impacts not only on the socio-economic development and on living conditions of the population, but also may have caused serious problems to the environment and in particular, to species living in the environment. In addition, during recent years, several natural disasters such as droughts, frosts, heavy snow falls, dust storms, inundations, fires and also damage caused by pests like rodents, have taken place in Mongolia and have caused severe damage to society, economy and the environment, as a whole. Furthermore, the population growth in some places, the increased use of natural resources and the shortage of precipitation have continuously intensified the desertification process.

### 1.2.1 Geographic Location and Land Surface

Mongolia is a land-locked country which covers an area of 1 564 118 square kilometers on the southernmost fringe of the Great Siberian boreal forest and the northernmost Central Asian deserts and vast steppes bordering the Russian Federation in the north and the People's Republic of China in the east, south and west. The total area of Mongolia is larger than the combined areas of Great Britain, France, Germany and Italy. According to size, Mongolia is the seventh largest country in Asia and among the biggest of the land-locked ones (Figure 1).

The Mongolian environment has a large variety of features. The northern part of the country is covered by forest mountain ranges dominated by Siberian Larch *Larix sibirica,* Siberian Pine *Pinus sibirica,* and Scotch Pine *Pinus sylvestris,* the southern part encompasses desert, desert-steppe and steppe areas with low mountains, rolling hills, hillocks with a sparse vegetation cover, the western part is made up of a cradle of snow capped high mountains and glaciers, and the eastern part consists of an area of vast plains and wild heaths. About 81 per cent of Mongolian territory is situated higher than 1000 metres above sea level and the average elevation of the country is 1580 metres above sea level (the lowest and highest points being at 532 metres and 4374 metres, respectively). Besides, one third of Mongolian territory consists of desert and desert steppe zones. These examples show that the Mongolian landscape is one of great variety and contrast.

Maps drawn according to different scales on Mongolian geomorphology (i.e., mountains, moving sand areas, rugged reliefs and quaternary deposits, tectonics and seismic motions, mineral resources) and hydrogeology that are based on data collected during the last few decades, are important in gauging the extent of public knowledge about Mongolia's physiography and resources.

### 1.2.2 **Basic Natural Belts and Zones**

Mongolia can be divided into 6 natural belts and zones: the Alpine, Mountain Taiga, and Mountain Forest Steppe belts; the Arid Steppe, Desert-Steppe and Desert zones. These belts and zones differ from each other on the basis of their soil quality and plant and animal species which, in turn, are adapted to different habitats and climatic conditions characteristic to each of these belts or zones.

The Alpine belt of the Mongolian Altai, Khangai and Khentii mountainous regions, with their perpetual snow, glaciers, traces and signs of ancient ice covers, has been well preserved due to a constantly cold climate and strong winds. The area is inhabited by some endangered animal (i.e., the Wild Mountain Sheep *Ovis ammon,* Siberian Ibex *Capra sibirica,* Snow Leopard *Uncia uncia*, Rock Ptarmigan *Lagopus mutus,* and Altai Snowcock *Tetraogallus altaicus* and plant (i.e., the Dwarf Siberian Pine *Pinus pumila, Ptilagrostis mongolica,* and White Gentiana *Gentiana algida* species.

The Mountain Taiga belt comprises about 5 per cent of Mongolian territory in the Khuvsgul and Khentii mountain ranges in the northernmost part of the country and experiences a relatively cold and humid climate with an annual precipitation of close to 300 to 400 millimetres. Due to a brief warm period, the growing season is not long enough for many plant species. Forests in this belt are dominated by the Siberian Pine *Pinus sibirica* and the Siberian Larch *Larix sibirica,* and are inhabited by such animal species registered in the Mongolian Red Book as the Musk Deer *Moschus moschiferus*, Elk *Alces alces*, Lynx *Lynx lynx,* the Eurasian Otter *Lutra lutra* etc.

The Mountain Forest Steppe belt extends through the Mongolian Altai, Khangai, Khuvsgul mountain massifs and borders on the Mongolian Taiga belt which is in the southernmost fringe of the Great Eastern Siberian Taiga. One specific feature of the Mountain

Forest Steppe is that the back slopes of the mountains facing the north, northeast and northwest are covered with different species of forest and woody plants whereas their front slopes facing the east, south and southwest are densely covered by the steppe plants almost up to the sharp ridges of the mountains, giving an impression of sharp boundaries of habitats of the mountain forest and steppe species. The Mountain Forest Steppe belt encompasses 25 per cent of Mongolian territory and is inhabited by such globally endangered animal species as the Manul *Felis manul* and the Black Grouse *Lyrurus tetrix,* and plants threatened by extinction such as the Mongolian Pheasant's Eye *Adonis mongolica* and *Saussurea involucrata.*

The Arid Steppe zone with an area of approximately 20 per cent of the country's territory comprises the entire Eastern and Central Mongolian vast flat plain extending as a tapering zone thousands of kilometers westwards to the northwestern fringe of the Khangai mountain range called Khankhokhii. The Mongolian steppe is part of the great plain which starts from the Don river in Hungary and includes the Puszta, sweeping the east up to the Manchurian steppe in Eastern Asia. The vegetation of the Mongolian steppe is dominated by *Xerophyta,* several species of *Caragana, Artemisia frigida* and many forms of feather grass. Mongolian Gazelles *Procapra gutturosa,* roaming and grazing in herds of several thousand can also be spotted in this area.

The Desert Steppe zone includes the Depression of Great Lakes, the Valley of Lakes and the Middle and Eastern Gobi Low Lands. This area belongs to the semi-arid zone which has an annual precipitation of 100 to 220 millimetres, loose soil and fewer species of animals and plants compared to the zones, northwards. The Desert Steppe is a habitat for such animal and plant species like the Asiatic Wild Ass *Equus hemionus,* Saiga Antelope *Saga tatarica,* Black-tailed Gazelle *Gazella subgutturosa,* Houbara Bustard *Chlamydotis undulata,* and *Caragana bungei.*

The Desert zone is located in the southern and southwestern parts of Mongolia and has a severe climate with annual precipitation of less than 100 millimetres and high diurnal temperature fluctuation. The Desert zone is an area of extremely unique physical formations of changing contrasts like hills, hillocks, rolling heaths and sand dunes. It contains deposits of ancient flora, fauna and mineral resources, and provides a habitat for threatened animal species such as the Wild Camel *Camelus ferus bactrianus,* Gobi Bear *Ursus arctos gobiensis,* Mongolian Agama *Stellio stoliczkanus;* plant species found in such a habitat include, the *Populus diversifolia,* Potanin's Trumpet Flower *Incarvillea potaninii, Ammopiptanthus mongolicus, Halimodendron halodendron* etc.

### 1.2.3 Origins of the Formation of the Organic Sphere

The oldest remains of early organisms in Mongolia are stromatolites and onkolites which later developed into blue green algae found in lime-stones from the Reefian period. These findings prove that in the Vendian period over 75 per cent of the present Mongolian territory was covered by a shallow sea. During this period, the sea was inhabited only by soft-bodied animals. The first shelled animals started to emerge in the next Cambrian period followed later by sponges, worms, hyolithids and different species of toads. Later such animals

like Trilobites and *Archaeocyatha* emerged, and of these, the *Archaeocyatha* together with algae secreting limelike substances, began to form cliffs of reeflike forms. The first representatives of organisms with bone-like structures, for example radiozias, and cockle-shelled animals emerged in this period. In the Precambrian period, the climate was warm and the sea water, lukewarm. At the end of this period, the area covered by the sea began to decrease. In the late Cambrian period, moss animals, molluscs and the first coelomic species emerged. It should be noted that the present Central Asian region included in the ancient sea basin has preserved much of its fossil strata. In the Silurian period, the Asian mainland was connected with North America.

During Carboniferous period, present day Mongolia was situated in a marginal area between Central Asia and a huge ancient sea called Tetis which had shifted at the time to the southeastern part of the area. There are some signs and findings indicating that during this period some sub-tropical species like fusulids, moss animals and corals were living in this region. The ancient sea located in the area of the present Khangai and Khentii mountainous regions was connected with the water basin of the Northern cold zone. This sea was inhabited by moss animals and coral-rhugoses. During this same period, sea lilies emerged, their growth covering a broad expanse of water. During the mid-Carboniferous period, the sea level of the present area of southern Mongolia subsided and the number of the cold-adapted animal species sharply declined. Several plant species forming the Carboniferous plant communities in Mongolia belonged to the primordial plant assemblage of the Angara series from Central Asia and were located at that time outside their sub-tropical zones. Although the Mongolian region was dominated by scaled plants, some scattered species of pea plants and the genus *Botrychium* in the pre-Carboniferous period, the number of plant species was substantially reduced due to the disappearance of scaled plants which adapted to a warmer climate at the start of the mid-Carboniferous period. This period was characterized by the intensive evolution of many deciduous seed plants and the genus *Botrychium.*

During the Permian period, the climate became colder and caused certain changes in the composition of flora and fauna in the region. Corals and sea-bottom animals vanished and were replaced by moss animals. The region was inhabited by molluscs and sea lilies, while being dominated by species of corals such as rhugose and tabulite. At this time, most of the dry land in Mongolia was covered by forests.

During the Triassic period, almost all of the sea covering Mongolian territory disappeared remnants of it still existing in the eastern part of Mongolia. A great number of remnants of coniferous forests, and some fossilized seeds of certain *Botrychium* species and Ginkgo have been found there.

During the Jurassic period, the climate became colder, resulting in the current climatic conditions of Mongolia, which are similar to that of Siberia.

Along and near river valleys and springs, remnants of ancient forests consisting of Pines *Pinus, Ginkgo* and species of *Botrychium* and of terrestrial insects like Cockroaches *Blattoidea,* Beetles *Coleoptera* and Orthopteran insects *Orthoptera,* can be found. By the end of this period the climate of the region became warmer and drier, making recent Mongolian territory akin to the Euro-Sinian region. This period was characterized by the wide distribution of coniferous forests and formation stages of big lakes.

At the end of the Jurassic period and in the beginning of the Cretaceous period, the landscape changed and volcanoes were active. The big lakes with lukewarm water were inhabited by molluscs, marine insects, fish, turtles, large water reptiles and one-celled algae. During that time, the most commonly found animals in the continents were dinosaurs. Bones and skeletons of dinosaurs such as the herbivorous *Psuttazaur,* Uryanodits, Ankylosaurs and Sauropods, as well as, large and small carnivorous dinosaurs have been found in Mongolia. In addition, parts of the fossilized skeleton of a large flying lizard, a birds's feather, remnants of primitive mammals (particularly insectivorous ones) and insects have been found. The fauna of the late Cretaceous period can be defined through the fossils of species such as *Protocheratops,* and with different species of gadrosaurs, giant tyrannosaurs, armored reptiles, and with other large and small reptiles and sauropod species. Most of these fossils have been found from areas belonging to present day Mongolia (Figure 2).

Towards the end of the Cretaceous period, these creatures became extinct; in the Paleocene period, mammals appeared and began to populate the world. Geological and paleontological studies indicate that environmental conditions during the Paleocene period were suitable for the development of different forms of mammals and woody plants.

In the late Paleocene, the climate became colder in the northern part of Asia causing the species assemblage of the flora and fauna of the continent to be changed. Certain remnants of animals from that time have been discovered in places called Ergeliin Zoo and Khoyer Zaan (Two Elephants) in Mongolia (Figure 3).

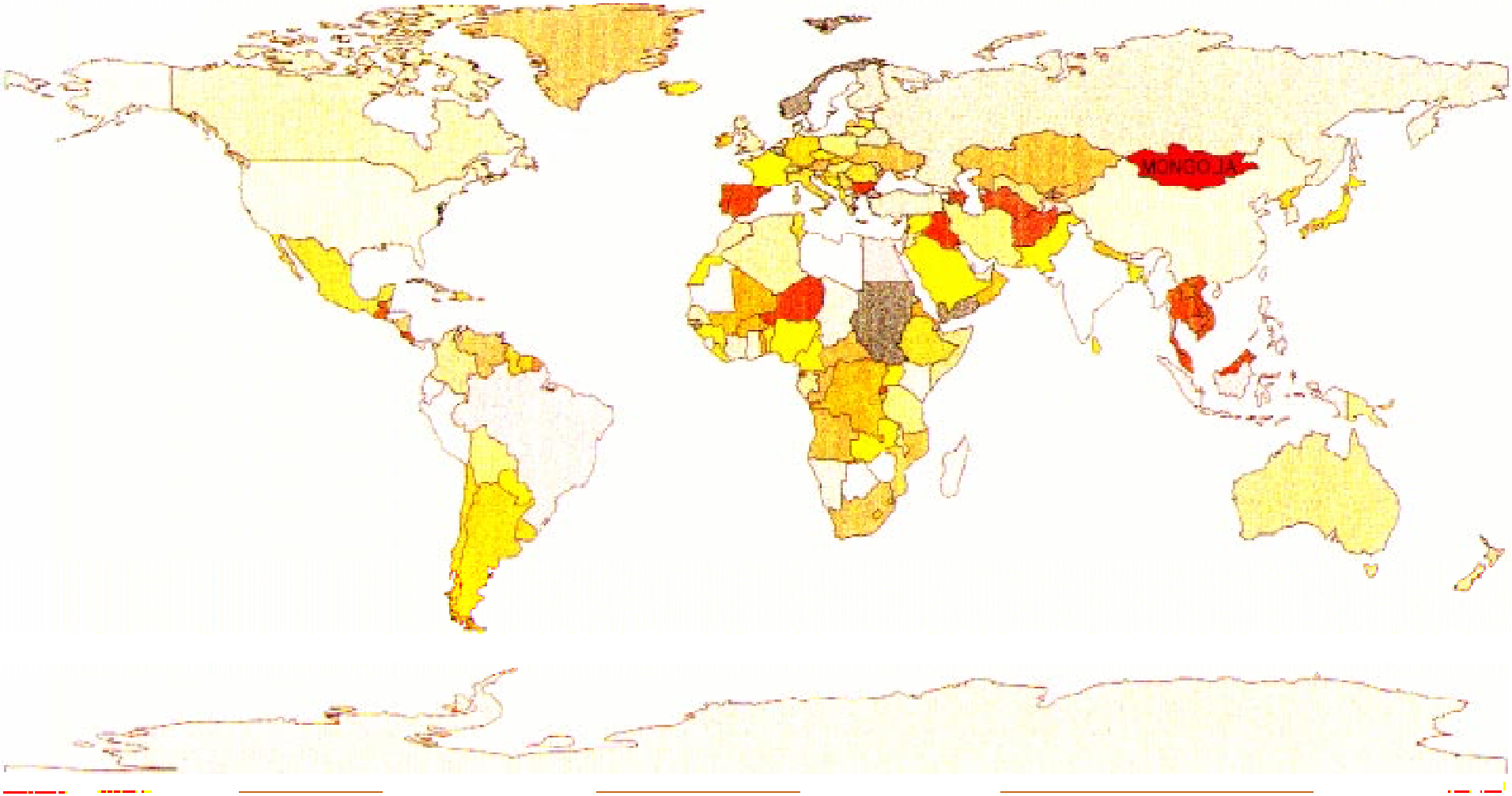
During the Eocene, the Mongolian mountain systems were more elevated and the valleys between the mountains were deeper than they are today. As a result of the humid and warm climate at that time, present day Mongolia was, for example, dominated by species belonging to the elephant subfamily *Elephanfinae,* representatives of the same subfamily being found among the Pleistocene remnants from all continents. Due to increased moisture in the environment during that time, the region was dominated by elephant-like animals such as the *Alserateri* and *Gobitern,* horse-like animals such as the Three-toed Horse *Anhiteri,* moose-like animals such as *Lagomeriku,* deer-like animals such as the *Dikroplsepus,* Bisons, as well as, wideleafed and coniferous forests. At the end of the Miocene, the climate became drier in this region and hence, the steppe plain started to appear in the western and eastern hollows of Mongolia and a kind of savannah landscape was formed in the southern part of the country.

Until the Pliocene, the climate changed and became cooler. The plains started to be colonized by a variety of plant species, the mountainous and elevated areas being forested by such deciduous tree species as Poplar *Populus*, Birch *Betula* and Willow *Salix;* the plains became colonized by animal species like Gazelles, Steppe Rhinoceroses, Bisons, Ostriches, Swans, Geese and Pheasants. Fossils of these animals can be found in the northern part of Mongolia. For example, a fossil of an ancient Slender Monkey was found from the place called Shaamar in the Selenge province. By the end of Eocene, favorable environmental conditions existed for the emergence and further evolution of the present fauna.

Mongolia is, without any doubt, one of the richest places in the world, from the geological and paleontological points of view, in terms of having prehistoric flora and fauna material. Recently, Mongolian scientists together with their colleagues from the USA, Russia, Great

Figure 1.

# Geographical location of Mongolia



Location of Cretaceous Fossil Findings Period

Figure 2.

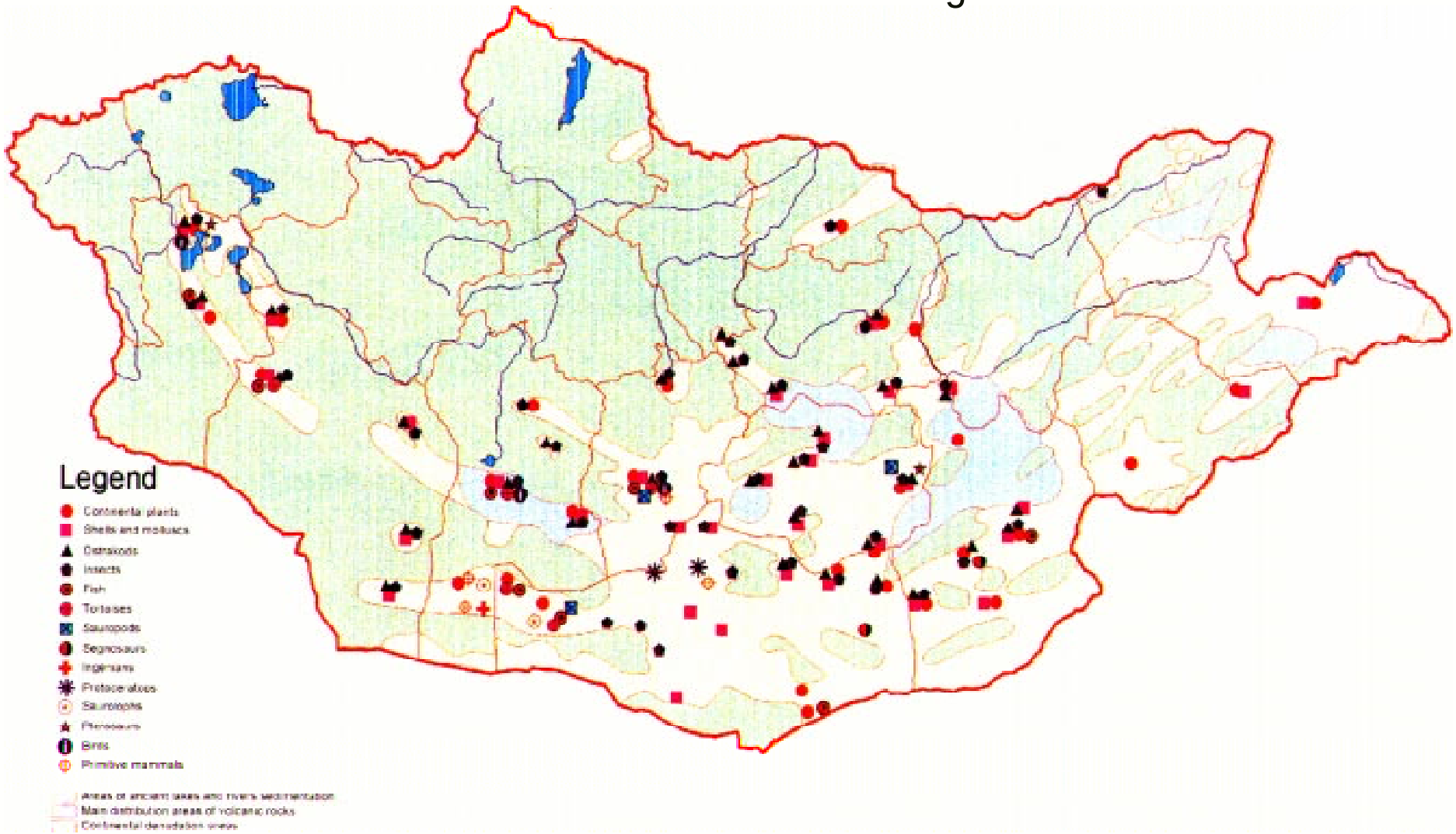
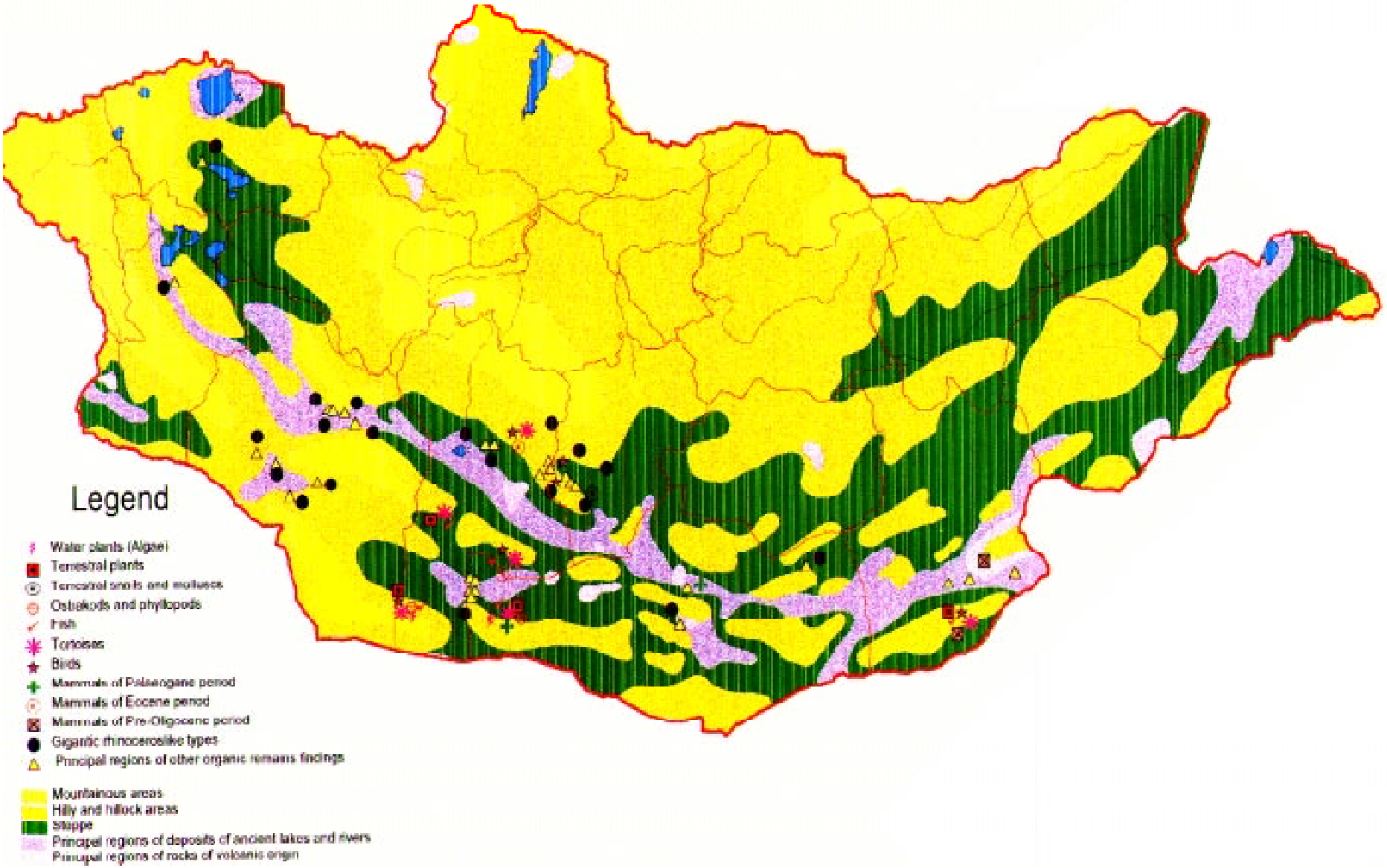


Figure 3.

# Location of Fossil Findings of Paleogene Period



Britain, Canada and Japan have conducted fundamental geological and paleontological studies and have made new discoveries.

### 1.2.4 Climate

The main characteristics of the climate of Mongolia are sunny days, long and cold winters, low precipitation and large annual, seasonal, monthly and diurnal fluctuations in air temperature. The average mean temperature recorded in January is -34°C in the plateau and depressions but extreme temperatures have been recorded between -50°C and -56°C. In the northern mountains the average mean temperature in the warmest month is between + 15°C and +20°C, but again, extreme temperatures have been recorded +35°C to + 41°C, depending on the area. The total annual precipitation in mountainous regions averages to about 400 millimetres, in the steppe from 150 to 250 millimetres and in the desert-steppe less than 100mm. About 75 to 85 per cent of the precipitation falls during the three summer months.

Mongolian territory is demarcated along the mountains in the north and down through the plateau semi-desert where it reaches a drop in elevation in the southernmost part of the Gobi-desert. Accordingly, there is more precipitation in the north and less in the south, as well as, drier, warmer and more windy weather in the south

**Winter.** Past weather records show that winter usually starts during the last 10 days of October in the north and in mid-October in hollows and valleys. Winter lasts for about 140 to 170 days up to the end of March or the beginning of April. However, winter begins in the steppe and desert-steppe zones during the first 10 days of November and lasts for 100 to 129 days, ending during the last 10 days of February. The extreme cold period sets in at the end of November and lasts until the end of February. The fluctuations in annual average temperatures is between -9°C and 5°C.

The mean temperature in January of the Khankhokhii mountain ranges of the Khangai mountain massifs depressions, the valleys of Tesiin gol river, the Darkhad hollow, Great Lakes' Depression, high flat lands of Khangai Mountain Lakes, Orkhon-Selenge River basin, springhead of the Kherlen and Tuul rivers and other river and stream beds is lower than -30°C. In some low mountainous areas and in the Eastern Mongolian steppe, the average mean temperature may fall between - 20°C and -25°C. In the desert, the average mean temperature may fall between -15°C and - 20°C. In Ulaanbaatar, the coldest temperature was recorded in December 1964 at -49°C. Colder temperatures have been recorded in the Tariat and Tsakhir soums (counties) of the Arkhangai aimag (province), and the Tosontsengel, Songino and the Bayan-Uul soums of the Zavkhan aimag. At the time, the lowest temperatures recorded were between -50°C and -53°C in these areas. In the Gobi Desert, the temperature falls between - 36°C and -40°C.

During winter, anti-cyclonic-type weather and the Asiatic high-pressure air masses dominate the northern part of the country. Because only about 10 per cent of the country's total precipitation falls in winter, the snow cover is shallow, averaging around 5 to 10 centimetres. In some places, the depth of the snow cover has been up to 36 centimetres. Snow covers are extremely uneven depending on area. For example, the snow cover averages have been quoted as such: Ulaangom, 13 centimetres; Moron, 9 centimetres; Choibalsan, 4

centimetres; and Sainshand, 2 centimetres. Often, some parts of the steppe, semi-desert and desert zones are without any snow at all during winter.

It begins snowing earlier and the snow cover stays longer in the northern part of the country. For instance, it starts to snow in the north from mid-October or the beginning of November to the end of March or the beginning of April. The average snow-water conversion amount is only 14 millimetres and this is why snow does not contribute much to the total amount of the country's soil moisture.

Spring. Spring starts in the mountainous areas at the beginning of April and continues to the end of June. Therefore, the spring season in these areas is comparatively longer than that of the steppe, semi-desert and desert zones, lasting from 55 to 70 days. Because the air temperature increases relatively early in the year in the depressions and valleys of these three areas, the spring is shorter and lasts only for about 45 to 54 days. However, since the mountains stand over an average of 1500 metres above sea level, it is common that these areas have dry air, strong winds and occasional freezing until June. In general, the precipitation level is comparatively higher in spring than in winter. The average precipitation in April in the mountainous areas is 15 to 18 millimetres; in the forest steppe, 10 to 15 millimetres and in the southern parts of the country, less than 5 millimetres. The level of precipitation decreases southwards starting from the forest steppe zone, causing the areas to fall within this zone to be very dry. It is quite rare to have 40 millimetres of precipitation per month in spring in these areas. In other words, such a level of precipitation can be expected during a 10 year period at a frequency of 4 times in the forest steppe, and once in steppe, semi-desert and desert zones. However, at a probability of 75 to 80 percent, precipitation can be expected to be 10 to 12 millimetres in the north and 5 to 10 millimetres in the south.

The air humidity in spring is 35 per cent or lower in the north and 20 to 25 per cent or lower in the south. The velocity of spring winds often reaches 15 metres per second and in extreme cases, even more. The number of days in spring when the wind speed is higher than 15 metres per second, is approximately 30 , whereas during winter, the number of such days is only 1. The number of extremely windy days in highlands, steppe and desert zones often exceeds 30 to 40. The number of spring dust storms increases from north to south; the duration of 60 per cent of all dust storms is 1 to 6 hours.

Summer. Summers are short in the mountainous areas. Normally, summer starts in mid- June and continues to the end of August in these regions. In the steppe and desert zones, the summer continues over 3 months. July temperature of the Mongolian Altai Khangai, Khentii and the Khuvsgul mountainous regions averages less than 15°C. The maximum summer temperature can reach anywhere from 35°C to 39°C in the north and 38°C to 41°C in the south. In summer, a temperature of 30°C or more is experienced in the mountainous and forest steppe regions for 7 to 10 days, and in the desert zone for about 30 to 39 days. In the mountainous areas, the cold spring air mass disperses around mid-June and re-forms around the end of July. It is always cool in summer at elevations of over 2 000 metres above sea level. But, annually in the forest steppe there are 80 to 90 warm days and the number of warm days increases southwards, reaching 140 warm days in the Gobi Desert.

Most of the precipitation coincides with the summer months with 85 to 90 per cent of annual rain and snow falls taking place from April to October; however, 50 to 60 per cent of it

occurs in July and August. The Mongolian Altai, Khangai and the Khuvsgul regions receive more than 3 50 millimetres of precipitation in the summer. The precipitation of the forest steppe is 250 to 300 millimetres and that of the steppe zone is 150 to 250 millimetres, and in some parts of desert areas, it can be less than 100 to 150 millimetres.

The number of rainy days decreases from north to south. For instance, the average annual rainy season lasts from 60 to 70 days in the northern high mountainous regions, from 40 to 60 days in the low mountainous areas, and in the valleys between them, as well as, in the eastern part of Mongolia, and for about 30 days in the semi desert and desert zones. Because of the generally high elevation and the mountainous nature of the country, Mongolia often experiences cloudbursts, along with thunderstorms and downpours, which cause soil erosion. The temporal and spatial distribution of precipitation in Mongolia is variable.

There is very little precipitation at the beginning of the growing season but much more in the second half of the season when cool air starts to spread around the country. There is a lot of variation, yearly, in the amount of precipitation. This variation has considerable effects on the growth of several spring plants. Summer, autumn and winter precipitation is a source of soil moisture but it is insufficient for vegetation to thrive in this country.

**Autumn.** Autumn occupies a short period of time in Mongolia. It starts in mountainous regions by the end of August and lasts for some 40 to 50 days till the end of September; in steppe, semi desert and desert zones autumn begins at the end of October or sometimes, in the beginning of November, lasting some 65 days.

Although, Mongolia has many warm and sunny days in autumn, the air temperature starts to fall in September. In the north, the mean daily temperature falls below 10°C in the first week of September. But, in the desert the mean daily temperature falls below 10°C around the end of September. The mean daily temperature reaches 0°C in the north during the first week of October, and in the south, at the end of October.

The meteorological data sampled during the last 60 years show that the average annual air temperature in Mongolia has increased by 0.7°C. The extent of climate warming varies according to the different regions and zones. For example, the temperature has increased by 2°C in mountainous regions but by less than 1°C in semi-desert and desert zones. It is obvious that winters have become warmer since 1940, when the average winter temperature warmed up by about 3°C in Mongolia. During this time, the average summer temperature for June, July and August decreased by about 0.5°C. Contrary to this situation, the number of days when the temperature was above 0°C, increased and the annual temperature sum increase was recorded between 100°C and 300°C. Consequently, permafrost layers and perpetual snow on mountain tops have begun to erode. The distance it takes to measure a soil temperature of 0°C has changed from 10 centimetres to 65 centimetres. Precipitation seems to have increased.

Mongolia has had exceptionally dry periods from 1937 to 1950 and later, in the 1980s. If global warming persists, it will undoubtedly have negative implications concerning Mongolian ecosystems and biodiversity. Therefore, more scientific research is needed to assess such a problem and to come up with measures to prevent the rise of further problems.

### 1.2.5 **Soil**

The harsh continental climate, rugged mountains, Central Asian steppes and deserts have created specific conditions for the formation and distribution of various soil covers in Mongolia. The lower latitude steppe, desert -steppe and desert zones extending throughout the southeastern, southern and southwestern parts having an extremely dry climate and sparse vegetation contain the arid-steppe's brown, the desert-steppe's gray brown and the real desert's gray brown soils. The northern high regions with sufficient moisture and more temperate climate contain the mountain and mountain forest-steppe's gray soil or the mountain steppe's brown soil, the mountain taiga's cinder like soil (Figure 4). The soil formation and distribution are affected by a variety of conditions like the climate, landscape forms (including slope steepness) and direction as determined by the four cardinal points of the compass (i.e., north, south, etc.).

Mongolian soil is divided into two soil-bio-climate regions: northern and southern, belonging to special regions of Central Asia. The northern mountainous region is generally characterized by having dark brown and brown soil. Because the quality of the soil is good, this region harbours twice or thrice the number of species found, for example, in the Gobi desert region. The southern, southwestern and western parts of the country contain light chestnut, light gray and gray steppe soils.

Mongolian precipitation mostly occurs as downpours or cloudbursts. Dust storms often occur in this country, especially in spring in areas which are covered by soft, thin soil layers and scattered plant species. Therefore, the ground of those areas is subject to erosion and degradation. The map drawn according to a scale of 1: 1 000 000 on Mongolian soil: soil-geography regionalization, saline soil distribution, chemical composition of different types of soil, soil deterioration and the various ecosystems. This map was drawn based on data from studies carried out during the last 40 years and can be regarded as a scientific foundation for the protection of soil, proper use of natural resources and their restoration (Figure 5).

### 1.2.6 Water

Mongolia has comparatively high levels of surface and ground water resources. The rivers of Mongolia belong to the inland drainage basins of the Arctic Ocean, the Pacific Ocean and Central Asia. The higher and middle Selenge, the biggest river in the country, and parts of the Yenissei River which start from Mongolia belong to the Arctic Ocean drainage basin. In the northern and western mountainous parts of Mongolia, the water network is of high density. The southern, central and southeastern parts of the country have few rivers and other water resources and they are usually situated in depressions without any outflows. Mongolia has 3 811 rivers and streams with a total length of 67 000 km, over 3 000 big and small lakes with a total volume of 500 cubic kilometres, about 6 900 springs with steady flows, over 190 glaciers with a total size of about 540 square kilometres and over 250 mineral water springs which form specific water ecosystems.

Rain, ground water, snow and glaciers are the main water sources of rivers. It is common that in the north-south and east-west directions, rain is the more important source for

# Soil-geographical zones of Mongolia

Figure 4

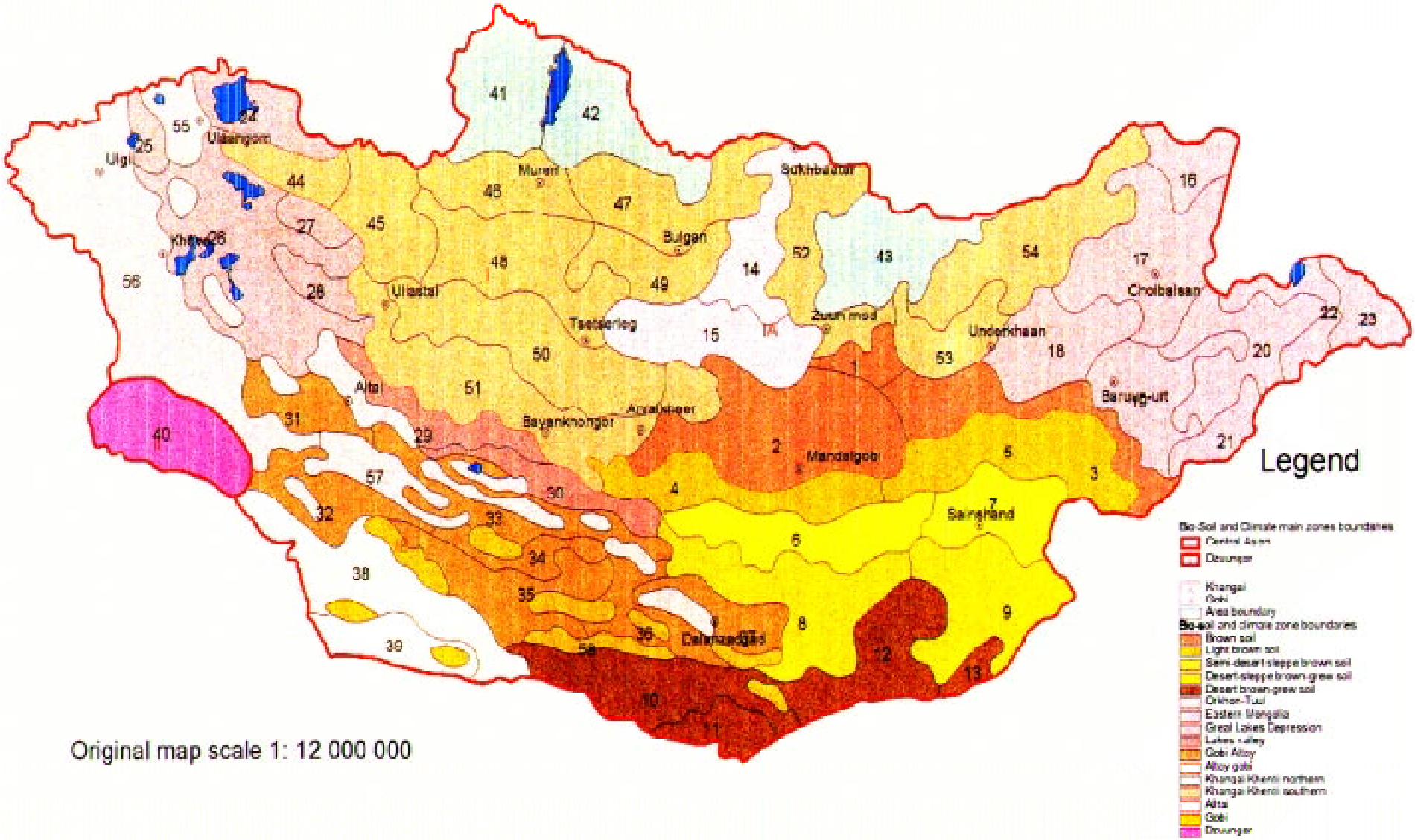
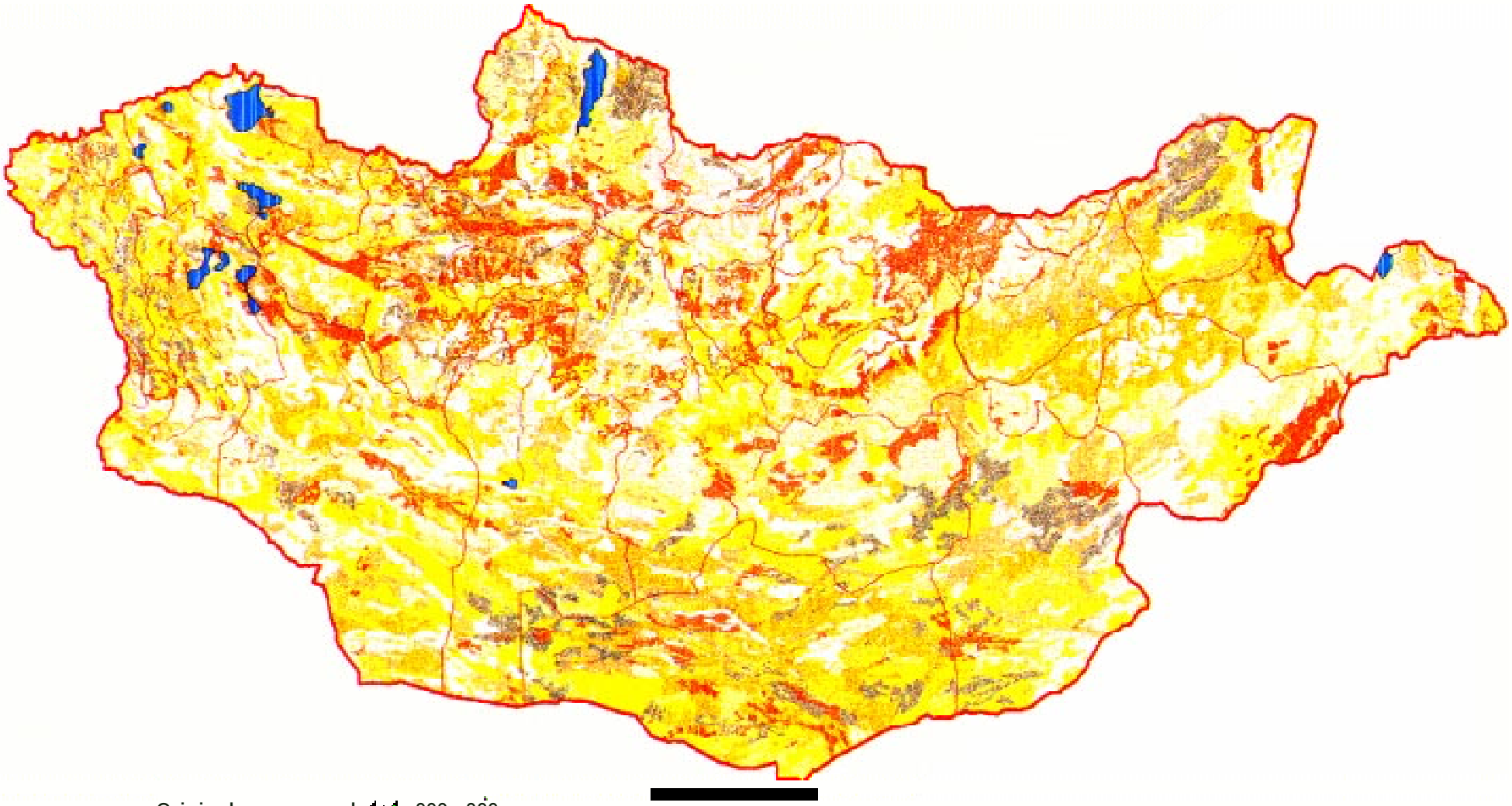


Figure 5.

# Map of soil in Mongolia



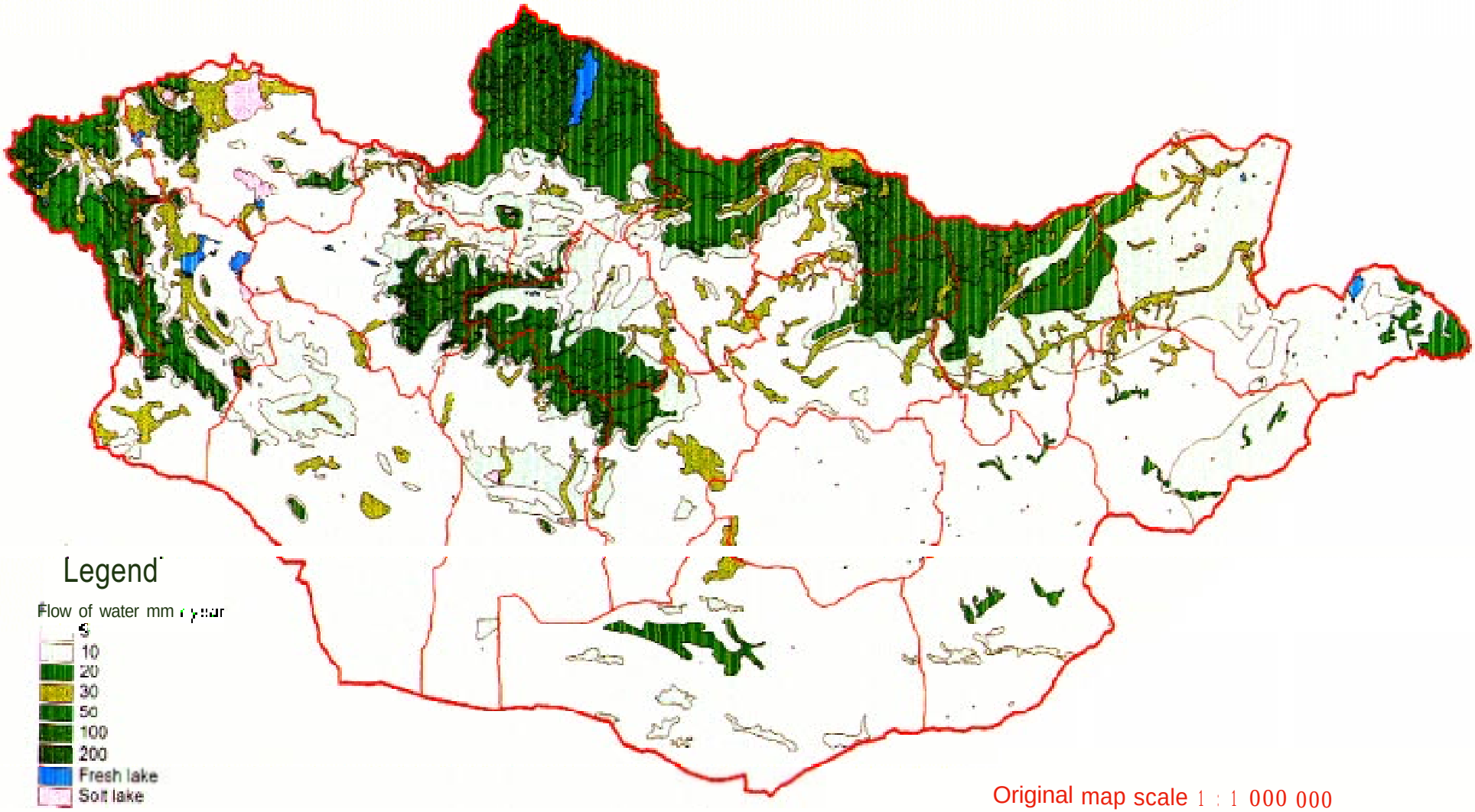
Original map scale 1:1 000 000

the rivers, while the amount of snow water flow decreases. The ground water resources in the country are spread unevenly and from north to south the chemical components of the water changes and mineralization increases. It is caused by the changes in climate, as a decrease in precipitation from north to south, increases the air temperature and evaporation. Therefore, southern parts of the country have sparse vegetation and fewer species of animals.

An integrated study was carried out on water networks, their density, chemical components of ground water, over-flood flows, genera1 humidity levels, ground water flows, water evaporation, river water regime, water energy resources, glaciation, and lakes of the country. Maps drawn on different scales have become basic documents that can be used for conservation and the proper use of water resources based on these findings (Figure 6).

# Underground water flow in Mongolia

Figure 6




Original map scale 1 : 1 000 000

# CHAPTER II

## Causes of the Loss of Biodiversity in Mongolia

### 2.1 Mongolian Biodiversity: specifics regarding its Regional and Global Significance

Because Mongolia is a haven for several pre-historic life forms as well as, at present, containing some endemic animal and plant species which have adapted genetically to extreme climatic conditions, which include cold, humid areas in the north and intensively dry areas in the south. Mongolian biodiversity is a significant part of the world's biological heritage because it contains some unique features in its biosphere and its ecosystems have not been altered much by human activities. Although the number of Mongolian biological species and endemic animals and plants is lower than the numbers of species in many other countries, the particular assemblage of species and intact ecosystems is something which can not be found anywhere else. The Siberian Taiga forests, the Central Asian Steppe and the Desert together form transitional ecosystems with a species composition of unique features and conditions for the restoration of the environment and the increase of natural resources. For example, the Mongolian natural desert, desert-steppe and steppe ecosystems have a global importance because some of these ecosystems in neighbouring countries are deteriorating and some species which are endangered or under the threat of extinction, manage well in Mongolia. The Mongolian eastern steppe plains are becoming the last habitat for herds of thousands of Mongolian Gazelles *Procupra gutturosa.* The annual migration of the gazelle herds is an impressive natural event comparable with the migrations of large herbivores in the Serengetti.

While the environment in many neighbouring countries is degrading and the biological diversity, decreasing, the sparsely populated pristine nature of Mongolia is an important component in the conservation of habitats for many endangered species in the Central Asian region. Besides, many species belonging to Mongolian ecosystems may have a decisive role in the future towards the restoration of already disappearing or deteriorating ecosystems. For instance, the eastern steppe of Mongolia and the Gobi desert with Saxaul *Haloxylon ammodendron* forests and many other species are examples of natural ecosystems which are of great global importance. In many cases, a large percentage of the rarest animal populations of the world like the Wild Camel *Camelus ferus bactrianus,* Gobi Bear *Ursus arctors gobiensis,* Asiatic Wild Ass *Equus hemionus,* Mongolian Saiga *Saiga tatarica mongolica,* Wild Horse *Equus przewalskii,* Houbara Bustard *Chlamydotis undulata* and Snow Leopard *Uncia uncia* exist in Mongolia.

Since Mongolian forests form an important junction between the three large continental basins and the most southern edge of the great Siberian permafrost, it is an inseparable part of the world's biosphere and hence globally significant. Mongolia not only harbours numerous bird species year round, but it is also an important stop pver for several migratory species, including dozens of globally endangered species. Additionally, several valuable remains and fossils of prehistoric birds have been found in Mongolia. Therefore,

Mongolia can be considered a country which has great potential for ornithological science research.

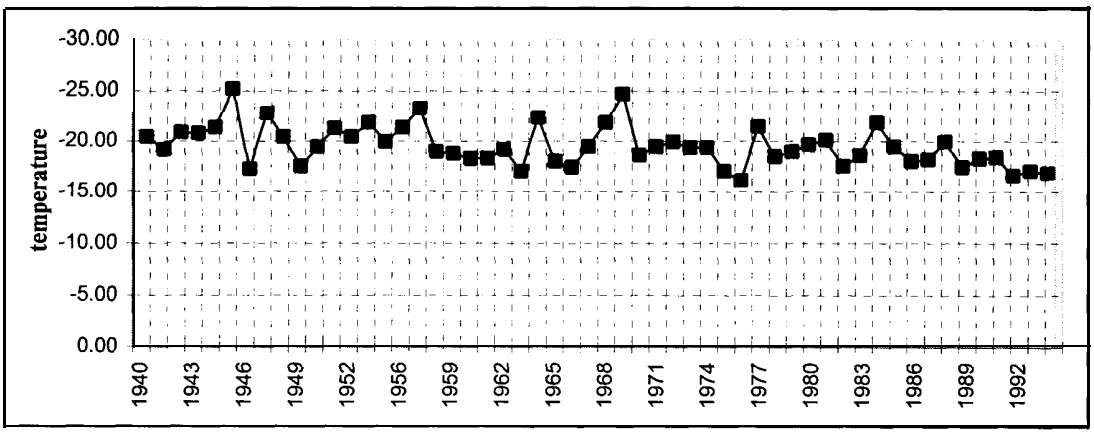
## 2.2 Causes for the threatened status of Mongolian Biodiversity

### 2.2.1 Climate Change

The continuation of global climate change has already had a negative impact on soil moisture, temperature, vegetation cover and the habitats of herbivorous animals. During the last 50 years or so, the average annual temperature in Mongolia proper, has increased by approximately $0.7^0$C and has caused the melting of permanent snow, glaciers and permafrost in some high mountain ranges, where climate warming has been more apparent (about $2^0$C); whereas, in the Gobi Desert, the increase has been less than $1^0$C. The average winter (December to February) temperature has increased by $3^0$C between 1940-1995 (Figure 1).

Figure 1

**Average winter (December-February) temperature between 1940-1995.**




Temperature records from spring and autumn do not show such a clear sign of climate warming, and this suggests that the warming is more clear in cold periods and in more elevated areas. Surprisingly, it has been observed that during the last 50 years, the average June-August temperature in Mongolia has decreased by $0.5^0$C (Figure 2). This drop in the average temperature re-confirms that a variety of changes going on have serious impacts on the growth of natural and cultivated plants. The annual growing season in Mongolia lasts for only about 120 days which is not sufficient for the stable growth of plants and if the growing season becomes shorter, many plant species will be threatened with extinction and this condition will surely pose a threat to the survival of many herbivores (Figure 3).

Although the annual precipitation has increased by about 4 millimetres between 1940-1996, the drought lasting for several years in some regions has started to intensify desertfication and reduce the vegetation cover in those areas.

For example, from 1937 to 1950 and in the 1980s, the Mongolian desert, semi-desert and steppe zones experienced extreme periodic dry spells. At that time, the ground water in desert and semi-desert areas decreased and many rivers, streams, springs, brooks and lakes lost water, and wildlife and domestic animals suffered from this. Several plant species, which normally grow in small, sparse wet habitats, were unable to thrive or produce seeds during these dry spells, causing some of these populations to become extinct.

Figure 2

**Average summer (June-August) temperature between 1940-1994.**

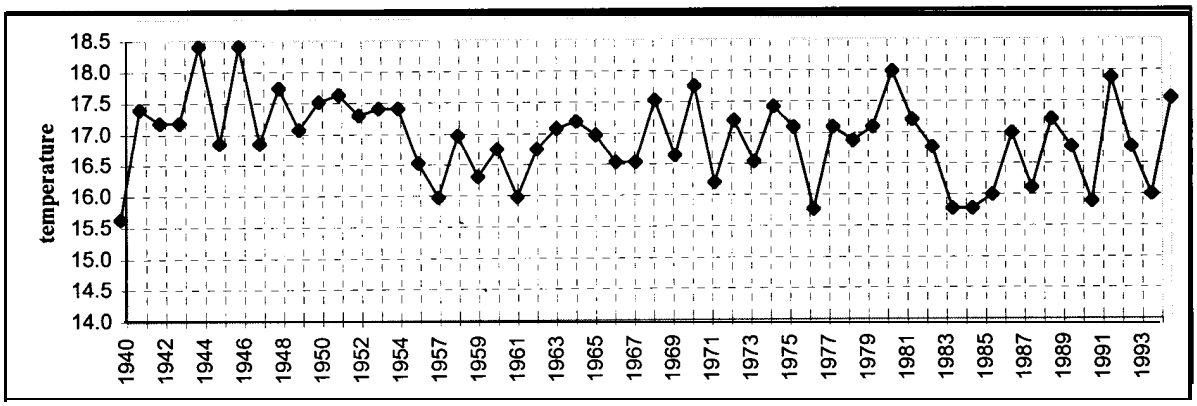
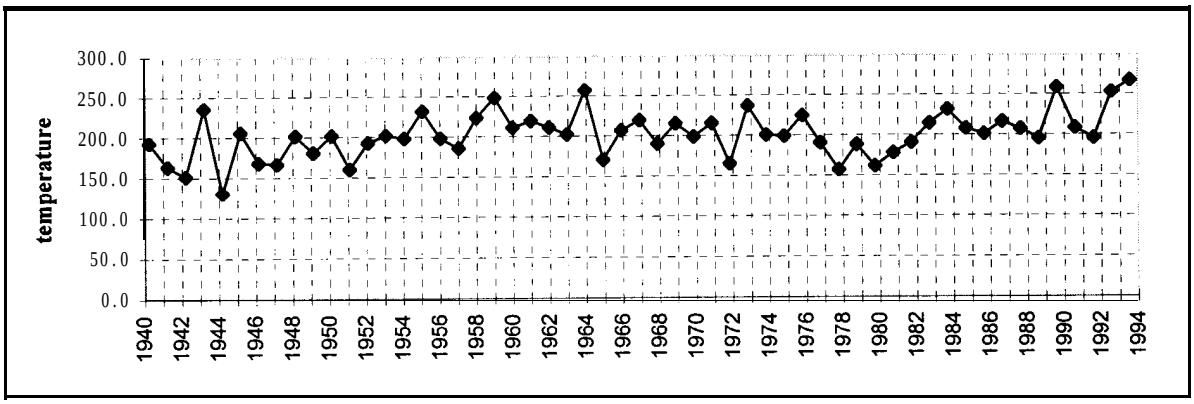



Figure 3

**Average warm session (April-September) temperature between 1940-1994.**




In general, when a drought persists in areas occupied densely by humans and livestock, good quality fodder plants are eventually dominated by weeds. A drought affecting a quarter of Mongolian territory, can occur once every 2 to 3 years; half of Mongolia can be overrun by a drought once every 4 to 5 years.

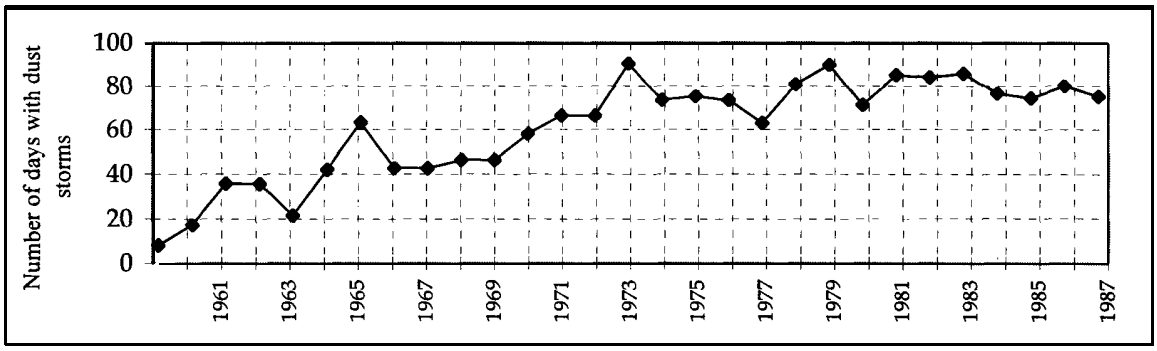
Besides the drought, late autumn snowing or sudden heavy snowfalls in spring may cover and freeze fodder plants and increase the mortality rate among herbivores. The meteorological recordings collected during the last 60 years indicate that heavy snowfalls covering half or quarter of Mongolia are expected to occur once every 5 to 6 years and once

every 2 to 3 years, respectively. The summer drought and severe winters force the animals to disperse at long distances, and while dispersing, they often get exhausted and die. Often the herds of the Mongolian Gazelle *Procapra gutturosa,* Goitered Gazelle *Gazella subgutturosa,* Asiatic Wild **Ass** *Equus hemionus*, Wild Mountain Sheep *Ovis ammon* and Siberian Ibex *Capra sibirica* migrate through urban areas and encounter poachers or are preyed on by wolves.

Mongolia is a windy country having 30 to 40 windy days with a wind velocity of more than 15 metres per second in the desert and steppe zones. In recent years, Mongolia has tended towards increasing numbers and wider distributions of heavy snow fall and sand or dust storm days (Figure 4). Because of heavy snowfalls and sand storms, herbivores often migrate across the borders of Mongolia to neighbouring countries.

Figure 4

**Number of days with dust storms in the Gobi desert area (1960-1987)**




Heavy sand storms in the desert and desert steppe zones cause ecological damage to the soil in the form of increased erosion, uncovered plant roots and loss of moisture.

In addition, more than 300 species of different kinds of pests, including more than 200 species of insects causing plant diseases, have been identified in Mongolia.

**2.2.1.1 Desertification.** Desertification deteriorates the environment and reduces its biological resources. Due to climate warming, an uneven distribution of precipitation, frequent droughts, overgrazing, soil erosion of cultivated land and settlements, over-exploitation of mineral resources and other destructive human activities, desertification has intensified in the arid areas of Mongolia. Desertification worsens the environment and conditions for the normal propagation of plants, hence, reducing resources for rare animals and plants in the desert and desert-steppe zones. In addition, desertification increases the occurrence of floods, soil erosion and the leaching of fertile soil. Desertification in various levels has been observed in 70 percent of Mongolian territory, especially in the desert and desert- steppe zones.

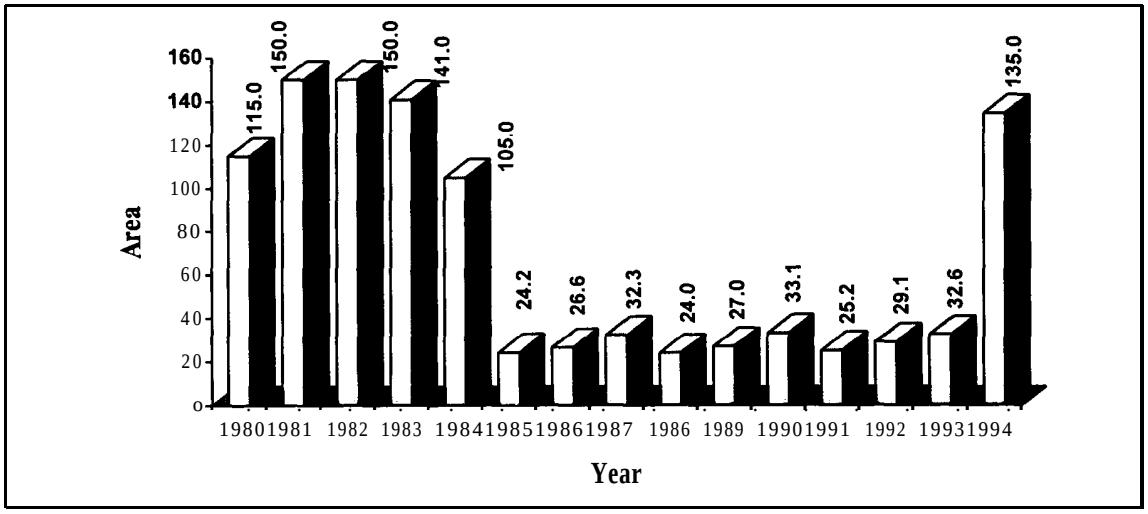
**2.2.1.2 Forest Insects.** Several species of fungi, bacteria, nematodes, viruses and insects have severely damaged large areas of Mongolian forests. In many cases, forests have lost their ability to restore themselves naturally. According to studies carried out since the 1950s, this change can be connected with different factors including climate change, improper

forest use, forest fires, insect damage and the use of wrong methods in controlling them. More than 600 insect species, among them more than 40 harmful species belonging to 35 genera and 14 families in the orders of beetles, flies, butterflies and sawflies, have been identified in Mongolian forests.

Some insects such as the Silkworm, Jacobson's Cankerworm, Gipsy Moth, Brush-tailed Moth and Larch-leaf Tube-builder have spread over 400 thousand hectares of forested land in the Khangai, Khentii and Khuvsgul mountain ranges and damage an average of some 40 to 50 thousand hectares of forest annually (Figure 5).

Figure 5

**Area damaged by insects (per 1000 ha)**



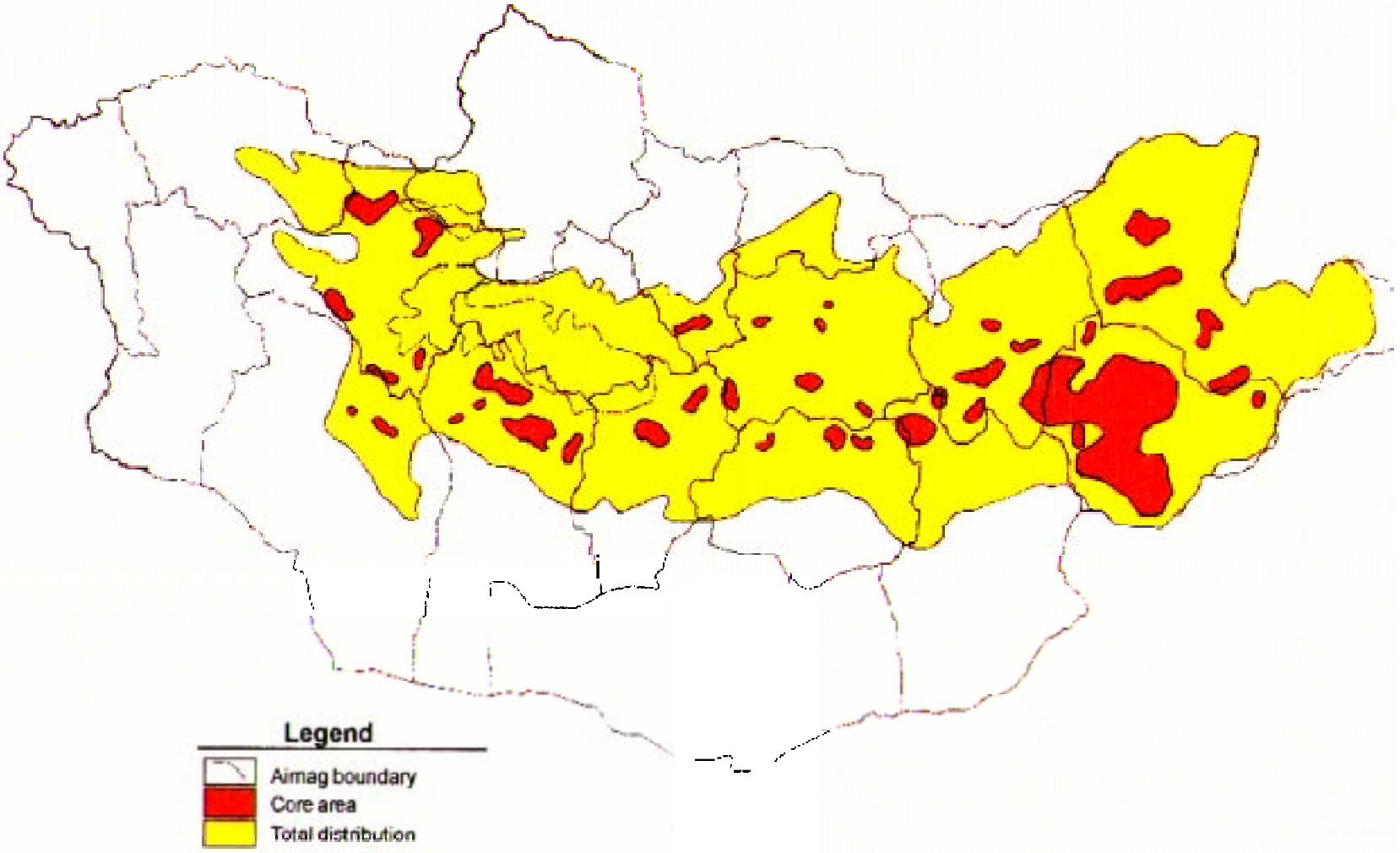

Since 1978, the range of many harmful insect species has increased reaching the present wideness in 1981-1983. It has been shown that the range of the Silkworm and Jacobson's Cankerworm has been enlarged after every forest fire.

The increase in the Siberian Bugfly number usually ceases the development of 97 per cent of naturally growing young trees and planted bushes. Conditions for the expansion of parasites improved significantly in 1996 and 1997 when Mongolia experienced an outbreak of big forest fires and the distribution of plant diseases spread to more than 1 500 hectares of sub-urban green zone areas like Khandgait, Sanzai, Maikhan Tolgoi and the Bayangol valley, in Ulaanbaatar.

**2.2.1.3 Rodents.** Some rodents, especially the Brandt's Vole *Microtus brandti,* and some species of Grasshoppers have caused serious problems in certain pastures. On a large scale, the Brandt's Vole has occupied over 40 million hectares of the steppe zone. The core area of the rodent's distribution is currently approximately 2.9 million hectares, and it has shown a tendency towards further extension. By 1997, the Brandt's Vole spread to 8 million hectares of a new area and there, it started to cause deterioration of 90 per cent of the vegetation cover (Figure 6). In the 1950s, Mongolia still had a healthy environment with normal and balanced relations with rodents and insects. Studies conducted during the last few

Figure 6.

# Distribution of Brandt's Vole



years show that the environmental deterioration in and around urban areas caused by the centralization of humans and livestock will continue also in the future.

On the other hand, the use of chemicals to control rodents from the 1960s until present has had negative effects on the environment, as well. Many carnivores including wolves, foxes, corsac foxes and some birds of prey have been poisoned during these years, and their numbers have declined. Consequently, this has affected the ecological balance of Mongolia. During the last 30 years, some 40 thousand tonnes of zinc-phosphate worth one billion tugrugs were used on a grand scale to control the Brandt's Vole. The peak densities of the Brandt's Vole in Mongolia have been measured in 1956-1957, 1963-1965, 1970-l 973, 1980-1985 and in 1990-1991.

### 2.2.2 Impact of Human Activities on the Environment

The studies conducted during the last few years indicate that the extension of urban areas, population growth, mining activities, continuous degradation of pasture and arable land, cutting or logging, intensive use of animal and plant species, as well as air, water and soil pollution, and off-road multiple tracks, have all reduced Mongolian biological diversity. At the same time, because of an increase in the population growth and industrial activities, there will be a need to re-design the land use patterns throughout the country. 11.2 per cent of Mongolian territory is forest, 1.4 per cent, water, 77.4 per cent (including pastures) in agriculture, 0.3 per cent is occupied by urban areas and 5.2 per cent is for infrastructural and industrial development, and for defense purposes. In 1997, 17.1 million hectares of land containing exceptional biodiversity have been placed under special protection.

Since the 1960s, arable land has been increased 10 times and many new towns, settlements and mining centres have been established. This development has gradually reduced the margins of the pristine environment of Mongolia.

2.2.2.1. **Economic Policy.** Up to 1990, when Mongolia had pursued a policy aimed at the intensive utilization of its natural resources according to the acceleration of its economic development, the question of nature protection was not a priority of the Government. Legislation concerning the use of natural resources at the time only applied to a few resources. In short, Mongolia never had a clear long-term policy to conserve the environment, to properly use the natural resources, and to restore the environment.

2.2.2.2 **Population Growth.** The population of Mongolia has increased from 758 900 in 1950 to 2.4 million in 1997. Today, about 80 per cent of the country's population live in 25 towns, 340 administrative soum (county) centres and in 40 industrialized townships. During the last 40 years, the urban population increased 6.5 times, whereas the population on the national level increased only 2.5 times. Urbanization and increased centralization of the population have led to the pollution and degradation of the environment, which has had a very limited capacity to restore naturally; related problems include erosion in towns and settlements, decline of water resources, the disappearance of some animals, replacement of some plant species and substantial decrease in the yield of fodder. Many urban and sub-urban areas have lost their original vegetation cover and weeds have started to dominate these areas.

**2.2.2.3. Industrialization.** Population growth, increased consumption and the general socio-economic development have led to the expansion of the mining, energy, construction, communications, transportation, and food industries, as well as, to the concentration of urban centres and to the construction of satellite towns and settlements. However, these developments have caused the erosion of soil, decline of natural resources including that of forests, miscellaneous plants and animals, as well as, the various bodies of water; furthermore, these developments have led to the pollution of soil, water and air. Since the 1960s, the increasing use of energy, construction of new power stations and the intensive use of strip mining methods have seriously been contributing to soil erosion, environmental pollution and the deterioration of the habitats of various species. Every year, one million cubic metres of timber are cut by several logging companies. This has an adverse effect, not only on the habitats of plants and animals, but also on the levels of river and spring water, soil conditions and the forest ecosystems. Mining has caused large scale land degradation and little has been done so far to recover the environment destroyed by strip mining and mineral exploitation. Today, Mongolia has over 120 deposits of construction raw materials, 15 large coal mining pits and many other deposits of different minerals, covering 6 000 hectares of land.

2.2.2.4 **Transport.** There has never been a clear policy on the development of road networks. Consequently, at present, Mongolia has approximately one million hectares of land destroyed by the multiple off-road tracks of different vehicles.

**2.2.2.5 Crop Land.** Of the 1.3 million hectares of arable land used for the last 30 years, 564.5 thousand hectares have been abandoned and are now subject to erosion and deterioration. Because of the use of out-dated methods in farming, the spread of plant diseases, insects and weeds is currently taking place. Intensive agricultural practices, such as the excessive use of water and fertilizers, has damaged arable land. As a result, some 20 per cent of the original soil fertility of cultivated land has been lost. At the same time, the selection of methods to control weeds has been inappropriate and has led to soil pollution.

**2.2.2.6 Pastures.** Since the beginning of the 20th century, with developments in new industrial sectors, construction of towns and settlements, concentration of people and livestock in and around urban areas in Mongolia, the problems of overgrazing, degradation of pastures and the general deterioration of environment have arisen. At the same time, there has been a tendency towards the decrease in the yields of pastures. For example, the growth of vegetation cover of desert steppe and steppe zones, and the number of species per square unit decreased. The increase in the number of droughts, their duration's and their expansions each year are worsening environmental deterioration and slowing down plant growth. At present, Mongolia has around 30 million heads of livestock grazing on 128 million hectares of pastures.

The urban and suburban areas, as well as, bodies of water that have constantly been used for livestock grazing and watering for over 40 years, are severely damaged because of over-exploitation. Currently, approximately 70 per cent of pastures are facing degradation on different levels (Table 1).

As a consequence, the pasture's fodder yield has decreased up to 5 times and the number of plant species per square unit has diminished 6 times. The relatively large increase in deterioration of the pastures has happened in desert, desert steppe and steppe zones which

comprise almost half of Mongolian pastures. Additionally, apparent signs of deterioration have been observed in and around urban areas, alongside rivers, springs, brooks, near lakes, ponds and other water reservoirs in the mountain forest zone which is densely populated by humans and their livestock. Between 1970 and 1990, the number of different plant species in pastures of the desert and desert steppe zones has decreased from 33 to 18 species and the amount of fodder yield per hectare has decreased from 0.32 to 0.23 tonnes in these zones.

The Mongolian pastures are divided into 203 different categories and a map illustrating this has been drawn on a scale of 1: 1 000 000. There is an urgent need to formulate an integrated policy for regional development, nature protection, as well as, the prevention of environmental deterioration and destructive human activities in order to save pastures from further degradation. This policy should also encompass such additional aspects as the regulation of livestock numbers, all kinds of human activities, land restoration, establishment of a legal foundation for sustainable economic development.

Table 1

**Pasture degradation**

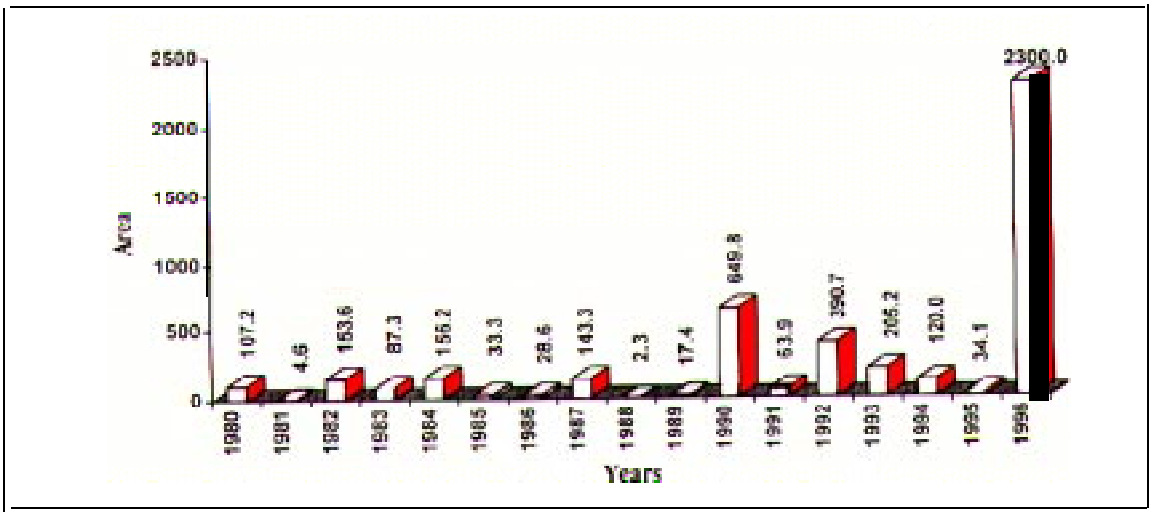
| Aimag name | The level of pasture degradation | | | | |
|---|---|---|---|---|---|
| | Not degraded | Low (10 %) | Middle (20 %) | High (30 %) | Very High (over 50%) |
| 1. Arkhangai | 134.8 | 988.2 | 2470.7 | 898.4 | |
| 2. Bayan-Ulgii | 41.7 | 584.1 | 2086.3 | 1251.7 | 208.6 |
| 3. Bayankhongor | 238.2 | 1905.3 | 5716.1 | 1667.2 | |
| 4. Bulgan | | 727.4 | 2727.7 | 181.8 | |
| 5. Gobi-Altai | 276.9 | 1846.2 | 5815.5 | 1292.3 | |
| 6. Dornod | | 2125.2 | 7332.0 | 1168.9 | |
| 7. Dornogobi | | 3768.3 | 5092.3 | 1324.0 | |
| 8. Dundgobi | | 2218.3 | 4436.7 | 517.6 | 221.8 |
| 9. Zavkhan | | 1031.0 | 3711.8 | 2130.8 | |
| 10. Uvurkhangai | - | 598.2 | 2392.9 | 2692.0 | 299.1 |
| 11. Umnugobi | | 9097.0 | 4108.3 | 1467.0 | |
| 12. Sukhbaatar | | 772.6 | 6181.8 | 772.7 | |
| 13. Selenge | 98.3 | 590.0 | 393.3 | 786.6 | 98.3 |
| 14. Tuv | 180.1 | 660.3 | 2461.1 | 2401.1 | 300.2 |
| 15. uvs | 282.1 | 1410.5 | 1974.7 | 1974.7 | |
| 16. Khovd | | 604.0 | 3321.7 | 2114.0 | |
| 17. Khuvsgul | 590.5 | 1181.2 | 2066.9 | 2066.9 | |
| 18. Khentii | 305.5 | 1955.0 | 2016.1 | 1221.9 | 611.0 |
| 19. Darkhan | | | | 44.6 | |
| 20. Ulaanbaatar | - | | | | 75.5 |
| 21. Erdenet | | | | 53.0 | |
| 22. Choir | | | | | |
| Total | 2148.1 | 32062.9 | 64306.1 | 26027.4 | 1814.5 |
| per centage | (1.7%) | (25.4%) | (50.8%) | (20.7%) | (1.4%) |

**2.2.2.7 Haymaking areas. Some 80 per** cent of the fodder for domestic animals is produced from natural pastures. In 1993, Mongolia had I 977.5 thousand hectares of haymaking pastures. In 1980, 1 125.4 thousand tonnes of hay were produced in this country. Later, these figures were: 866.4 thousand tonnes in 1990. 885.5 thousand tonnes in 1991. 668.8 thousand tonnes in 1992 and 689.7 thousand tonnes in 1993. Because the vegetation cover in Mongolia is **sparse** and the soil cover soft and thin. it has a limited potential to restore naturally; haymaking without rotation causes changes in the composition of plant species leading to the reduction in their quantity and quality. This kind of situation can cause shortages in food supplies for animals and even threaten their existence.

2.2.2.8. **Forest and** Steppe Fires. Between 1971 and 1997. there were outbreaks of approximately 2 700 large and small scale fires. which **destroyed** over 14 **million hectares** of land (Figure 7). In 1996. the worst year in Mongolian history'. altogether 417 forest and steppe fires occurred. Depending on area. some of these fires were overwhelmingly large and lasted longer than past fires and, as far as it is known. over 10.5 million hectares including parts of 120 soums (counties) in 16 aimags (provinces) were engulfed in flames. Damage of these fires with regards to ecological resources was worth of 32.5 billion tugrugs. More than 90 per cent of these fires was caused by careless human activities.

Figure 7

**Forested areas damaged by fire** (per 1 000 **ha)**




From the total number of annual forest and steppe fires. more than 70 per cent occur during the dry months of April and May. and September and October. The peak period for fires lasts for about 75 days every year. Between 1914-1994. the area of forested land declined by 1.4 million hectares due to cutting and logging. damage by insects. plant diseases and forest fires. Studies conducted during the last 30 years show that substantial changes have taken place in 40 to 50 per cent of the forests or in more than 5 million hectares of forested land.

**2.2.2.9 Environmental Pollution.** At present, power stations, steam-boilers using coal as fuel, ger townships producing smoke and soot, and cars are important permanent pollution sources especially in urban areas. In addition, a variety of toxic chemicals, solid wastes and sewage are constantly damaging the environment. Sulphur oxides, carbon mono and dioxides, nitrogen oxides, dust, and toxic chemicals released by these sources not only pollute the environment, but are also health hazards.

**Air pollution.** Studies indicate that the air of Ulaanbaatar City, Darkhan, Erdenet and Baganuur towns contains relatively high amounts of sulphur oxides, nitrogen oxides and carbon dioxides. Especially, in winter, the level of air pollution in Ulaanbaatar often exceeds the permitted levels up to 5 times.

Ulaanbaatar's power plants consume up to 5 million tonnes of coal annually and by doing this they continuously release toxic emissions to the air. In addition, there are approximately 27 000 motor vehicles polluting the soil with heavy metals, 60 000 gers and houses using yearly up to 200 000 tonnes of coal and 160 000 cubic metres of logs. The dust and dirt from degraded and eroded areas spread by wind, the 65 hectares of power plant waste dumps, and over 200 steam boilers burning 400 tonnes of coal annually, seriously increase the level of air pollution in Ulaanbaatar, spread diseases among people and degrade their environment. Therefore, there is an urgend need to introduce environmentally sound and economically efficient technology into the country's energy sector. Such technology includes non-exhaustible and renewable energy resources like solar and wind energy, as well as water power.

**Water pollution.** The toxic substances, solid wastes and sewage have been considered the main reasons for environment pollution during the last few years. The findings of a Government study, conducted in 1994, on the use and storage of toxic chemicals have revealed that 1 297 enterprises and production units used 3 774.8 tonnes of 7 276 different kinds of chemicals in their production and processing. These enterprises dispose 52.6 tonnes of 1 460 different kinds of chemicals into the environment; of these, 68 are released into the air, 790 into the water and 602 into the earth, annually. Besides, 10 1.5 tonnes of chemicals which did not meet the quality requirements were disposed of, half of the amount being deposited into the soil.

The noticeable increase in water, air and soil pollution is thought to be in connection with the growing use of chemical substances in industry and in the other sectors of the economy. There are cases where the permitted levels of chemical contaminants in the Tuul river in the Ulaanbaatar sub-urban district, the Kharaa river in Darkhan and the Orkhon river near Sukhbaatar, have all been exceeded several times. The Selenge river's oil based pollution level has increased from 10 to 26 times, its phenol level, 10 and its level of heavy metals, 2 to 6 times. The Tuul river near the site called the Songino Recreational House has the highest level of pollution in Ulaanbaatar. During the rainy season, the nitrogen, phosphorus and heavy metal levels in the Tuul river usually increases by 10 to 18 times than the permitted levels and 40 to 50 times than the levels during the dry season. Several years ago, there was large scale poisoning of fish in the Tuul river. Every year, in the whole country some 10 million cubic metres of waste are released and dumped in open areas fields. This dumping has already spoiled some 11 200 hectares of urban and sub-urban land.

Ulaanbaatar City produces 572 777 cubic metres of waste, annually. 153 253 cubic metres of this total volume are produced in ger townships, 279 524 cubic metres in the

apartment blocks and 140 000 cubic metres are coming from street and office building cleaning. The uncontrolled waste dumping into gullies and sewage canals in populated areas and settlements litter and pollute the surface and ground water, as well as, the soil in these places. For instance, today, only in Ulaanbaatar some 21 springs and ponds are polluted, and consequently, do not meet the hygienic requirements of drinking water.

Out of the 114 waste treatment units in Mongolia, only 43 are operating normally, 39 are functioning only partially and the rest of them are completely out of use. On average, 119 million cubic metres of waste water are released without any sewage treatment processing, annually .

**Soil pollution.** The soil of Ulaanbaatar City, as well as, the towns, Nalaikh, Baganuur and Erdenet contain comparatively high levels of different heavy metals, and the soil of Moron town contains 4 to 20 times higher levels of phosphorus than other towns that are considered to be highly polluted. In the case of Moron, however, the primary reason for the high concentration of phosphorus in the soil is mainly a natural one, but independent of the primary reasons, effects of the high phosphorus concentration on human health and the environment are the same.

# Chapter III

# Biodiversity Resources: Protection, Use and Restoration

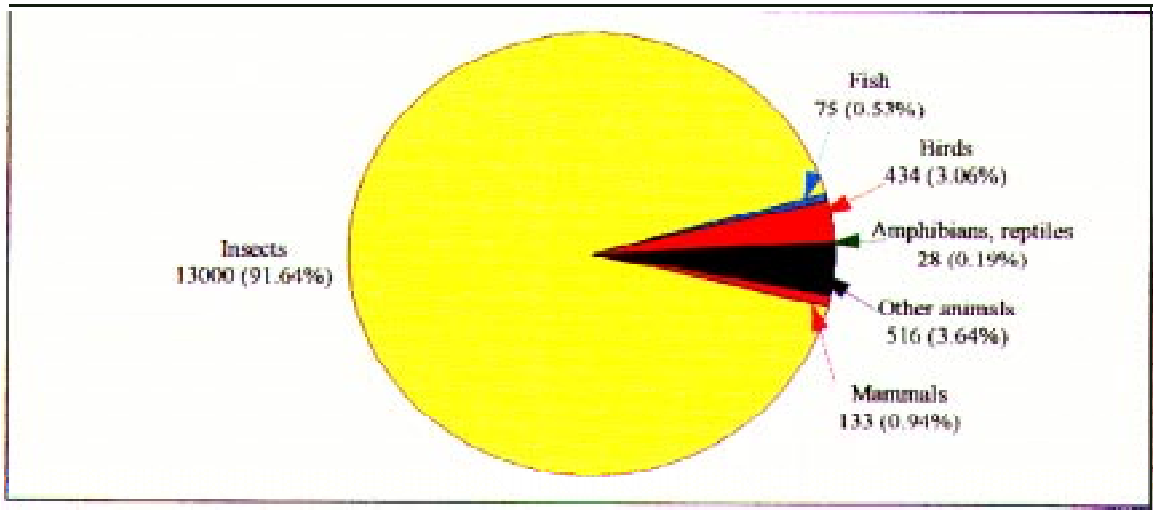
## 3.1 Protection, Use and Restoration of Fauna

Mongolian fauna is relatively rich in animal species which inhabit different habitats of the country's variable natural zones, such as forests, steppes, deserts, and high mountains forming communities according to their ecological requirements (Figure 1). The Mongolian fauna includes many species which are common in the Siberian taiga, European forests, or West-Asian and Turanian deserts. But, there are also species which are endemic to the steppe and deserts of central and east Asia. and are common in Mongolia. In addition, Mongolia is one of the richest countries in the world in terms of the prehistoric remains of various animal species.

Special attention paid to studies on Mongolia's fauna, its species composition, ecology and biology during the last 70 years, has produced a large amount of data. This report is based on this data and is divided into the following sections: mammals, birds, amphibians, reptiles, fish, insects and other wildlife Each sub-section gives information about species composition, their distribution and abundance, conservation, restoration, and use.

Figure 1

Species composition of Mongolian fauna



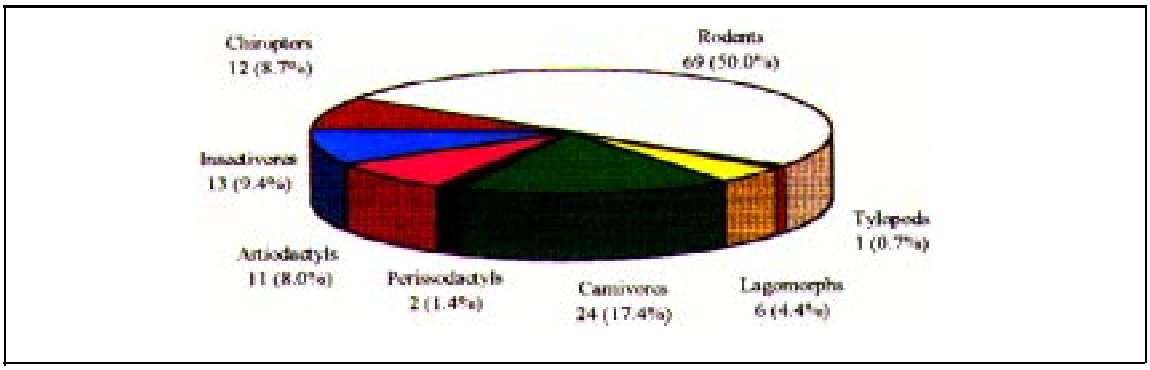
## 3.1.1 Mammals

Mongolian wild mammals have unique species composition, distribution and origin. Russian and European researchers started studying Mongolian wildlife, especially mammals, in the early 14th century Expeditions from the Russian Geological Association, working in Central Asia and Mongolia in the late 14th century, played an important role in collecting data and information on mammalian species composition. In the first half of the 20th century, mainly the Russian and European researchers continued these studies. The training of Mongolian wildlife researchers started in the early 1950s. The Mongolian-German joint biological expedition in 1962-1964 and the Russian-Mongolian joint biological complex expedition, which began in 1970 have been continuing research programmes until now, conducting a thorough study on wildlife species composition, distribution, their biology and ecology, forming a nch scientific data collection. This data base provides important reference material for the development of scientific justification of wildlife conservation and its sustainability

**3.1.1.1 Composition and Distribution of Mammals.** Altogether 133 mammalian species belonging to 73 genera, 22 families and 8 orders: out of which, 13 are insectivores, 12 chiropters, 6 lagomorphs, 69 rodents, 24 carnivores, 2 perissodactyls, 1 tylopods and 1 1 artiodactyls, exist in Mongolia.

Figure 1

**Mammalian species composition**

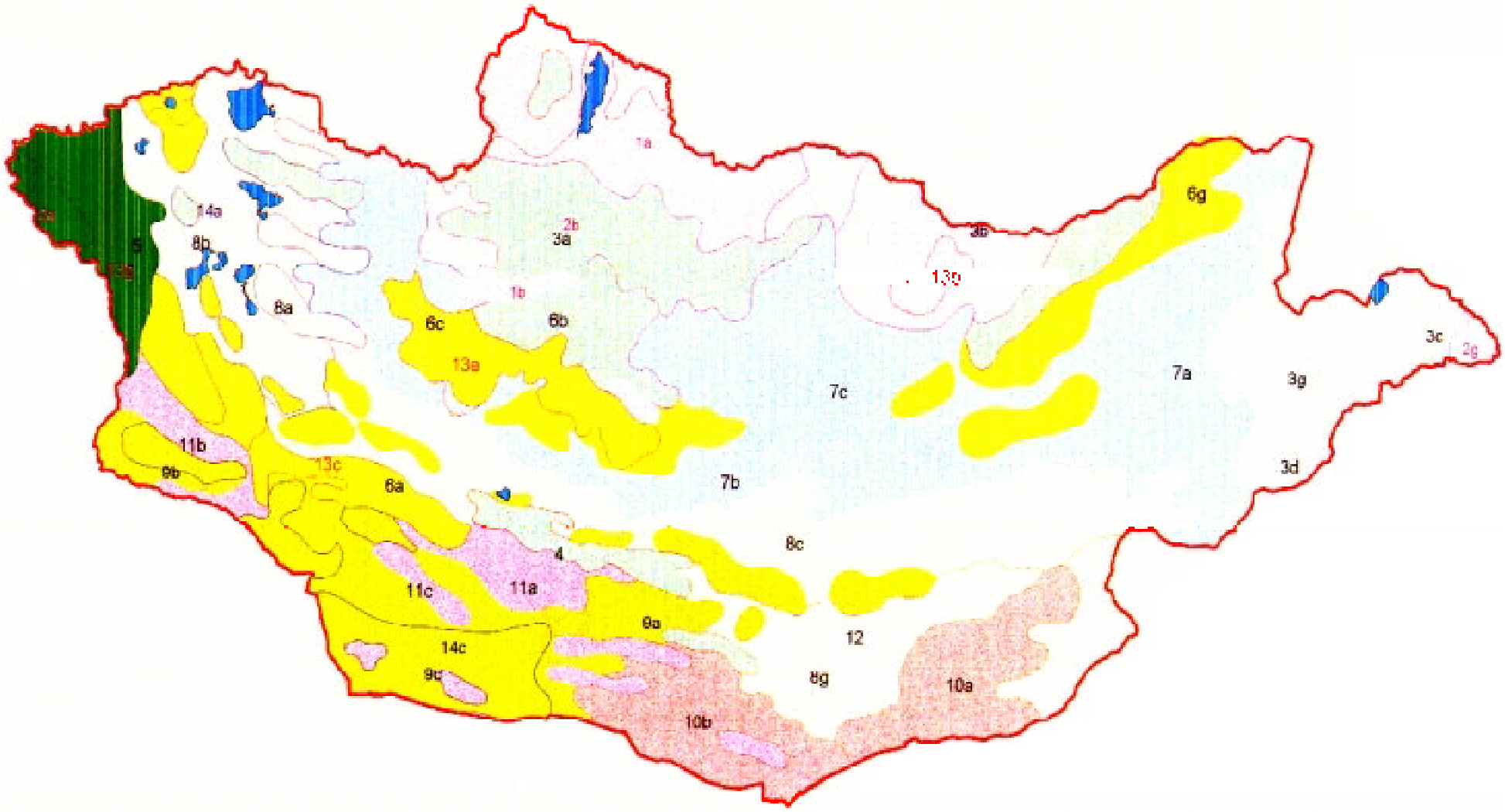



There are quite a few mammalian species endemic to Central Asia and Mongolia. These endemic mammalians include the Mongolian Vole *Microtus mongolicus*, Mongolian Gerbil *Meriones unguiculatus*, Gobi Jerboa *Allactaga bullata*, Kozlov's Pygmy Jerboa *Salpingotus kozlovi*, Mongolian Jerboa *Stylodipus andrewsi* and the Mongolian Hamster *Allocricetulus curtatus*. Generally, Central Asian species dominate the Mongolian mammalian fauna, although the current species composition is a mixture of species both from Middle and Eastern Asia and Siberia. The Elk *Alces alces*, Reindeer *Rangifer tarandus*, Wolf *Canis lupus* and Wolverine *Gulo gulo* are widely spread holarctic species whereas, Red Deer *Cervus elaphus*, Red Fox *Vulpes vulpes*, Brown Bear *Ursus arctos* and Eurasian Lynx *Felis lynx* are palearctic species.

The natural zones high mountain, forest-steppe, steppe, semi-desert and desert-largely determine the distribution of Mongolian mammals and their species composition. The ecology of the dominant mammalian species in each zone has been studied (Figure 2).

Figure 2.

# Distribution of mammals in Mongolia




Original map scale 1 : 6 000 000

## High mountain's mammalian association

| Dominated mammalian group | | | 'Meadow voles, pikas | | | |
|---|---|---|---|---|---|---|
| Ecological specifics of the dominated group | Main food | | 'Green grass | | | |
| | 'Season's activity | | Through vear | | | |
| | 'Dig activity | | L o w | | | |
| Mammalian species | Ecological definition | | | | | |
| | I | II | 13a | 13б | 13в | 13г |
| Sorex minutissimus | r3 | B5 | 1 | 1 | 0 | |
| Sorex tundrensis | r3 | B5 | 1 | 1 | 0 | |
| Ochotona alpina | b3 | A4 | 1 | 1 | + | 1 |
| Marmota sibirica | a5 | A4 | 0 | | 1 | 1 |
| Alticola argentatus | b3 | A4 | + | + | + | 1 |
| Alticola macrotis | b3 | A4 | + | + | 1 | |
| Martes foina | д3 | Г5БВ4 | 0 | 0 | 1 | 0 |
| Capra sibirica | el | A4,3 | 1 | | 1 | 1 |
| Ovis ammon | cl | A4,3 | 0 | | 1 | 1 |

## Forest mammal's association

| Dominated mammalian group | | | Meadow voles, shrews | | | | |
|---|---|---|---|---|---|---|---|
| Ecological specifics of the dominated group | Main food | | 'Plant's seeds, insects and trees' bough | | | | |
| | 'Season's activity | | Through year | | | | |
| | 'Dig activity | | L o w | | | | |
| Mammalian species | Ecological definition | | | | | | |
| | I | II | 1a | 1б | 2a | 2б | 2в |
| Sorex daphaenodon | r3 | B5 | 1 | 1 | 0 | | 0 |
| Sorex vir | r3 | B5 | 1 | 0 | 0 | | 0 |
| Sorex caecutiens | r3 | B5 | 1 | + | | + | + |
| Sorex minutissimus | r3 | B5 | | 0 | 0 | 1 | 0 |
| Sorex tundrensis | r3 | B5 | 0 | 0 | 0 | 1 | 1 |
| Ochotona hyperborea | b3 | A4 | 1 | 1 | | 0 | 0 |
| Tamias sibirica | a4 | Б2 | + | + | 1 | 1 | 1 |
| Clethrionomys rufocanus | в3,4 | АБВ3 | + | + | + | + | 0 |
| Clethrionomys rutilus | в3,4 | АБВ3 | + | + | + | 1 | 1 |
| Microtus oeconomus | в4 | A4 | 1 | 1 | 1 | 1 | 1 |
| Martes zibellina | д3 | ГБ2 | 1 | | 0 | | 0 |
| Mustela sibirica | д3 | Г2Б4 | 1 | 0 | 0 | 0 | 0 |
| Lynx lynx | д2 | Г4 | 1 | 0 | 0 | 0 | 0 |
| Cervus elaphus | cl | A2 3 | 1 | 1 | 1 | 0 | 1 |
| Capreolus pygargus | cl | A3 | 0 | 0 | 0 | 1 | 1 |

## Biotype mammalian association of the desert-steppe and desert regions' water

| Mammalian species | Ecological definition | | | | |
|---|---|---|---|---|---|
| | I | II | 14a | 14б | 14в |
| Erinaceus auritus | a3 | ВГ4 | | 1 | + |
| Sorex tundrensis | r3 | B5 | + | | |
| Crocidura sauveolens | r3 | B5 | 0 | 1 | 1 |
| Lepus tibetanus | дl | A3 | | + | + |
| Cricetulus migratorius | r4 | БВ4 | | 0 | + |
| Oeconomus | в5 | A7 | | 0 | 0 |
| Microtus oeconomus | в4 | A4 | 1 | | |
| Meriones tamariscinus | r5 | БА4 | | 1 | |
| Mus musculus | в4 | Б4 | 1 | 1 | 1 |

## Steppe mammalian association

| Dominated mammalian group | | | Meadow voles, shrews | | | | | | Meadow voles, shrews | | | | | Meadow voles | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ecological specifics of dominated group | Main food | | The green part of plants | | | | | | | | | | | | | |
| | Season's activity | | Through year | | | | | | Hibernate in | | | | | Through year | | |
| | Dig activity | | Middle | | | | | | Active | | | | | | | |
| Mammalian species | Ecological definition | | | | | | | | | | | | | | | |
| | I | II | 3а | 3б | 3в | 3г | 3д | 4 | 5 | 6а | 6б | 6в | 6г | 7а | 7б | 7в |
| Moots mystacinus | б3 | В1 | | | | | | | | 0 | | | | 0 | 0 | 0 |
| Ochotona pallasi | в5 | А4 | | | | | | + | + | + | | | | | 1 | |
| Ochotona daurica | в4 | А4 | + | + | + | + | + | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
| Marmota sibirica | а5 | А4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | + | + | + | + | 0 | 0 | 1 |
| Citellus undulatus | а4 | А4 | 1 | 1 | | | | | + | + | + | 0 | 1 | 0 | 0 | |
| Citellus dauricus | а4 | АВ4 | | | IC | | 0 | | | | | | 1 | | | 0 |
| Phodopus sungorus | а4 | БВ4 | | | 1 | 1 | 1 | 0 | 0 | 0 | | 0 | 0 | 1 | 1 | 1 |
| Cricetulus pscudogriscus | г4 | БВ4 | 0 | 0 | 1 | 1 | 1 | | | | | 0 | 0 | 1 | 1 | 1 |
| Myospalax aspalax | в5 | А6 | | 1 | | | | | | | 1 | 1 | | | | 1 |
| Microtus gregalis | в5 | А4 | + | + | + | 1 | 1 | | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| Lasiopodomys brandti | в5 | А4,5 | | | | 1 | 1 | | | | | + | 1 | + | + | + |
| Meriones unguiculatis | г5 | БА4 | | | | 0 | 0 | 0 | | 0 | | 0 | | 1 | 0 | 1 |
| Vulpes corsac | дl | Г4 | | | | | | | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| Mustela erminac | л3 | Г5 | 0 | 0 | 0 | | | 0 | 1 | 1 | 0 | 0 | 0 | | | |
| Procapra gutturosa | cl | А4 | | | 1 | + | 1 | | | | | | | 0 | | |

## Desert mammalian association

| Dominated mammalian group | | | Gerbils | | | | Gerbils,Jer ra | | | Jerboas,Striped hairy-footed hamster | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ecological specifics of dominated group | Main food | | Seeds and grasses | | | | Plant's seeds and insects | | | | | | | | |
| | Season's activity | | Through year | | | | Hibernate in | | | Hibernate in | | | | | |
| | Dig activity | | Activc | | | | Middle | | | L o w | | | | | |
| Mammalian species | Ecological definition | | | | | | | | | | | | | | |
| | I | II | 8а | 8б | 8в | 8г | 9а | 9б | 9в | 10а | 10б | 11а | 11б | 11в | 12* |
| Lcpus tibctanus | г1 | А3 | | | | | | 1 | | 0 | 0 | 0 | 0 | 0 | |
| Citellus erythrogenys | а4 | А4 | | 1 | 1 | 0 | 0 | | | | | 0 | | | |
| Phodopus sungorus | а4 | БВ4 | 1 | 1 | 0 | 0 | | | | | | | 0 | | |
| Phodopus roborovskii | а4 | БВ4 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | + |
| Cricetulus migratorius | г4 | БВ4 | | | | 0 | | 1 | 1 | 0 | 0 | | | 1 | |
| Meriones unguiculatus | г5 | БА4 | + | + | + | 1 | 1 | | | | 1 | | | 0 | |
| Meriones meridianus | г4 | БА4 | 0 | 0 | 0 | 0 | 1 | + | + | 1 | 1 | 1 | 1 | 1 | 1 |
| Rhombomys opimus | в5 | А3 | | | | | 1 | 1 | 1 | 1 | 1 | | | | |
| Allactaga sibirica | б4 | ББ5 | 0 | 1 | 1 | 1 | 0 | 0 | | 1 | 0 | 1 | 1 | | |
| Allactaga bullata | б4 | ББ5 | | 0 | 1 | 1 | 0 | | | 1 | | | | | |
| Allactaga elater | б4 | ББ5 | | | | | 1 | | 1 | 0 | 1 | | | | |
| Dipus sagitta | б4 | ББ5 | + | 1 | 1 | 1 | 1 | + | + | 1 | 1 | 0 | 1 | 0 | + |
| Salpingotus | а4 | А3ББ5 | | 0 | 0 | 1 | 0 | 0 | | + | | 0 | 0 | 0 | |
| Salpingotus crassicauda | а4 | Г4 | | | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | | 1 |
| Capra sibirica | c1 | Г5 | | 0 | 0 | | | | | | | | 0 | 1 | |

During the last few years, intensive research has been carried out to identify not only the endangered mammalian populations, but also hunting resources and the number of individuals of those species which can be hunted. For instance, in 1997. numbers of the Siberian Marmot *Marmota sibirica* and some endangered species such as the Black-tailed Gazelle *Gazella subgutturosa*, Wild Camel *Camelus ferus bactrianus*, Saiga Antelope *Saiga tatarica* and Wild Mountain Sheep *Ovis ammon*, which are included in the Mongolian Red Book, were determined covering their whole distribution area in Mongolia. There is relevant annual data from surveys conducted between 1980-1990 dealing with populations of over 50 game species, their distribution and numbers. Data of population sizes of endangered species included in the Red Book of Mongolia are shown in this report (Table1).

3.1.1.2 Conservation and **Re-introduction** of Mammals. There are several mammalian species whose population sizes and ranges have become smaller due to either the direct or indirect impact of human activities and the environmental and climate change. There are also several species which exist in small numbers in limited areas where the habitat loss may drive the species to extinction. Approval of the Mongolian Law on Nature Protection and the Law on Hunting in 1995 provide the base for all activities related to conservation, proper use and restoration of mammals.

According to Mongolian law, from I930 onwards, the hunting of more than 10 species of mammals, including the Wild Horse *Eguus przewalskii*, Saiga Antelope *Saiga tatarica*, Beaver *Castor fiber birulai* and the Otter *Lutra lutra* was to be prohibited, today, there is legislation concerning wildlife conservation. The Wild Horse *Equus przewalskii*, the Wild Ass *Equus hemionus*, the Wild Dog *Cuon alpinus*, Snow Leopard *Uncia uncia* and the Otter *Lutra lutra* have been included in the Red Book of the World Conservation Union (IUCN). The Otter *Lutra Lutra*, Gobi Bear *Ursus arctos gobiensis*, Snow Leopard *Uncia uncia*, the Wild Horse *Equus przewalskii*, and Wild Ass *Equus hemionus* are listed in CITES Appendix I, and The Wild Mountain Sheep *Ovis ammon*, Musk Deer *Moschus moschiferus*, Wild Dog *Cuon alpinus*,, Lynx *Felis lynx isabellina*, Saiga Antelope *Saiga tatarica*, Manul *Felis manul*, and the Wild Cat *Felis silvestris* are in Appendix II. The Wild Horse *Equus przewalskii*, and the Wild Dog *Cuon alpinus* have become extinct from the wild

The new Mongolian Red Book, published in 1997, has 2 categories of endangered species, rare and very rare and it includes 30 species and sub-species of mammals (Figure 3).

Figure 3

Mammals included in the Mongolian Red Book

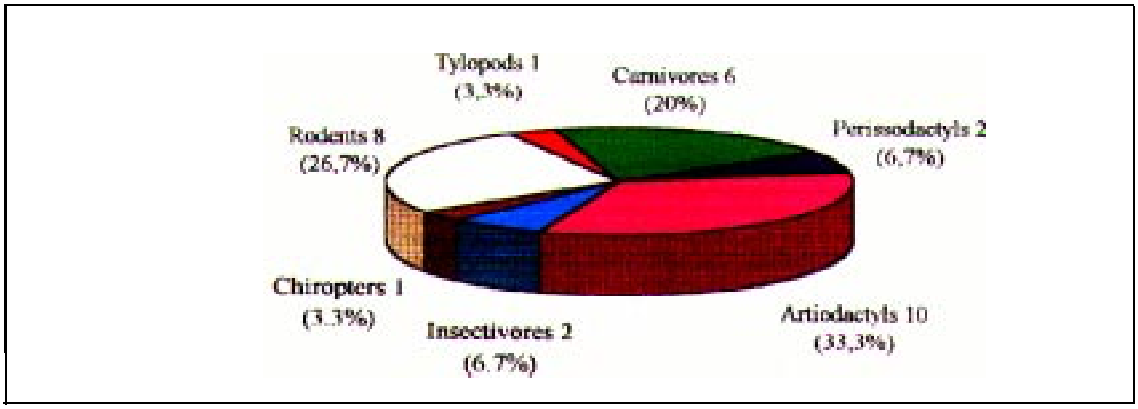


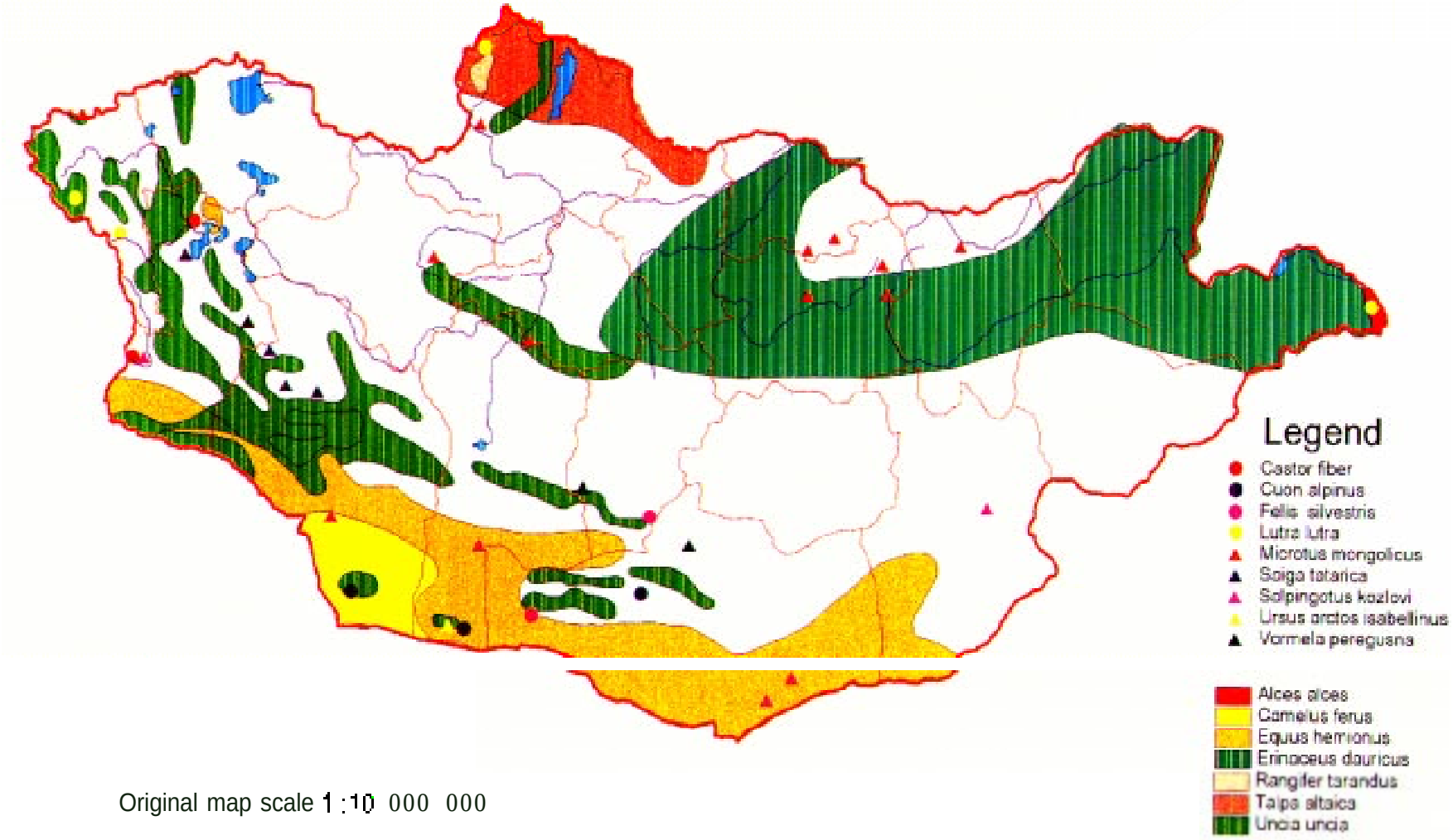
Table 1

**Endangered Mongolian mammals included in the protected areas network**

| # | *Mammal species* | Status | Population | Name of the protected area and size of area covered (thousand ha) |
|---|---|---|---|---|
| 1 | Daurian Hedgehog<br>*Erinaceus dauricus* | rare | | Numrug, Domod, Mongolian Daguur, 984.6 ha |
| 2 | Siberian Mole<br>*Talpa altaica* | rare | | |
| 3 | Eastern Bat<br>*Vespertilio superans* | rare | | Domod Numrug<br>881.6 ha |
| 4 | Asiatic Wild Dog<br>*Cuon alpinus* | very rare | | Gobi Gurvan Saikhan<br>2171.7 ha |
| 5 | European Wild Cat<br>*Felis silvestris* | rare | | Gobi Gurvan Saikhan, Small & Great Gobi PA, Sharga, Mankhan<br>9711.0 ha |
| 6 | Snow Leopard<br>*Uncia uncia* | very rare | over 1700 by 1995 | Gobi Gurvan Saikhan, Small & Great Gobi PA, Burkhan Buudai, Alag Khairkhan, Khukh Serkh, Altai Tavan Hogd, Turgen, Tsagaan Shuvuut, Ogontenger 9078.0 ha |
| 7 | Marbled Polecat<br>*Vormela peregusna* | rare | | Gobi Gurvan Saikhan, Small & Great Gobi PA, Zagiin us<br>9602.0 ha |
| 8 | Eurasian Otter<br>*Lutra lutra* | very rare | over 20 by 1970 | Tes, Bulgan, Nurnrug river |
| 9 | Gobi Bear<br>*Ursus arctos gobiensis* | very rare | over 30 by 1990 | Part A, Great Gobi SPA<br>4611.0 ha |
| 10 | Przewalski's Horse<br>*Equus przewalskii* | very rare | | Part B, Great Gobi SPA<br>700.0 ha |
| 11 | Asiatic Wild Ass<br>*Equus hemionus* | rare | 15000 by 1970 | Gobi Gurvan Saikhan, Small & Great Gobi Protected Areas, Part A, B<br>9321.0 ha |
| 12 | Bactrian Camel<br>*Camelus feros bactrianus* | very rare | over 320 by 1993 | Part A, Great Gobi SPA<br>4611.0 ha |
| 13 | Wild Boar<br>*Sus scrofa nigripes* | rare | | Khar Us lake, 480 ha |
| 14 | Musk Deer<br>*Moschus moschiferus* | very rare | | Khan Khantii, Bogd Uul, Gorkhi Terelj, Khoridol Saridag, Khuvsgul,<br>2326.0 ha |
| 15 | Reindeer or Caribou<br>*Rangifer tarandus* | very rare | 400 by 1996 | Khuvsgul |
| 16 | Elk or Moose<br>*Alces alces pfizenmayeri* | very rare | 10000 by 1980 | Khan Khantii, Gorkhi Terelj, Khoridol Saridag<br>1447.0 ha |
| 17 | *Alces alces cameloides* | very rare | 70-80 by 1990 | Numrug |
| 18 | Saiga Antelope<br>*Saiga tatarica tatarica* | very rare | | Sharga Mankhan<br>390.0 ha |
| 19 | Mongolian Saiga Antelope<br>*Saiga tatarica mongolica* | very rare | 1400 by 1993 | Sharga mankhan |
| 20 | Goitered Gazelle<br>*Gazella subgutturosa* | rare | 60000 by 1995 | Great and Small Gobi SPA, Part A, B, Sharga Mankhan, Gobi Gurvan Saikhan, Ergel, Zagiin Us, Ikh Nart 10087 ha |
| 21 | Wild Mountain Sheep<br>*Ovis ammon* | rare | 40000 by 1970 | Khukh Serkh, Altai Tavan Bogd, Turgan, Khoridol Saridag, Tsagaan Shuvuut, Alag, Ogontenger, Gobi Gurvan Saikhan, Great and Small Gobi SPA, Part A, B, Ikh Nart, Bogs Mountain, Burkhan Buudai 10196.0 ha |
| 22 | Ibex<br>*Capra sibirica* | rare | | Khukh Serkh, Altai Tavan Bogd, Turgan, Khoridol Saridag, Tsagaan Shuvuut, Alag, Ogontenger, Gobi Gurvan Saikhan, Great and Small Gobi SPA, Part A, B, Ikh Nart, Bogs mountain, Burkhan Buudai 10289.0 ha |
| 23 | Alashan Ground-squirrel / Souslik<br>*Citellus alaschanicus* | rare | | Gobi Gurvan Saikhan 2171.0 ha |
| 24 | Beaver<br>*Castor fiber birulai* | very rare | 300 by 1997 | Bulgan River, Khar Us Lake, Teslin River |
| 25 | Satunin's Jerboa *Cardiocranius paradoxus* | rare | | Khar Us Lake, Sharga Mankhan, Great Gobi SPA, Part A, B, Gobi Gurvan Saikhan, Zagiin Us, Suikhant, Ergel 8690.0 ha |
| 26 | Kozlov's Pygmy Jerboa<br>*Salpingotus kozlovi* | rare | | |
| 27 | Thick-tailed Pygmy Jerboa<br>*Salpingotus crassicauda* | rare | | |
| 28 | Long-eared Jerboa<br>*Euchoreutes naso* | rare | | |
| 29 | Tamarisk Gerbil<br>*Meriones tamariscinus* | rare | | Great Gobi SPA, Part A, B<br>5311.7 ha |
| 30 | Forest Dormouse<br>*Dryomys muscilus* | rare | | Bulgan River |

Figure 4.

# Distribution of endangered mammals

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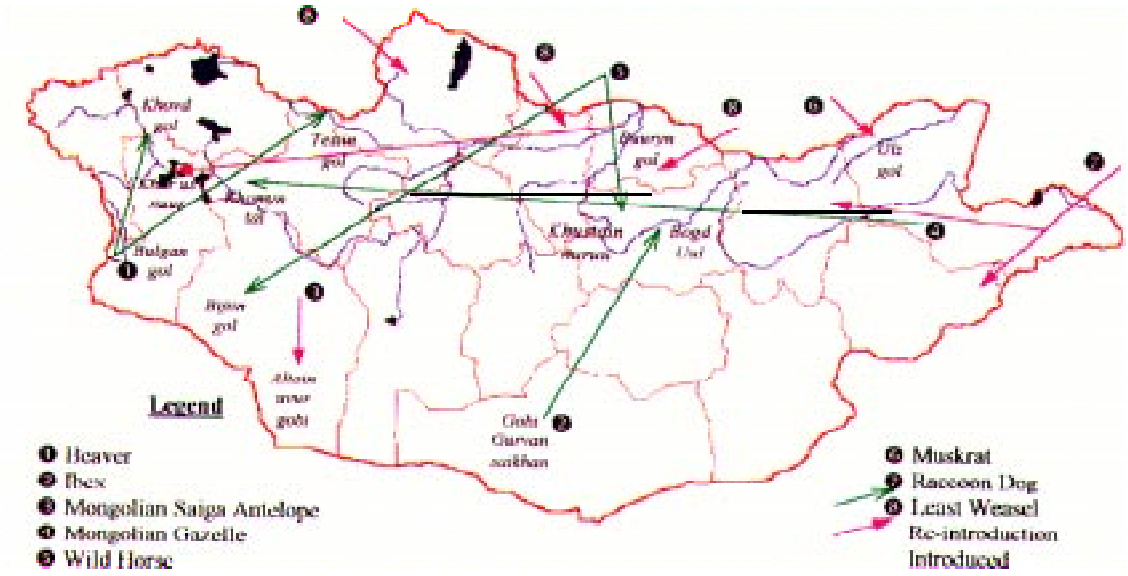
The protected areas network in Mongolia covers fully the range of the Wild Camel *Camelus ferus*, Gobi Bear *Ursus arctos gobiensis*, Wild Horse *Equus przewalskii*, Saiga Antelope *Saiga tatarica*, Elk *Alces alces*, Wild Boar *Sus Scrofa*, Beaver *Castor fiber birulai* and Forest Doormouse *Dryomus nitedula*. About 70 per cent of the range of the Snow Leopard *Uncia uncia*, Wild Ass *Equus hemionus*, Eurasian Otter *Lutra lutra*, Musk Deer *Moschus muschiferus*, Wild Mountain Sheep *Ovis ammon* and the Siberian Ibex *Capra sibirica* have been placed under protection (Table 1, Figure 4).

A few rodent species such as the Satunin's Jerboa *Cardiocranius paradoxus*, the Thick-tailed Pygmy Jerboa *Salpingotus crassicauda* and Long-eared Jerboa *Eucoreutus naso* have remained outside the protected areas network.

Mongolians have re-introduced and relocated certain species of mammals throughout history like the Red Deer *Cervus elaphus* and the Siberian Marmot *Marmota sibirica*, which are viewed as important hunting resources (Figure 5).

Figure 5

**Re-introduced and introduced mammals**




The Muskrat *Ondatra zibethica*, Stoat *Mustela erminae* and Raccoon Dog *Nyctereutes procyonoides* have spread into Mongolia from Russia and China, and the White-tailed Gazelle *Procapra guturosa*, Saiga Antelope *Saiga tatarica*, Wild Horse *Equus przewalskii*, Beaver *Castor fiber and* Siberian Ibex *Capra sibirica* have been re-introduced to the areas where they have become rare. 20 Wild Horses were re-introduced from Europe in 1992 in Khustain Nuruu and in Takhiin Tal. In1997 the horse population reached a total of 100 individuals (Table 2).

Table 2

**Mammals w-introduced in Mongolia**

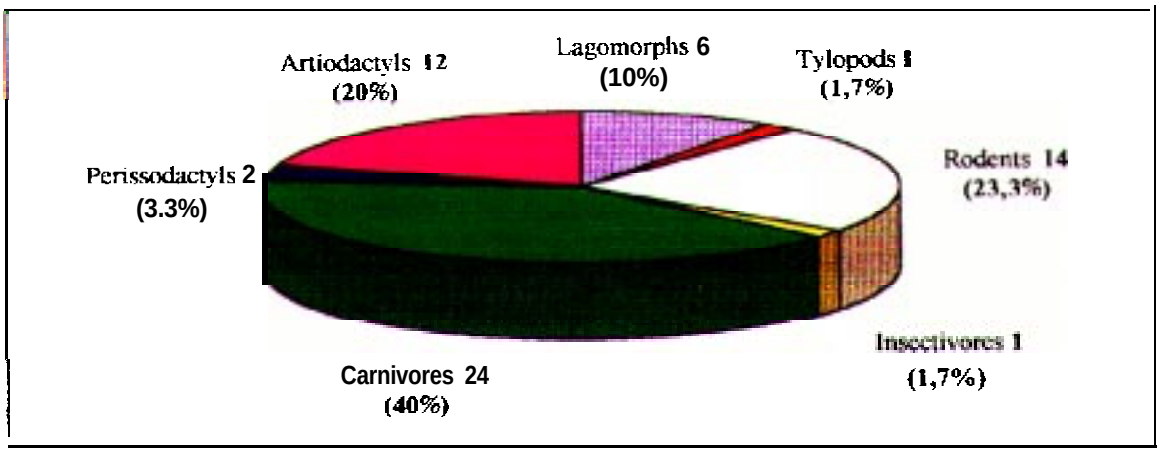
| Species | Year & Number of Individuals | Original Population | Re-introduction site | Current population (by 1997) |
|---|---|---|---|---|
| | | *Re-introduced* | | |
| 1 *Castor fiber* | 112 in 1971-1981 | Bulgan river | Khovd and Tesiin Rivers | over 200 |
| 2 *Saiga tatarica* | 50 in 1985-1989 | Shargiin gobi | South of Altai Gobi | |
| 3 *Capra sibirica* | 12 in 1984 | Gurvan saikhan | Bogd Uul | 35 in 1997 |
| 4 *Procapra gutturosa* | 50 in 1988-1990 | Matad | Khomiin Tal | 5000 in 1997 |
| 5 *Equus przewalskii* | 21 in 1992-1997 | The Ukraine, Australia, Switzerland, Holland | Takhiin Tal, Khustain Nuruu | 106 in 1997 |
| | | *Natural colonizations* | | |
| 6 *Ondatra zibethica* | 50 in 1963-1967 | Selenge and Buuriin Rivers | Khar Us Lake, Ulz and Onon Rivers | is a hunting resource. |
| 7 *Nyctereutes procyonoides* | by 1960's | from China | through Khalkh River | |
| 8 *Mustela nivalis* | by 1970's | from Russia | | |

**Additional management activities** like re-introductions are needed in the future for many more species which have become endangered.

3.1.1.3 **Mammals as a Resource.** Hunting has **always been** an **integral** pan of **Mongolian culture - it can** be regarded as a supplementary activity to sheep, goat or cattle herding. The hunted animal is used almost entirely. Besides the meat and fat, pelts, horns, and skulls are valuable raw materials for household and commercial use. There are approximately I33 mammalian species living **permanantly** in Mongolia. 24 out of these species are game species, 32 species are hunted in small **numbers** and 4 are only rarely hunted. Most of the game mammals are carnivores, rodents and **artiodactyls** (Figure 6).

Figure 6

**Species composition of game mammals**

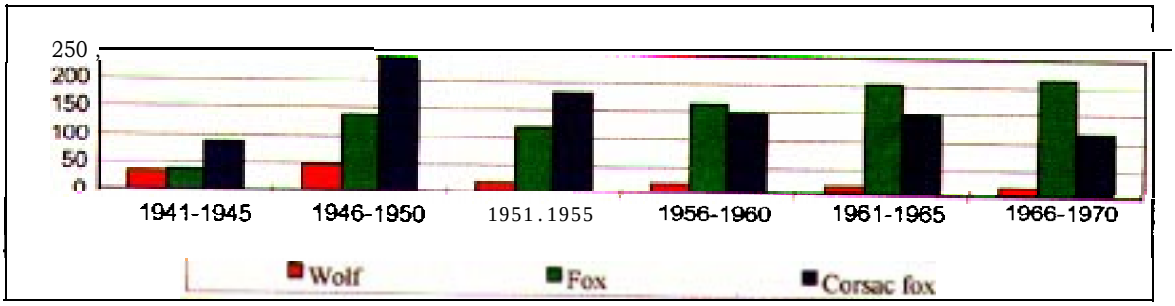


Among all the furred species, the Siberian Marmot *Marmota sibirica* and the Altai Marmot *Marmota baibacina* are the most important ones. Also *Citellus*-species, Siberian Chipmunk *Tamias sibirica* and the Brown Squirrel *Sciurus vulgaris* are commonly hunted, Among the carnivorous mammals, Sable *Martes zibellina* is most commonly hunted because of its pelt. Concerning the perissodactyls, the Red Deer *Cervus elaphus*, Siberian Roe-Deer *Capreolus pygargus*, Wild Boar *Sus scrofa* and White-tailed Gazelle *Procapra guturosa* are important game species. In many areas, the Wild Mountain Sheep *Ovis ammon* and the Siberian ibex *Capra sibirica* populations have increased up to potential hunting numbers and these species have been hunted with special permission.

Since hunting in Mongolia has been centrally planned and organized from the beginning of the 1930s, the number of hunted animals and their products was high For example, in 1941-1970, 26 300 Wolves *Canis lupus*, 145 500 Foxes *Vulpes vulpes* and 153 800 Corsac Foxes *Vulpes corsac* were hunted and exported. Mongolians started to use fire arms in the beginning of the 1950s for large scale hunting (Figure 7).

Figure 7

**Number** of pelts of wolves, **fores and corsac** foxes **hunted between 1941 -** 1970



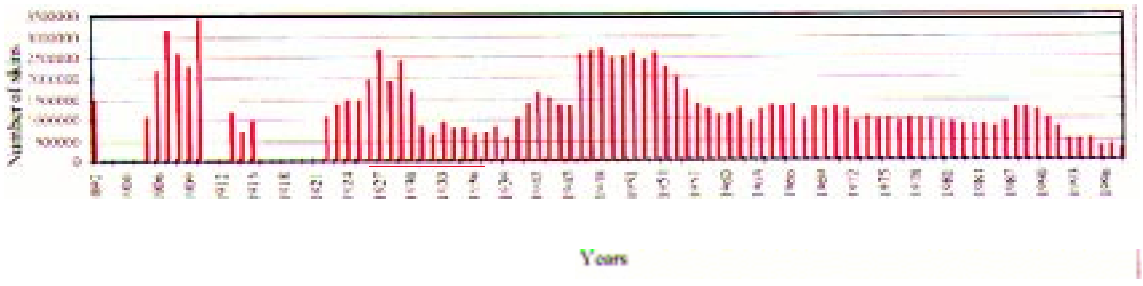

Since Mongolia switched to a market economy in 1990, the processing and marketing of game animals was discontinued. After 1990, there were no hunting plans in effect and the number of animals hunted annualy decreased. However, illegal hunting espccially where endangered species are concerned, increased. Therefore, it is now difficult to get the accurate number of animals hunted every year. The Red Deer *Cervus elaphus*, Musk Deer *Moschus moschiferus* and the Siberian Marmots *Marmota sibirica*, in particular, have been hunted illegally.

For centuries, Mongolians have hunted Marmots *Marmota sibirica* and *M. baibacina*, the main game species for pelts and fat. Until the early 19th century, the number of Marmots hunted was low. In the 1890s, the price of Marmot skins increased in Leipzig and as a result, the hunting of Marmots in Mongolia intensified Since then, during the last 100 years, Marmots have been hunted and their skins, exported in great numbers.

Because of intensive Marmot hunting in previous years, the Marmot distribution has decrcased and their populations have declined. Although plans were made to limit the Marmot harvest to 265 000, there have been problems in controlling the illegal hunting, the use of firearms, and the processing and marketing of skins. According to available data, 700 000-1 300 000 Marmots were hunted yearly between 1990 and 1997. Most of these skins were exported to Russia

Figure 8

**Marmot skin** yields from 1892-1997

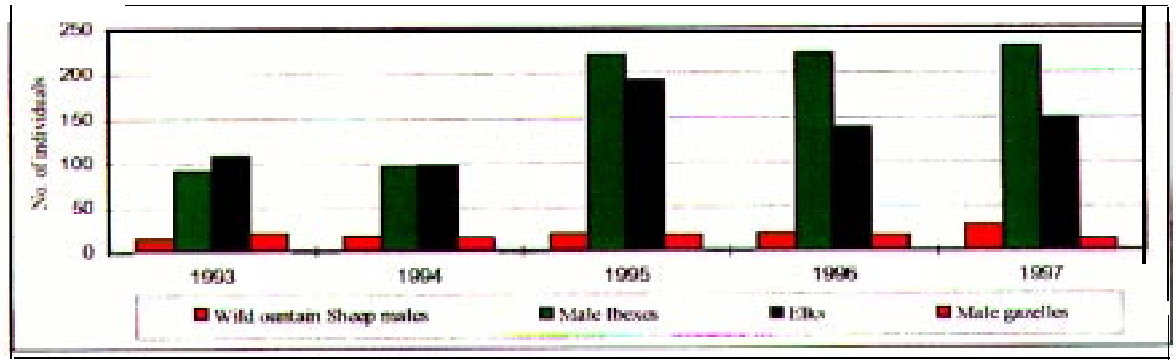



The range of the White-tailed Gazelle *Procapra gutturosa*, which covered almost a million square kilometres of the forest steppe, steppe, desert steppe and desert in the mid of 20th century, has been reduced to 500 square kilometres and the number of White-tailed Gazelles has sharply decreased. After the 1960s, the number of gazelles dramatically declined especially in the central and western provinces of Mongolia where their range was cut by the railway line built in the 1950s between Ulaanbaatar and Zamiin-Uud. However, thanks to protection activities and the fact that gazelles have started to cross the railway tracks, their population density has started to increase and their range, widen.

Some species **like the** Wild Mountain Sheep *Ovis ammon*, Siberian Ibex *Capra sibirica*, Red Deer *Cervus elaphus* and the Saiga antelope *Saiga tatarica* have been hunted by tourists with special permits (Figure 9). In 1985-1991, hunting of around 80 male Wild Mountain Sheep were permitted annually, but later it was reduced to 15-30 individuals per year.

Figure 9

**Number of animals hunted by tourists in 1993-1997**




### 3.1.2 Birds

Mongolia has a rich composition of bird species due to the migration routes from the Pacific and Indian Oceans to the Mediterranean Sea and to the Arctic Ocean and northern Tundra. 4 combination of Holarctic, Palearctic and Central Asian species have representatives in the Mongolian bird species assemblage.

3.1.2.1 Composition and Distribution of Bird Species. 434 species belonging to 193 genera, 56 families and 17 orders have been observed so far in Mongolia. More than 330 species from this total are migratory and the remaining 104 species inhabit Mongolia year round. 322 migratory species nest here and more than 10 species, nesting in the tundra and in the Arctic Ocean coasts, over-winter in Mongolia. Approximately 50 species migrate through Mongolia and 20 species are observed here occasionally. Numerous species migrate between various sites in Mongolia according to the season.

For example, the Houbara Bustard *Chlamydotis ungulata,* Henderson's Ground Jay *Podoces hendersoni,* and Desert Wheatear *Oneanthe deserti* are dominant species in desert and semi-desert zones, whereas the Steppe Eagle *Aquila rapax,* Upland Buzzard *Bueo hemilasius,* and Great Bustard *Otis tarda* are dominant in the steppe zone (Figure 1).

The Spotted Flycatcher *Muscicapa striata* and Lesser Whitethroat *Sylvia curruca* are common in the mountain forest-steppe zone, whereas, the Black-billed Capercaillie *Tetrao parvirostris,* Oriental Cuckoo *Cuculus saturatus,* and Little Owl *Athene noctua* are widely spread in the taiga. Mountainous areas have the widest composition of different bird species. Different waterfowl groups occupy mainly the depression in the western part of the country and along the lakes and rivers in the northern and eastern part of Mongolia. Half of the bird species in Mongolia are insectivorous, about 25 per cent are herbivorous and 10 per cent feed mostly on water plants and animals.

3.1.2.2 Conservation of Birds. Mongolia has several advantages: a wide range of unspoiled nature, a small human population, and very little water-howl hunting. Therefore, it is one of the safest areas for many bird species to live permanently or to visit seasonally.

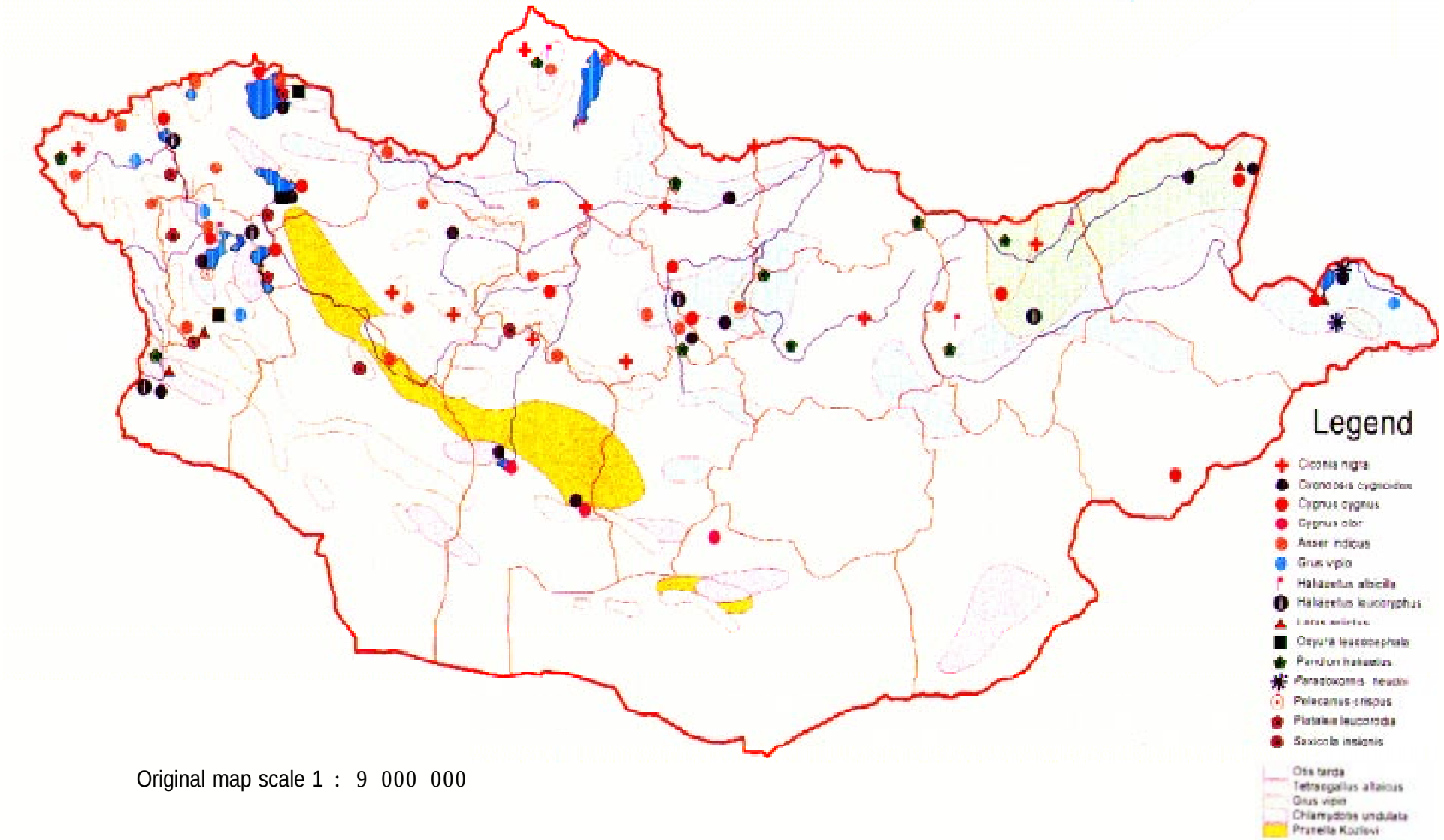
For example, in 1995, under the "Mongolian Law on Hunting", the Houbara Bustard *Chlamydotis ungulata,* Whooper Swan *Cygnus cygnus,* White-naped Crane *Grus vipio,* Common Pheasant *Phasianus colchicus,* Hooded Crane *Grus monacha,* and Siberian Crane *Grus Zeucogeranus* were placed under protection; in addition, 22 species of birds as rare including the Altai Snowcock *Tetraogallus altaicus,* Bar-headed Goose *Anser indicus,* Mute Swan Cygnus *olor,* Great Bustard *Otis tarda,* Black Stork *Ciconia nigra* and Oriental White Stork *Ciconia boyciana* were registered under this law. The assessment of game bird species as raw materials and fees charged for their use, have been important measures in limiting possibilities to hunt and trade birds. The "Law on Hunting" also decreased permitted waterfowl, as well as other bird species hunting by taking 41 days away from the usual period. The Mongolian Red Book contains a register of 30 bird species, which are not only rare worldwide but also rare in Mongolia. As an important act of conservation, parts of big lakes and rivers, which are densely inhabited by birds, like Khuvsgul, Uvs, Khar Us, Dayan, Khorgon and Terkhiin Tsagaan, were protected.

The Daguur, Dornod and Numrug Strictly Protected Areas were established in order to protect the Siberian Crane *Grus Zeucogeranus,* White-naped Crane *Grus vipio,* Houbara Bustard *Chlamydotis undulata,* Black Stork *Ciconia nigra,* Dalmatian Pelican *Pelecanus crispus,* White Spoonbill *Platalea leucorodia,* Baikal Teal *Anus formosa,* Asiatic Dowitcher *Limnodromus semiplamatus,* and Relict Gull *Larus relictus.*

Mongolia signed the "CITES convention" in 1994 and the "Ramsar convention" in 1997. The Peregrine Falcon *Falco peregrinus,* Imperial Eagle *Aquila heliaca,* White-tailed Sea Eagle *Haliaetus albicilla,* Japanese Crane *Grus japonensis,* and Relict Gull *Larus relictus are* listed in Appendix 1 of "CITES Convention".

Distribution of some endangered species of birds in Mongolia

Figure 1.

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**3.1.2.3 Bird Harvesting.** There are more than 120 bird species in Mongolia which are important to hunters. Between 1934-1990, birds in general were hunted according to the State Hunting Plan. Abundances and distributions of the 8 most hunted bird species, like the Willow Ptarmigan *Lagopus lagopus*, Black Grouse *Lyrurus tetrix,* and Black-billed Capercaillie *Tetrao parvirostris* have been studied in more detail (Table 1).

Table 1

**Distribution and numbers of game bird species**

| | Species | Size of distribution area (1000 sq.km) | Population (1000 ind.) |
|---|---|---|---|
| 1 | *Lagopus mutus* | 5.0 | **200.0** |
| 2 | *Lagopus lagopus* | **9.0** | **270.0** |
| 3 | *Lyrurus tetrix* | **17.0** | **250.0** |
| 4 | *Te trao parvirostris* | **63.0** | |
| 5 | *Bonasia bonasia* | **54.0** | **2300.0** |
| 6 | *Perdix dauricae* | **350.0** | **20000.0** |
| 7 | *Alectoris chukar* | **40.0** | **1600.0** |
| 8 | *Syrrhap tes paradoxus* | **650.0** | **6600.0** |

Many wetland bird species migrate to Mongolia, on their way to and from the Siberian tundra. Traditionally, Mongolians do not eat birds except the Great Bustard *Otis tarda* and Altai Snowcock *Tetraogallus altaicus.* However, during the last few years people have begun to poach the Great Bustard *Otis tarda,* Houbara Bustard *Chlamydotis undulata,* Baikal Teal *Anas formosa*, Greylag Goose *Anser anser,* and Dalmatian Pelican *Pelecanus crispus* and have also started stealing eggs from wetlands.

## 3.1.3 Amphibians and Reptiles

Habitats for reptiles and amphibians are fairly scarce in Mongolia due to the high altitude and extreme continental climate.

**3.1.3.1 Composition and Distribution of Amphibians and Reptiles. Similarly with** the other dry areas in Central Asia, Mongolia has relatively few species of reptiles and amphibians; 22 species of reptiles belonging to 14 genera and 8-10 species of amphibians belonging to 4 genera, exist in Mongolia (Table 1 and 2).

Table 1

**Species composition of amphibians in Mongolia**

| Order | Family | Species |
|---|---|---|
| Caudata | Hynobidae | 1. Siberian Salamander *Salamandrella keyserlingii* |
| Anura | Bufonidae | 2. Common Toad *Bufo bufo*<br>3 Green or Middle Asiatic Toad *Bufo danatensis*<br>4. Siberian Sand Toad *Bufo raddei* |
| | Hylidae | 5. Japanese Tree Toad *Hyla japonica* |
| | Ranidae | 6. Siberian Wood Frog *Rana amurensis*<br>7. Asiatic Grass Frog *Rana chensinensis*<br>8. Dark Spotted Frog *Rana nigromaculata* |

Table 2

**Species composition of reptiles in Mongolia**

| Sub-order | Familiy | Species |
|---|---|---|
| *Lacertilia* | *Gekkonidae* | *I. Teratoscincus przewalskii* |
| | | *2. Cyrtopodion elongatus* |
| | | *3. Alsophylax pipiens* |
| | *Agamidae* | *4. Phrynocephalus helioscopus* |
| | | *5. Phrynocaphalus versicolor* |
| | | *6. Stellio stoliczkanus* |
| | *Lacertidae* | *7. Eremias argus* |
| | | *8. Eremias* arguta |
| | | *9. Eremias multiocellata* |
| | | *10. Eremias przewalskii* |
| | | *Il. Eremias vermiculata* |
| | | *12. Lacerta agilis* |
| | | *13. Lacerta vivipara* |
| *Serpentes* | *Boidae* | *14. Eryx tataricus* |
| | *Colubridae* | *15. Coluber spinalis* |
| | | *16. Elaphe dione* |
| | | *17. Elaphe schrenckii* |
| | | *18. Natrix natrix* |
| | | *19. Psammophis lineolatus* |
| | *Viperidae* | *20. Vipera berus* |
| | | *21. Vipera ursini* |
| | *Crotalidae* | *22. Aqkistrodon halys* |

The distribution of the reptile and amphibian species is uneven in Mongolia. 64.2 per cent of all reptiles and amphibians found in this country, or 2 species of amphibians and 16 species of reptiles live in the Gobi region. Furthermore, there are 11 species of reptiles and two species of amphibians in the Altai mountainous zone, 6 species of reptiles and 4 species of amphibians in the Khangai and Khentii regions and 4 species of reptiles and 3 species of amphibians in the eastern steppe region. Most amphibians live in the northern part of Mongolia where there are more water reservoirs, whereas most reptiles are found in the desert (Table 3).

Amphibians such as the Siberian Wood Frog *Rana amurensis* and Siberian Sand Toad *Bufo raddei* and reptiles such as the Steppe Racerunner *Eremias arguta,* Multi-cellated Racerunner *Eremias multiocellata,* Gobi Racerunner *Eremias przewalskii,* Mongolian Racerunner *Eremias argus,* Pallas' Coluber *Elaphe dione,* Central Asian Viper *Agkistrodon halys* and Viviparous Lizard *Lacerta vivipara* are common in Mongolia. There is evidence, however, that their populations and distributions have tended to decrease in recent years due to negative human impacts. In the 1960s, there was a dense Siberian Salamander *Salamandrella keyserlingii* population in the Bayanzurkh district in Ulaanbaatar, but today the population has declined dramatically. The Siberian Salamander *Salamandrella keyserlingii* and Siberian Sand Toad *Bufo raddei*, which are rarely seen now, were common in the rivers near Ulaanbaatar. The frog population structure in the Buuriin River in the Selenge aimag has changed and is now dominated by young individuals, because 10-l 5 thousand Siberian Salamanders *Salamandrella keyserlingii* are caught every year in this region by the university for teaching purposes.

Table 3

**Distribution of reptiles and some amphibians in various zones of Mongolia**

| Species name | Altain mountainous region | | | Khangai-Khentii mountainous region | | | Eastern steppe region | | | Gobi region | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| ***Amphibians*** | | | | | | | | | | | | |
| Salamandrella keyserlingii | | | | + | + | + | | | | | | |
| Bufo raddei | | + | | + | + | + | + | + | + | + | + | |
| Bufo viridis | + | | | | | | | | | | + | |
| Hyla japonica | | | | + | | | | | | | | |
| Rana arvalis | | | | + | + | | | + | + | | | |
| Rana chensinensis | | | | | | | + | | | | | |
| ***Reptiles*** | | | | | | | | | | | | |
| Teratoscincus prezwalskii | | | | | | | | | | | + | |
| Cyrtapodion elongatus | | | | | | | | | | | + | |
| Alsophylax pipiens | + | + | | | | | | | | + | + | + |
| Phrynocephalus helioscopus | | | | | | | | | | | + | |
| Phrynocephalus versicolor | + | + | | | | | + | + | | + | + | + |
| Stellio stoliczkanus | + | + | | | | | | | | | + | |
| Eremias argus | | | | + | | | + | | | + | | + |
| Eremias arguta | | | | | | | | | | | + | |
| Eremias multiocellata | + | + | | | | | | | | + | + | + |
| Eremias przewalskii | | | | | | | | | | + | + | + |
| Eremias vermiculata | | | | | | | | | | + | + | |
| Lacerta vivipara | + | | | | + | + | | | | | | |
| Lacerta agilis | + | | | | | | | | | | | |
| Eryx tatarica | | | | | | | | | | | + | + |
| Coluber spinalis | | | | | | | | | | + | | + |
| Elaphe dipne | + | + | + | + | + | + | + | + | + | + | + | + |
| Elaphe schrencki | | | | | | | | | + | | | |
| Natrix natrix | + | | | + | + | | | | | | | |
| Psammophis lineolatus | + | + | | | | | | | | + | + | |
| Vipera berus | + | | | | + | + | | | | | | |
| Vipera ursuni | + | | | | | | | | | | | |
| Agkistrodon halys | + | + | + | + | + | + | + | + | + | + | + | + |

♦ 1. Mongol Altai region, 2. Gobi Altai region, 3. Siilhem Kharkhiraagiin region, 4. Khangai region, 5. Khentii region, 6. Khuvsgul region, 7. Middle Khalkh or Dariganga steppe region, 8. Dornod steppe region, 9. Khyangan region, 10. Gobi region to the north of Altai, 11. Gobi region to the south of Altai, 12. Eastern gobi region

♦ (+) - observed in the region

**3.1.3.2 Conservation of Amphibians and Reptiles.** Reptiles and amphibians in Mongolia have been protected by law because of their importance in the food chains of their ecosystems.

The Mongolian Red Book includes 5 reptile species: the Gobi Naked-toed Gecko *Cyrtapodion elongatus,* Sunwatcher *Phrynocephalus helioscopus,* Steppe Racerunner *Eremais arguta,* Tatar Sand Boa *Eryx tataricus and* Slender Racer *Coluber spinalis,* and 4 amphibian species: the Siberian salamander *Salamandrella keyserlingii,* Siberian sand Toad *Bufo raddei,* Japanese Tree Toad *Hyla japonica,* and Asiatic Grass Frog *Rana chensinensis.*

In the last few years, the protected areas network has expanded to include the current ranges of most reptiles and amphibians existing in Mongolia. The range of few species, such as,

the Sunwatcher *Phrynocephallus helioscopus,* Great Black Coluber *Elaphe schrencki* and Common Northern Viper *Vipera berus,* however, have not been covered by the protected areas network.

3.1.3.3 **Amphibians and Reptiles as a Resource.** Reptiles and amphibians are not treated as food resource - some of them are important for research or teaching purposes. However, snake poison and lizard meat have since become popular.

## 3.1.4 Fish

**3.1.4.1 Composition, Distribution and Stocks of Fish Species.** There are 75 species of fish belonging to 36 genera and 11 families living in the Mongolian water system. This water system is based on the three main basins in the country which geographically belong to the Arctic Ocean Drainage, the Pacific Drainage and the Central Asian Inland Basins (Figure 1).

Economically important lakes such as Tsagaan Nuur and Terkhiin Tsagaan Nuur are located in the region belonging to the Arctic Ocean Drainage Basin. The estimated annual fish yield of the Tsagaan Nuur lake, situated in the Darkhad Depression (in the far north of Mongolia), is about 100 to 150 tonnes, while the estimated yields of the Terkhiin Tsagaan lake is 50 to 100 tonnes.

The fish production capacity of the Buir Nuur lake, belonging to the Pacific Drainage Basin, is around 200 tonnes per year, while the yield of the Khoton, Khorgon, Khonkhor Ulun, Tolbo, Uvs, Uureg, Bayan and Ulaagchiny Khar lakes (which belong to the Central Asian Inland Drainage Basin), is more than 300 tonnes altogether.

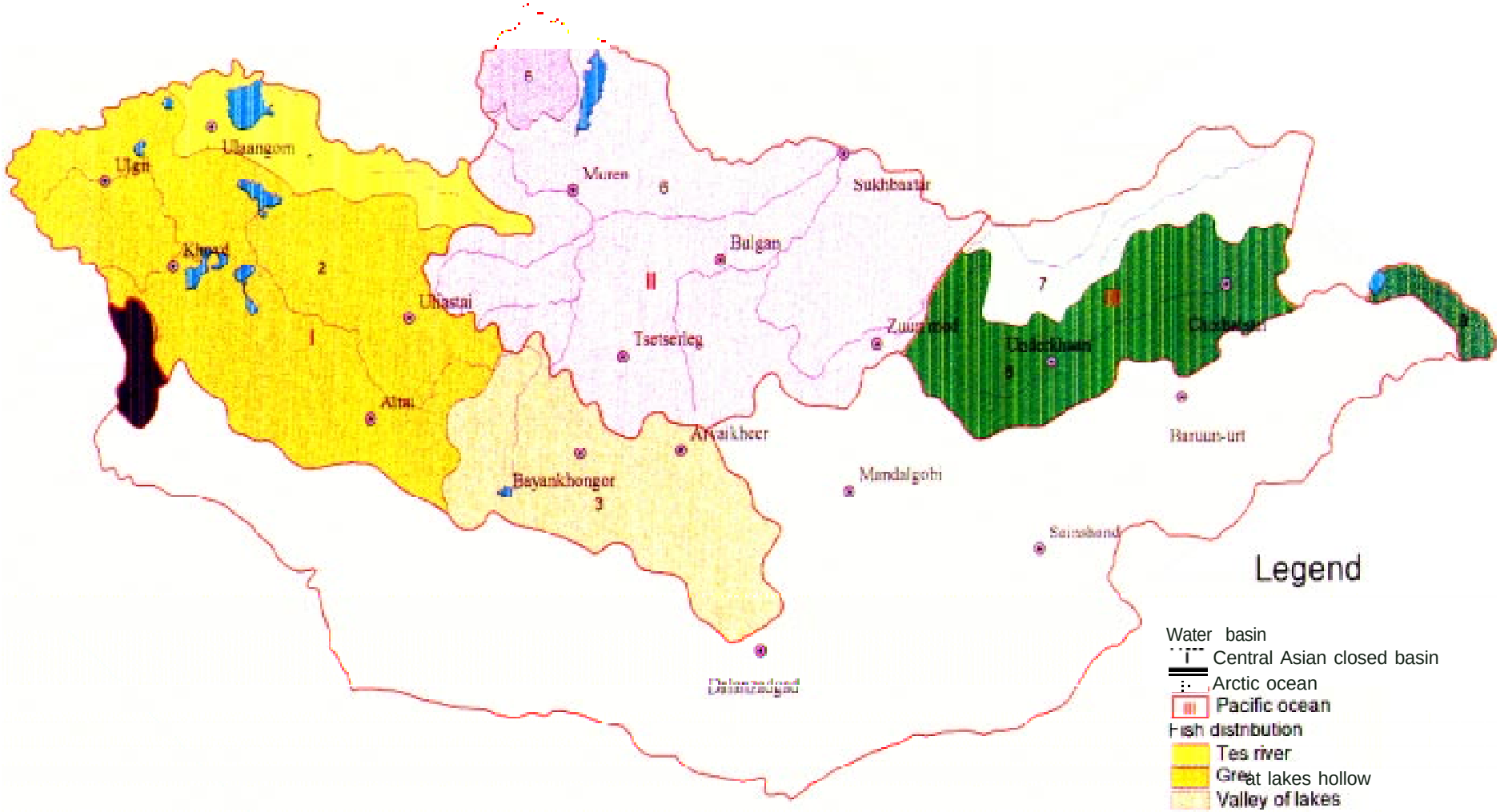
**3.1.4.2 Conservation and Propagation of Fish.** "The Mongolian Law on Hunting" adopted in 1995, supported by other laws and regulations, has played an important role in the development of fish cultures, proper use and conservation of fish species in this country. According to the provisions of this Law, the Amur Sturgeon *Acipenser schrenki* and Siberian or Baikal Sturgeon *Acipenser Baeri* are listed as protected and, the Grass (Chinese) Carp *Ctenogharyngodon idella*, Silver Carp *Hypophthalmicthys molitrix,* and Tench *Tinca tinca,* are registered as endangered. In addition, 6 species of fish have been included in the Mongolian Red Book and necessary measures have been taken to conserve these species.

In order to preserve the fish stocks on a larger scale and to maintain favourable conditions for their breeding, several lakes, such as the Khuvsgul, Uvs, Terkhiin Tsagaan, Dayan, Khoton, Khar Us lakes and some important parts of rivers have been categorized as protected areas. At the same time, in the Naiman Nuur lake in the Uvurkhangai aimag (province), located in Central Mongolia, 25 000 individuals of fry of the Omul or Peled Whitefish *Coregonus pelled* were planted for the first time in 1978 and again 50 000 in 1979. In 1986, Mongolia imported millions of the Baikal Omul or Arctic Cisco *Coregonus autumnalis migratorius* fry individuals from the former USSR and planted them in the Tsagaan Nuur lake in the Khuvsgul aimag

Between 1983-1986, around 10 million Omul or Peled Whitefish *Coregonus autumnalis* fry specimens were imported from a Fish Hatchery in the Altai Region (which belonged once to the former USSR were introduced successfully into the Ulaagchny Khar and

Figure 1.

# Distribution of fish species of Mongolia




Original map scale 1.9 000 000

## Fish distribution

| The Geographic Regions | The Central Asian | | | The Arctic Ocean | | | The Pacific Ocean | | |
|---|---|---|---|---|---|---|---|---|---|
| | I | | | II | | | III | | |
| Species, subspecies | The Tes river | Valley of the Great lakes | Valley of the lakes | Bulgan river | Shishigt river | Selenge river | Onon river | Kherlen river | Halhin river |
| Lampetra japonica | | | | | | + | | | |
| Acipenser baeri | | | | | | +++ | | | |
| Acipenser schrencki | | | | | | | +++ | | |
| Hucho taimen | | | | | ++ | ++ | ++ | ++ | ++ |
| Brachymystax lenok | | | | | + | + | + | + | + |
| Coregonus Lavaretus pidschian | | | | | + | + | | | |
| Coregonus chadary | | | | | | | + | | |
| Coregonus autumnalis migratorius | | | | | | + | | | |
| Coregonus peled | | + | + | | | | | | |
| Thymallus arcticus arcticus | | + | | + | + | + | | | |
| Thymallus arcticus grubei | | | | | | | + | + | + |
| Thymallus arcticus nigriscens | | | | | | + | | | |
| Esox lucius | | | | | | + | | | |
| Esox reicherti | | | | | | | + | + | + |
| Rutilus rutilus lacustris | | | | + | + | + | | | |
| Oreoleuciscuspotanini | + | + | + | | | | | | |
| Oreoleuciscus pewzowi | + | + | + | | | | | | |
| Leuciscus leuciscus baikalensis | | | | + | | + | | | |
| Leuciscus idus | | | | | | | + | | |
| Leuciscus waleckii | | | | | | | + | + | + |
| Ctenopharyngodon idella | | | | | | | | | ++ |
| Tinca tinca | | | | + | | | | | |
| Hypophthalmictys molitrix | | | | | | | | | ++ |
| Phoxinus phoxinus | | | | + | + | + | + | + | + |
| Phoxinus percnurus | | | | | | + | + | + | + |
| Phoxinus Lagowskii | | | | | | | + | + | + |
| Phoxinus Chaekanowskii | | | | | | | + | + | + |
| Pseuaspius leptocephalus | | | | | | | + | + | + |
| Pseudorasbora parva | | | | | | | + | + | + |
| Gobio gobio cynocepalus | | | | + | | | + | + | + |
| Gobio.Albirinartus tenuicorpus | | | | + | | | + | + | + |
| Gobio soldatovi tugussicus | | | | | | | + | | |
| Ghathopodgon chankaensis | | | | | | | + | | |
| Paraleucogobio strigatus | | | | | | | | | + |
| Chilogobio czerskii | | | | | | | | | + |
| Iadislavia taczanowskii | | | | | | | + | | |
| Saurogobio dabryi | | | | | | | | | + |
| Rostrogobio amurensis | | | | | | | | | + |
| Hemibarbus labeo | | | | | | | + | + | + |
| Hemibarbus macuatus | | | | | | | | + | + |
| Erythroculter erythropherus | | | | | | | | | + |
| Culter alburnus | | | | | | | | | + |
| Erythroculter Mongolicus | | | | | | | | | + |
| Hemiculter leucisculus warpachowskii | | | | | | | | | + |
| Rhodeus sericeus | | | | | | | + | + | + |
| Acanthornoeus asmussi | | | | | | | + | + | + |
| Carrassius carrassius | | | | + | | | | | |
| Carrassius auratus | | | | | | + | + | + | + |
| Nemachilus barbatulus | + | | | | | | | | |
| Cyprinus carpio haematopterus | | | | | | + | + | + | + |
| Cobitis taenia | | | | | | | + | + | + |
| Cobitis taenia sibirica | | | | | | + | | | |
| Misgurnus tossilius anguillicaudatus | | | | | | | + | + | + |
| Parasilurus asotus | | | | | | + | + | + | + |
| Lota lota | | | | | + | + | + | + | + |
| Perca fluviatilis | | | | + | | + | | | |
| Cottus poecilpous | | | | | | | + | | |
| Cottus sibiricus | | | | + | | + | | | |
| Mesocottus haitej | | | | | | + | | | |
| Paracottus kesslery | | | | | | + | | | |

Baga Nuur lakes in the Zavkhan aimag and also into a group of lakes named Tolbo and Khongor Ulun in the Bayan Ulgii aimag in western Mongolia.

Between 1991 and 1995, research was conducted, aiming to propagate and conserve the Taimen *Hucho taimen* and Siberian Grayling or Umber *Thymallus arcticus* in the lakes of the Darkhad Depression.

3.1.4.3 **Fish as a Resource.** Fish was never consumed by Mongolians in the past because they mainly ate meat. However, in the beginning of the second half of this century, they started to export fish and eventually began to learn how to catch and eat fish.

The establishment of fisheries in Mongolia started in the 1950s by the lakes known as Buir (located in the far eastern edge of Mongolia), Ulgii Nuur (located in Central Mongolia), and Tsagaan Nuur (situated in the northern part of the country). Until 1990, Mongolia produced an annual average of 120 to 200 tonnes of fish.

Due to the collapse of the centrally planned economy in 1990, fishing, as well as other economic sectors, became disorganized and lost their previous operational efficiencies; as a result, a sharp reduction in yield followed. At present, illegal fishing, an activity which employs the use of harmful methods, has started to threaten especially, the Taimen and Sig or Siberian Whitefish populations in those lakes stocked originally by such species.

## 3.1.5 Insects

Mongolian scientists have studied insects in cooperation with researchers from Germany, Czechoslovakia, Poland, Russia and Hungary. The Mongolian-Hugarian and Mongolian-Russian joint studies in 1963- 1968 and 1967, respectively, contributed significantly to research on insect morphology, their species composition, distribution, biology and ecology.

**3.1.5.1 Composition and Distribution of Insect Species.** Mongolian insect collections with 1.5 million speciments, were re-studied and over 2000 species, 100 genera and sub-genera, 2 families, all new in the world, were found. Altogether, 13 000 insect species of 26 orders have been registered in Mongolia (Table 1).

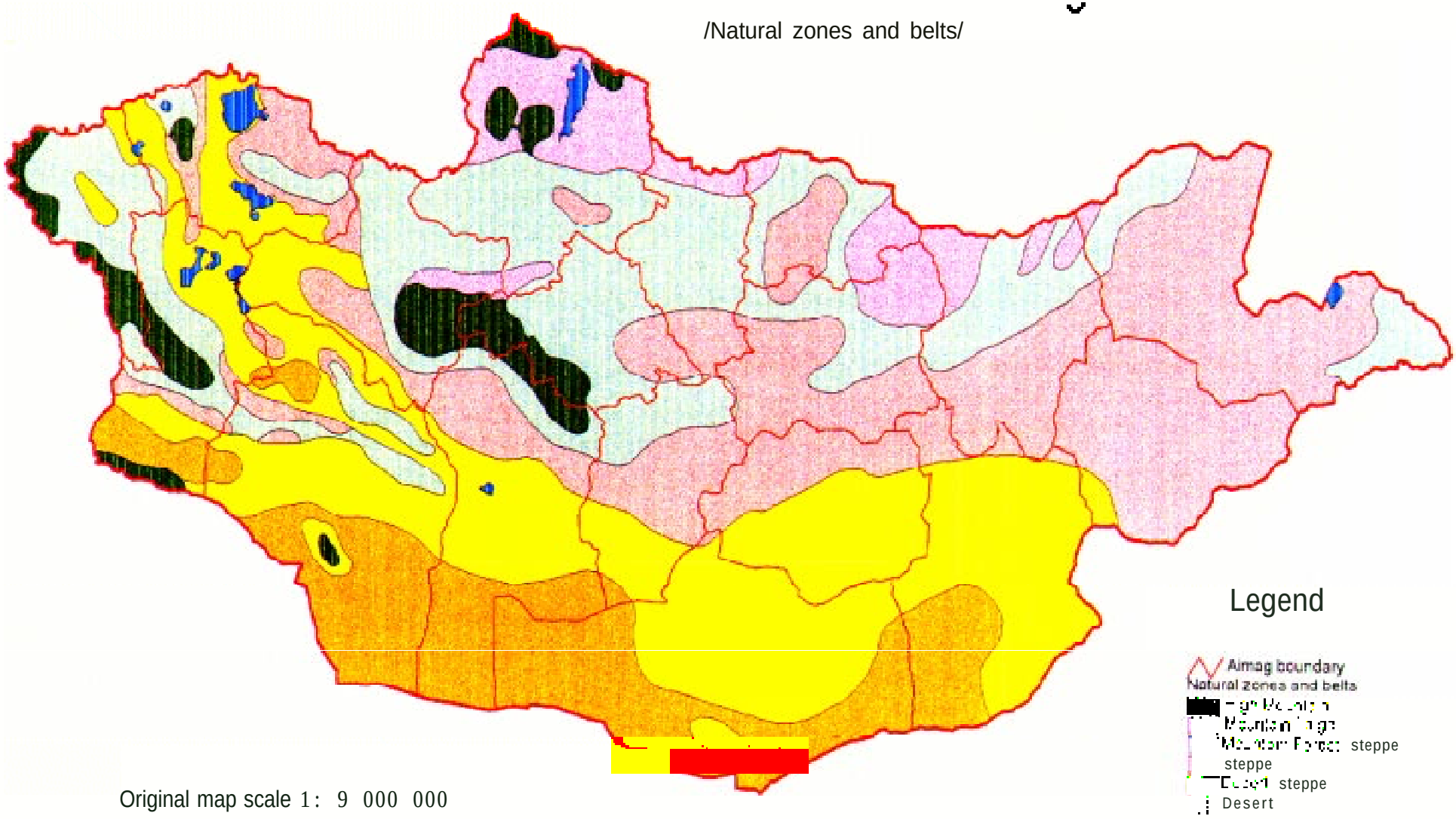
The orders, *Coleoptera, Heteroptera, Orthoptera* and *Hymenoptera* have been studied relatively well in Mongolia compared to the other orders of insects. Although *Diptera* with 1500 species, *Homoptera* with 920 species and *Lepidoptera* with over 1000 species are the richest orders in their species composition; they may, if studied further, potentially contain far more species. This report gives information about the biological and ecological features, species compositions, distributions and the economic importance of a limited number of orders (Figure 1).

*1. Collembola* 15 species out of the 26 in this order have been found only recently by Mongolian scientists. The number of Collembola individuals per square meter in the river valleys can reach 30 to 50 thousand individuals, but it declines to 10 to 12 thousand individuals per square meter in meadows and to 5 to 6 thousand individuals in the steppes. The species belonging to this order intensify the decomposition of organic matter in the soil and, therefore, have an important role in improving soil fertility.

Figure 1.

# Distribution of some insect associations in Monaolia

/Natural zones and belts/




Original map scale 1: 9 000 000

## Explanation of the insect distribution map

**High mountain zone**

Carabidae, Curculionidae, Chrysomelidae, Staphylinidae, Diptera and Tipulidae are dominant. There are mostly species, that live on soil, with no wings or short wings, and there are very few species that live under the soil

**Taiga zone**

Cerambycidae, Scolytidae, Siricidae, Tenthredinidae and many prders from of Lepidoptera, for example, Tortricidae and Lasiocampidae are dominant. Species composition is not rich with few endemic species Khentii and Khuvsgul have richer species composition, whereas Mongol-Altai and Khangai region has poorer composition.

**Mountain-forest steppe zone**

This zone is specific with its rich insect species. Hemiptera, Coleoptera, Lepidoptera, Cantharidae, Coccinellidae and Miridae are dominant, Insect species that live on bushes and grasses are common. The total number of insects is very high and their distribution is even. They have the largest population in early summer. Soil insects are also common.

**Mountain steppe zone**

This zone is rich with species that live on weeds and bushes and is dominated by Orthoptera, Homoptera, Tenebrionidae, Meloidae, Chrysomelidae, Curculionidae and Scarabaeidae. Although the insect population is large, its distribution is not even. Specks composition is the richest in spring and early summer. Endemic species are common.

**Semi-desert zone**

It is specific with its rare insect species. Orthoptera, Tenebrionidae, Curculionidae, Scarabaeidae and Meliodae are dominant. Nocturalspecies are common. Pray species of reptiles and species that live under soil are common. Active period in spring is not noticeable.

**Desert zone**

Species distribution is uneven, Nocturnal species that live in sandy and salty environment are common. Tenebrionidae dominants here, whereas Acrididae, Formicidae and Myrmeleonidae are common. Although the insect population is large, it is noticeable due to their nocturnal life. Active period in spring is not noticeable.

Table 1

**Insect orders, families, genera and species** in Mongolia

| Order | Number of families | Number of genera | Number **of species** |
|---|---|---|---|
| 1. Collembola | 4 | 6 | 26 |
| 2. Thysanura | 2 | 3 | 9 |
| 3. Ephemeroptera | 9 | 16 | 43 |
| 4. Odonatoptera | 8 | 19 | approx. 70 |
| 5. Mantoptera | 1 | 5 | 5 |
| 6. Plecoptera | 8 | 24 | 41 |
| 7. Blattoptera | 2 | 3 | 3 |
| 8. Orthoptera | 11 | 70 | approx. 170 |
| 9. Dermaptera | 2 | 3 | 4 |
| 10. Psocoptera | 9 | 16 | 31 |
| 11. Mallophaga | 5 | 13 | 52 |
| 12. Anoplura | 2 | 4 | 5 |
| 13. Homoptera | 22 | 289 | approx. 920 |
| 14. Heteroptera | 25 | 180 | approx. 500 |
| 15. Thysanoptera | 3 | 18 | 42 |
| 16. Coleoptera | 34 | approx. 610 | approx. 2800 |
| 17. Strepsiptera | 1 | 1 | 1 |
| 18. Neuroptera | 6 | 24 | 77 |
| 19. Raphidoptera | 2 | 3 | 7 |
| 20. Trichoptera | 16 | 39 | 94 |
| 21. Lepidoptera | 31 | approx. 120 | approx. 1000 |
| 22. Hymenoptera | 42 | approx. 150 | approx. 1350 |
| 23. Siphonaptera | 3 | 39 | 157 |
| 24. Diptera | approx. 30 | approx. 140 | approx. 1500 |

2. ***Thysanura*** 3 species and 2 genera in the *Lepismatidae* family, 6 species and 1 genera in *Machilidae* family have been described for the first time in the world. 7 out of these 9 species are endemic to Mongolia. The order *Thysanura* is an interesting group for further scientific studies.

3. ***Ephemeroptera*** *Ephemeroptera* larvae live in the water and are an important food resource for several fish and some waterfowls. On the other hand, species numbers of *Ephemeroptera* have been used as an indicator of the water pollution levels and are, therefore, important organisms in water quality diagnostics.

***4. Odonata*** *Odonata* larvae are an important food resource for certain fish and bird species, but also the larvae themselves eat small fish and fish spawn. The *Odonata* -larvae are hosts of some fish parasite species causing negative impacts on fishery.

***5. Plecoptera*** *Plecoptera* larvae live in the water and provide an important food source for several game fish species. They are very sensitive to water pollution. Due to water pollution caused by industry, they disappear in large numbers and are, therefore, important indicators of the water quality.

*6.* ***Orthoptera*** Several endemic species belong to this order. 47 per cent of the species are endemic belonging to 50 per cent of the genera. There are 98 species found in the grasshopper family 21 of which are endemic.

***7. Malophada*** The species belonging to this order are bird and mammal parasites and, therefore, their distribution depends on the distribution of their host species. The 30 year study on *Malophala* species composition, their distribution and their host species have revealed that there are, 52 species, belonging to 13 genera, 5 families and 2 sub-orders. 36 out of the 52 species found in Mongolia were previously unknown in the world.

***8. Homop tera*** There are great numbers of a variety of species and genera in this order and the number of individuals can also be high resulting in noticeable impacts on the economy. Most of the species live on plant stems and leaves feeding on plant juice. *Trialeurodes vaporrorum* have come into the country with the plant seeds from China and have been causing negative impacts on greenhouse cultivations of flowers and vegetables.

9. ***Heteroptera*** Most species of this order feed on the juice of plant stems and leaves or are parasitic animals. There are also many species that eat small insects and their larvae. Some families such as *Corixidae, Notonecfidae* and *Nepidae,* which live in the water, but *Hydrometridae, Veliidae* and *Gerridae* live on the surface of the water. Many species of *Heteroptera* can occur in large numbers and multiply fast, so they have a big impact on nature.

***10. Coleop tera*** They occur in all natural zones of Mongolia and play a great role in the agrocultural environment. They live everywhere, in surface soil, water and plants. In terms of their food, they can be divided into predators, herbivores, and omnivores. In terms of species composition, the number of genera in different families are allocated as follows: 51 in *Carabidae, 20* in *Gyrinidae,* 16 in *Histeridae, 6* in *Catopidae, 6* in *Silphidae, 9* in *Liodidae, 60* in *Staphylinidae, 5* in *Dermestidae, 5* in *Byrrhidae, 7* in *Cantharidae, 8* in *Meluridae*, *6* in *Cleridae, 3* in *Ostomotidae,* 1 in *Ptinidae,* 1 in *Anobidae,* 1 in *Bostrychidae, 29* in *Elateridae,* 16 in *Buprestidae, 9* in *Nitidulidae, 5* in *Cucuidae*, *2* in *Phalacridae, 25* in *Coccinellidae*, *6* in *Mordellidae, 39* in *Tenebrionidae,* 10 in *Meloidae*, 5 in *Bruchidae*, *53* in *Cerambycidae, 49* in *Chrysomelidae*, *12* in *Attelabidae, 40* in *Scarabaeidae, 4* in *Anthribidae*, *67* in *Curculionidae* and 24 in *Ipidae.* Their distribution differ according to different ecological zones (Table 2). The *Tenebrionidae* family live in the semi-desert zone. All other families have greater number of species in the forest-steppe zone.

***II. Raphidoptera*** They mostly live in trees eating larvae of other insects. Most of them consume Carabidae larvae and, are therefore, helpful in protecting forests from insects.

***12. Neuroptera*** They live on small insects and their larvae and so, play an important role in controlling the numbers of insects. They have a positive impact, especially on plant growth by eating those small insect species which thrive on the juice of plants.

Table 2

**Coleoptera distribution in different ecological zones of Mongolia**

| Coleoptera | Ecological zone | | | |
|---|---|---|---|---|
| | Forest-steppe | Steppe | Semi-desert steppe | Desert |
| Carabidae | **260** | **203** | 105 | 17 |
| Staphylinidae | 175 | 138 | 54 | 19 |
| Elateridae | 59 | 22 | 18 | 8 |
| Scarabaeidae | 74 | 90 | 54 | 26 |
| Tenebrionidae | 27 | 36 | 101 | 65 |
| Chrysomelidae | 228 | 174 | **117** | **39** |

***13. Lepidoptera*** They have great importance in nature and plant growing. Most butterflies feed on plants and mediate the pollination process. The larvae of several butterfly species feed on plants causing great negative impact on plant industry. For example, *Tinea pelinello* often damage woollen goods, dried fruit, mushrooms and candy.

*Lepidoptera* is one of the biggest insect orders in Mongolia. There are over 1000 species of butterflies from about 30 families. They can exist in large numbers, sometimes causing severe damage to forests, pastures and vegetable farms. These include *Tineapelinello* belonging to the *Tineidae* family, which can damage skins and hides; *Plutella maculipennis* belonging to the *Hyponoeutidae* family, which destroys cabbage plants in open fields and greenhouses, *Loxostede sticticalia* belonging to the *Pyralidae* family, which destroys many planted and natural plant species, *Peiris rapae* from the *Peiridae* family destroys cabbage and other plant leaves, *Aporia crataegi* damages apples and other fruit trees, *Dendrolimus superans sibiricus* from the *Lasiocampidae* family destructs larches, and *Orgyia antiqua* from the *Orgyidae* family which damages larches especially in the Khangai and Khentii regions.

**14. *Siphonoptera*** They live on animals, livestock, or in their shelthers. Because they are parasites of birds and other mammals, they can impact livestock production and wildlife negatively. It has been shown that they can transmit more than 30 different microorganisms from one species to another, bringing diseases to humans and animals.

*Vermipsylaa alakurti* and *Dorcadia joffi* live on livestock, and wild sheep and goats causing them to lose weight and energy.

Several species of *Siphonoptera* are specialized on one host species only. For example, 58 species of *Siphonoptera* were found in *Ochotona daurica,* **47** species on *Citellus undulatus* and 48 species on *Microtus brandti.* In addition, it was found out that fewer species of *Siphonoptera* live on birds. 37.1 per cent, or 55 species, of 157 *Siphonoptera* species are endemic to Mongolia.

**3.1.5.2 Insects as a Resource.** The Protected areas of Mongolia are playing an important role in insect conservation. Data collected in studies on insect species composition, their distrbution, importance and impacts, provide the scientifc basis for insect conservation

and control of harmful species. “Insects of Mongolia” consisting 11 Volumes and other scientific papers are available today regarding this issue.

Currently, 11 species from the order *Lepidoptera, 4* species from *Hymenoptera, 2* species from *Coleoptera, 1* species from *Odonata* and 1 species from *Diptera* are included in the Mongolian Red Book. Insects of Mongolia have been used for teaching and collection purposes.

## 3.1.6 Other animals

3.1.6.1 Molluscs. 36 species of aquatic and terrestrial Molluscs have been observed in Mongolia.

3.1.6.2 Worms. Although the study of this group has just started, 456 species of parasites have been found. They include 88 *Monogenea* species, 3 1 *Trematoda* species, 115 species of *Cestodea,* 20 1 species of *Nematoda,* 18 species of *Acanthocephala* and 2 species of *Hirudinea.*

3.1.6.3. Protozoa. 24 species that live on fish have been registered. They include 1 species of *Hymenostomata, 7* species of *Peritrichida (Infuzoria),* 1 species of *Parasitomonadina* (*Flagellata*), *13* species of *Myxosporodia (Sporozoa)* and 2 species of *Coccidiomorpha (Sporozoa).*

# 3.2 Conservation, Restoration and Use of Mongolian Flora

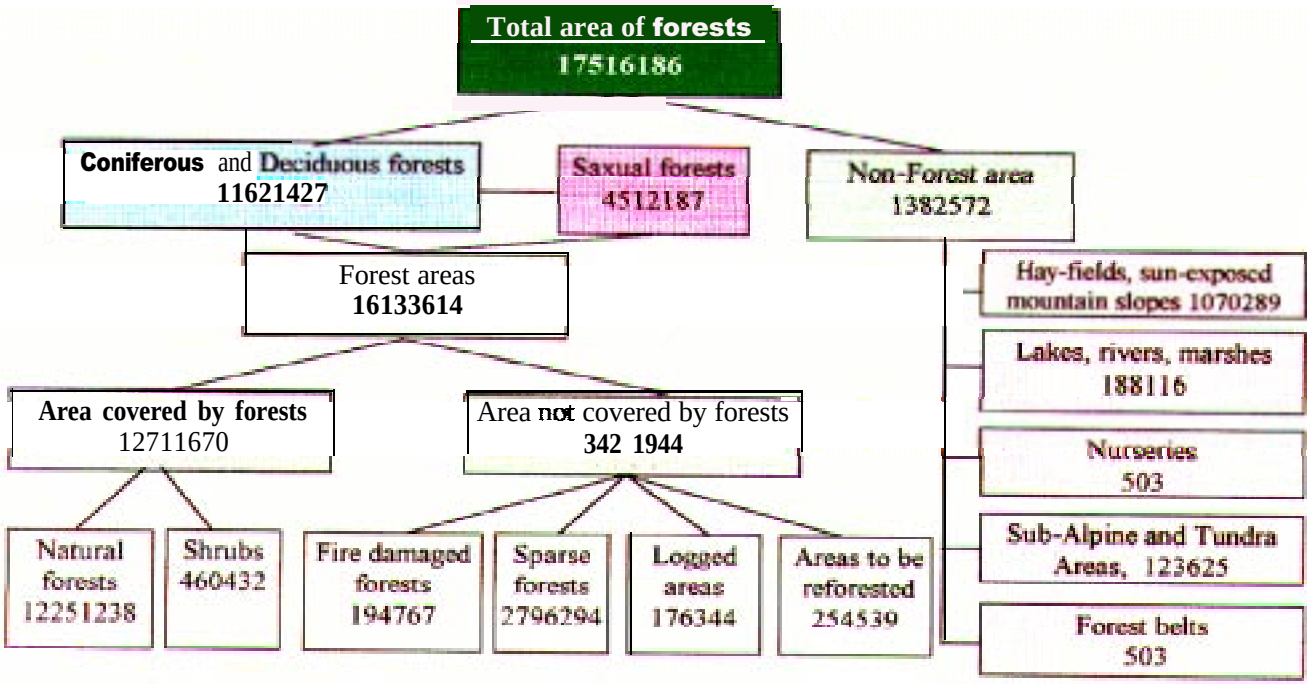
## 3.2. I Protection, Use and Restoration of Forests

**3.2.1.1 Composition, Distribution and Resource Abundance of Forest Species.** The natural regeneration of Mongolian forests is slow, and the forests are often damaged by fires and insects due to the Central Asian harsh continental climate. Only 8.1 per cent of Mongolia is covered with forests, which grow along the watersheds of the three large water basins in the world. The forests in Mongolia play an important role in the maintenance of naturally balanced water conditions in rivers and streams, in the prevention of soil deterioration, in the amelioration of the climate, in the control of the green house gasses, in the reduction of harmful emissions and in the preservation of the permafrost in its ecologically important form.

Mongolian forests contain about 140 species of trees, shrubs and woody plants. Forests cover a total of 17 5 16 186 hectares, of which **coniferous and deciduous** forests cover **74.2 per cent, and** Saxaul *Haloxylon ammodendron* forests, **25.8 per cent. 92.1 per cent or 16 133 614** hectares of the total original forested area is currently growing trees, while 7.9 per cent or 1 382 572 hectares is not (Figure 1).

Figure 1

**The forest resource structure of Mongolia (per ha)**



# Map of forests in Mongolia

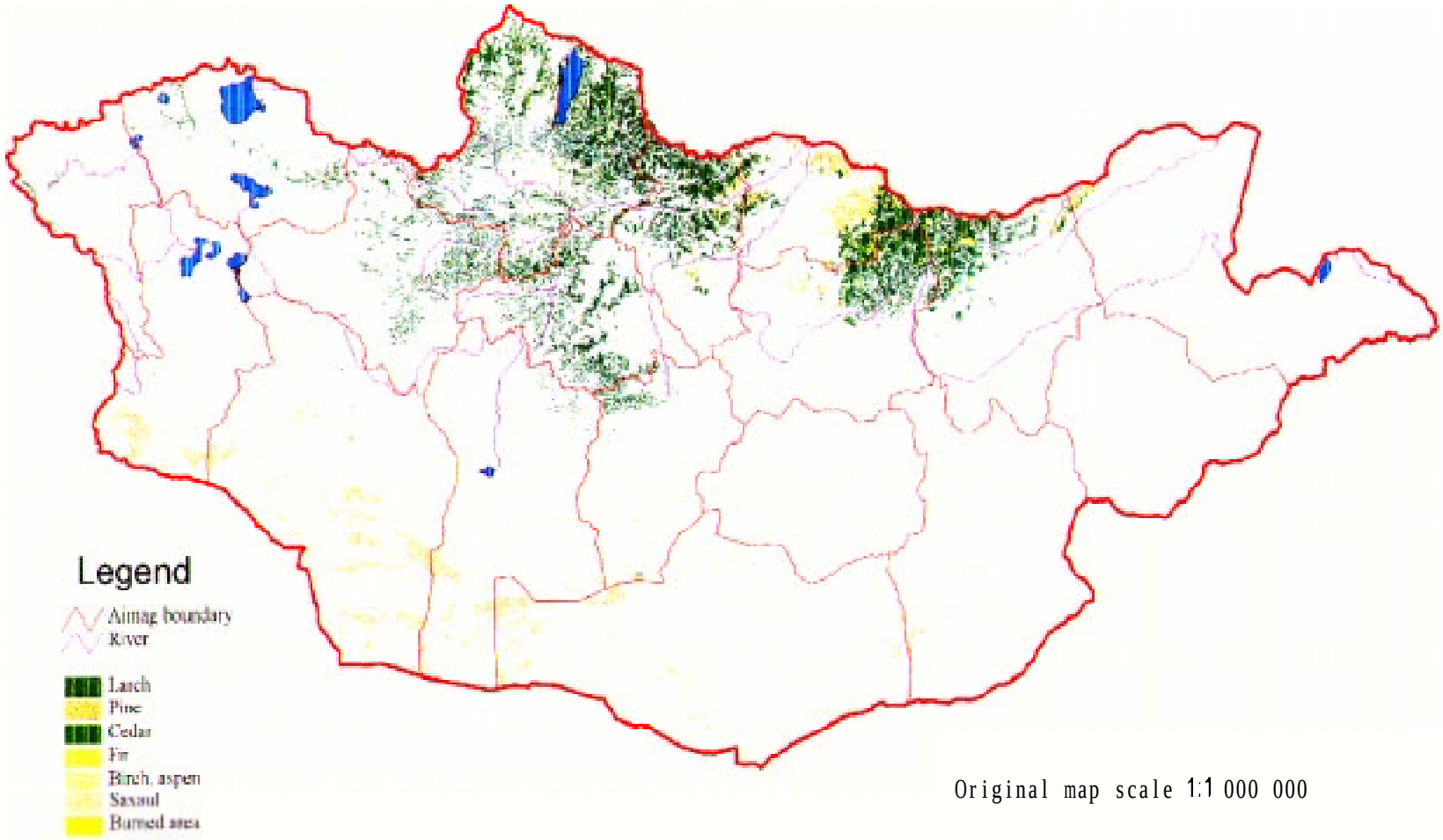


Table 1.

**Distribution of Forest**

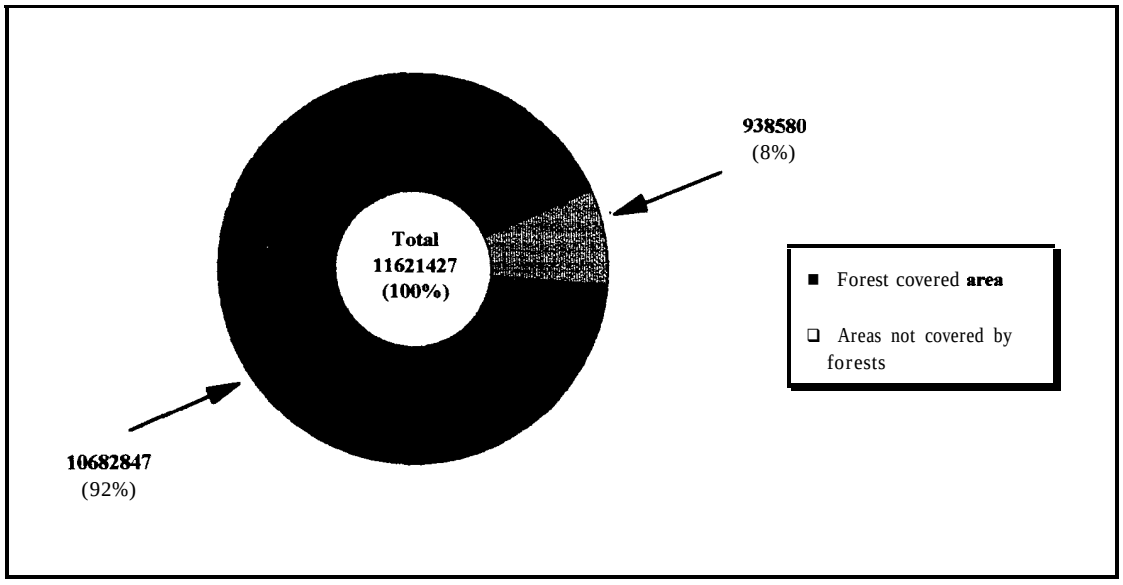
| **Area covered by forest** | | | **Area not covered by forest** | | | | | **Total forest area** | **Area of non-forest land** | | | | | **Non-forest area** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Natural forests | Shrubs | Total | Fire damaged | Sparce forest | Logged area | Area to be reforested | Total | | Hay-field, sun-expposed area of a montai | Lake, river, marsh | Nursery | Sub-alpine Tundra, sand | Forest belt | | |
| Total forest area | | | | | | | | | | | | | | | |
| 10222415 | 460432 | 10682847 | 194767 | 446124 | 51350 | 246339 | 938580 | 11621427 | 1070289 | 188116 | 503 | 123625 | 39 | 1382572 | 13003995 |
| 78,7 | 3,5 | 82,2 | 1,5 | 3,4 | 0,4 | 1,9 | 7,2 | 89,4 | 8,2 | 1,4 | | 0,9 | | 10,6 | 74,2 |
| Total saxaul forest area | | | | | | | | | | | | | | | |
| 2028823 | | 2028823 | | 2350170 | 124994 | 8200 | 2483364 | 45121187 | | | | | | | 4512187 |
| 45 | | 45 | | 52,1 | 2,8 | 0,2 | 55 | 100 | | | | | | | 25,8 |
| **Total of forest resources** | | | | | | | | | | | | | | | |
| 12251238 | 460432 | 12711670 | 194767 | 2796294 | 176344 | 254539 | 3421944 | 16133614 | 1070289 | 188116 | 503 | 123625 | 39 | 1382572 | 17516186 |

Figure 1 shows the area covered by coniferous and deciduous forests (excluding Saxaul forests). (Table 1)

The most common tree species in these forests is Larch (Figure 2 & 3).

Figure 2

**The structure of total forested areas (per ha)**




* Saxaul Forest not included

Figure 3

**The structure of areas currently covered by forests (per ha)**

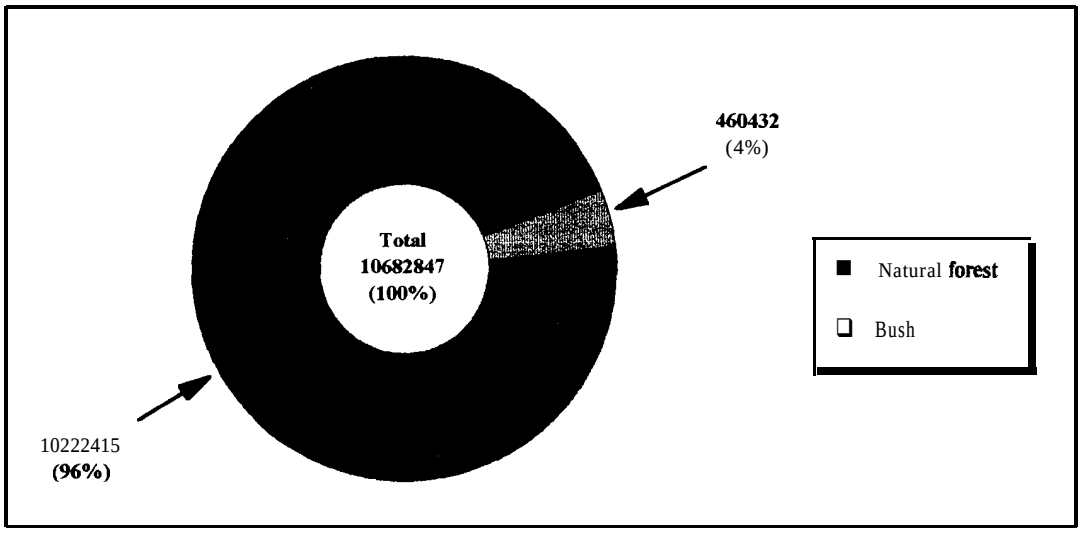
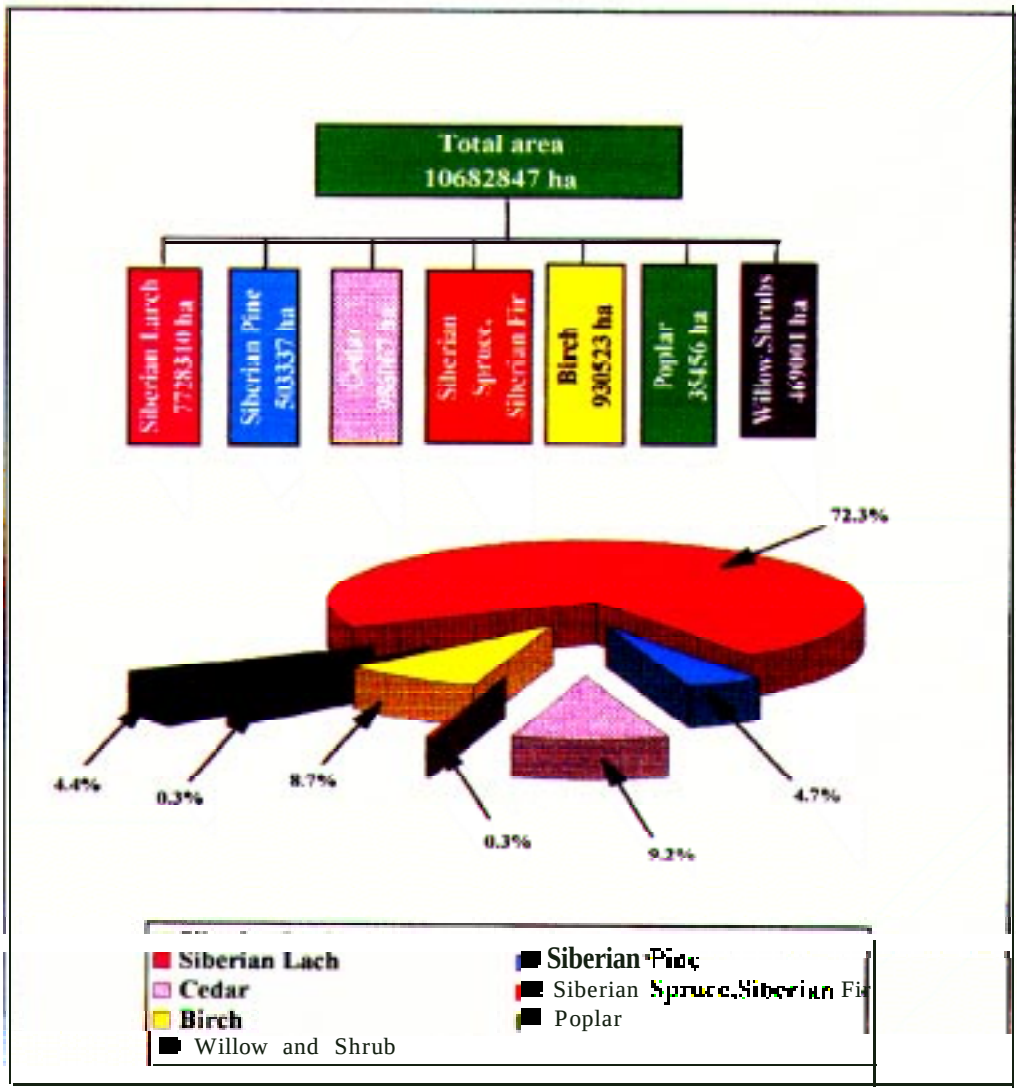


Figure 4

**Proportion of various forests (per ha)**

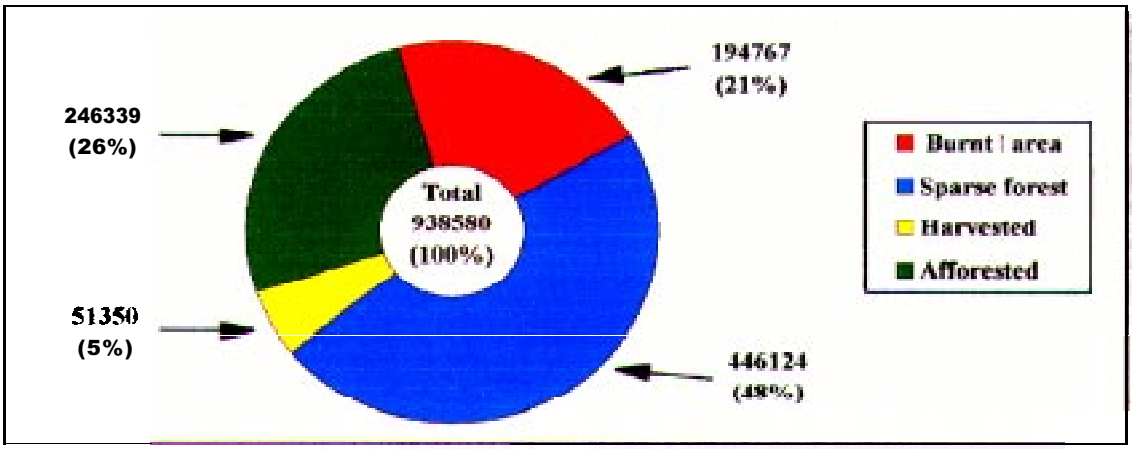



**The area** not covered by forests includes burnt areas covering 194 767 hectares, sparse forests occupying 446 124 hectares, logged areas covering 51 350 hectares and reforested areas occupying 246 339 hectares (Figure 5). In addition, this category includes the sun exposed mountainous areas totalling 1 070 289 hectares, marshes, rivers and lakes totalling 188 116 hectares, nurseries totalling 503 hectares, mountain peaks totalling 123 625 hectares and forest strips totalling 39 hectares.

According to the 'Mongolian Law on Forests", forests in this country have been divided into three categories (zones) according to their significance:

Figure 5

The structure of areas not covered by forests (per ha)



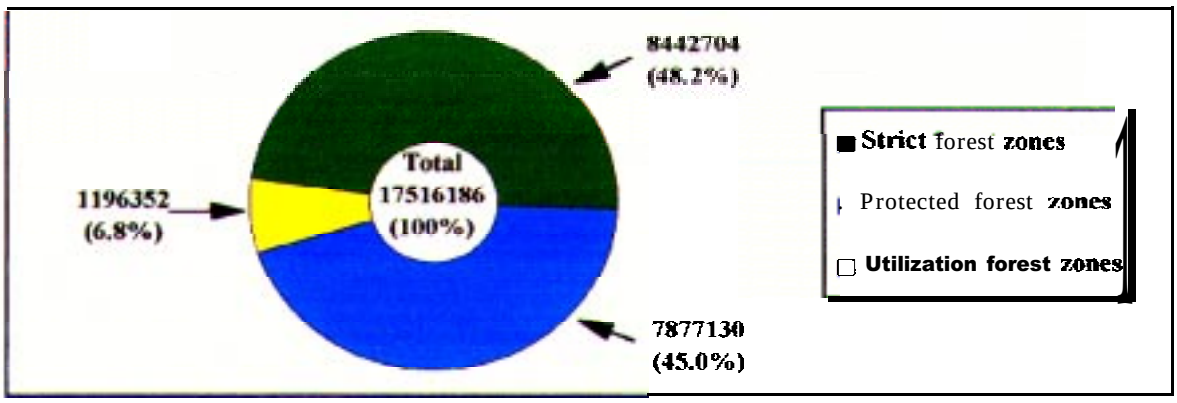

(a) The "Strict Forest Zones" include the strictly protected sub-alpine forests and those pans of the protected highland areas which have already been included in the network of the established Protected Areas, and also protected areas in other zones and regions like the steppe and desert. By and large, these densely forested zones have been considered as a part of Mongolia's emergency strategy. These forests cover up to 48.2 per cent of the country's total forested area

(b) The "Protected Forest Zones" include natural forests and woody plant reserves in the green sub-zones, forests in the Buffer zones, all saxaul forests, forests in oases and on mountain slopes steeper than 30 degrees. Forests in this category cover 45 per cent of the total forested area.

(c) The "Utilization Forest Zones" include all other forests, excluding those mentioned in other categories; these zones consist of forests where selective timber cutting and logging are allowed. These forests make up over 6.8 per cent of Mongolian forests (Figure 6).

Figure 6

Total area of various forest zones (per ha)



The forest growth rate and the quality of forests depend on environmental, climatic and geographical conditions (Table 2).

Table 2

**Basic forest inventory statistics**

| Tree Species | Average age of trees (years) | Bonitet index | Amount of wood ($m^3$/ha) | Annual growth ($m^3$/ha) |
|---|---|---|---|---|
| Siberian Larch | 129 | 4.2 | 140 | 1.2 |
| Siberian Pine | 97 | 3.7 | 139 | 1.5 |
| Cedar | 138 | 4.3 | 177 | 1.2 |
| Siberian Spruce | 114 | 4.2 | 124 | 1.3 |
| Siberian Fir | 130 | 5.0 | 130 | 1.2 |
| Birch | 44 | 4.2 | 65 | 1.3 |
| Aspen | 46 | 4.3 | 73 | 1.8 |
| Poplar | 39 | 4.1 | 66 | 2.8 |
| Willow | 27 | 4.2 | 19 | 0.9 |
| **Total** | | 4.2 | 103 | 1.4 |

The total amount of wood in Mongolian forests is 1 334 598 000 m³; according to species, the amounts are: Siberian Larch 1 029‘765 900 m³, Siberian Pine 70 5 16 700 m³, Cedar 161 393 900 m³, Siberian Spruce 3 624 800 m³, Siberian Fir 375 500 m³, Birch 66 053 300 m³, Aspen 1 528 300 m³, Poplar 1 118 300 m³ and Willow 221 400 m³.

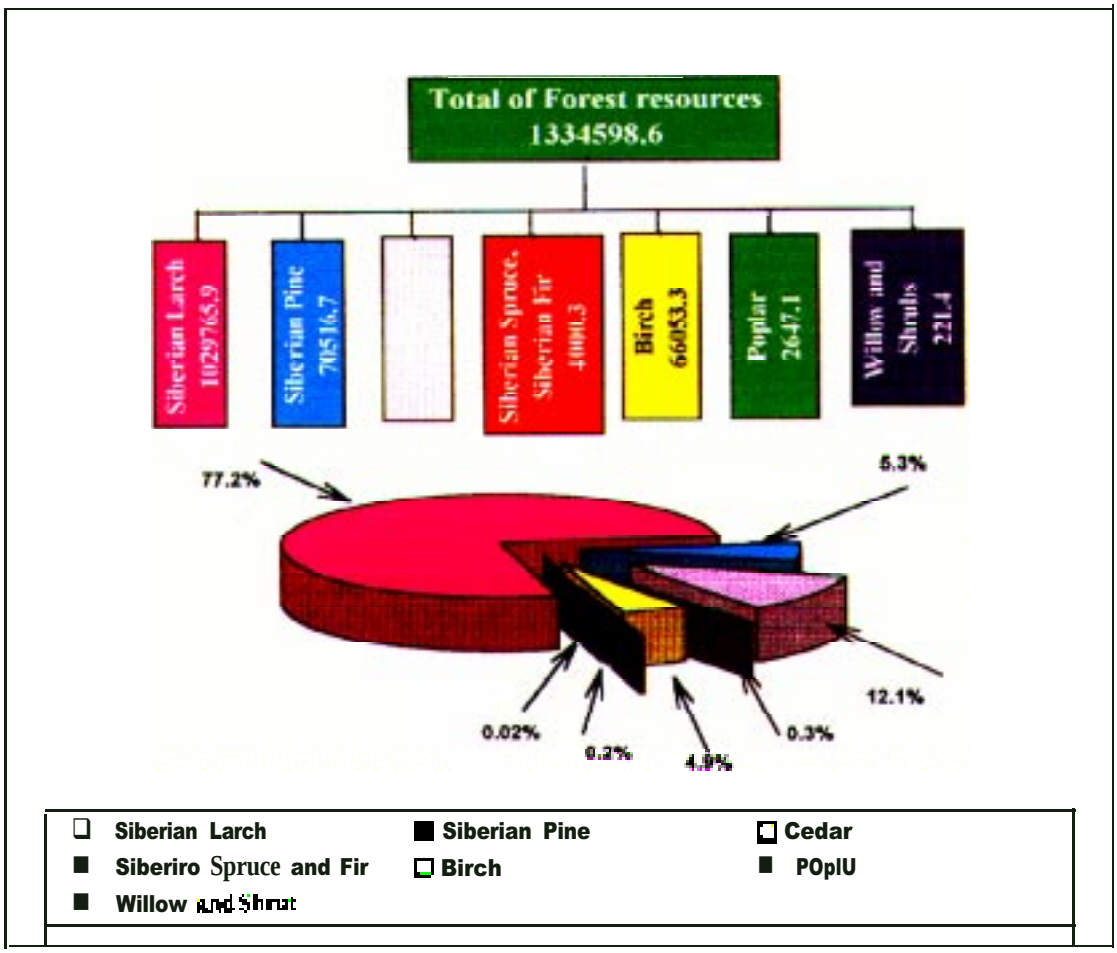
According to the “Mongolian Law on Forests”, the amount of wood in the “Strict Forest Zones” is 364 904 800 m³, in the “Protected Forest Zones”, 838 242 900 m³ and in the “Utilization Forest Zones”, 13 1 450 800 m³ (Figure 7).

The general indicators of forest conditions in Mongolia show that the average bonitet is 4.2, the average coverage per hectare is 0.53, the amount of wood per hectare is 103 m³, and the mean ages of coniferous trees and deciduous trees are 122 and 40 years, repectively. Khuvsgul, Selenge, Tuv, Bulgan and Khentii aimags have more forests than the other aimags in their areas (Figure 8).

Studies on Saxaul forests started in 1940 and the first Saxaul forest survey shows that in 1975, the area of the Saxaul forests in the sample area was 3 860 700 hectares. The forest survey carried out again during 1989- 1990, using maps drawn on a scale of 1: 100 000, found out that 4 5 12 187 hectares in 39 sums in 7 aimags had Saxaul trees. Out of this total of 4 5 12 187 hectares, 2 028 823 were covered by Saxaul forests, 2 350 170 were only sparsely covered by individual trees, and an area of 124 994 hectares were logged and 8 200 hectares were reforested by the Saxaul. The Gobi Altai and South Gobi aimags are abundant with Saxaul forests. The total amount of Saxaul is 1 400 100 m³, their mean age is 20 years, the average bonitet is 3.1 and the average coverage per hectare is 0.35. The total forest coverage in Mongolia is 8 per cent of the area but if Saxaul forests are excluded, it is 6.8 per cent.

**Figure 7**

Total area covered by forests (per ha)

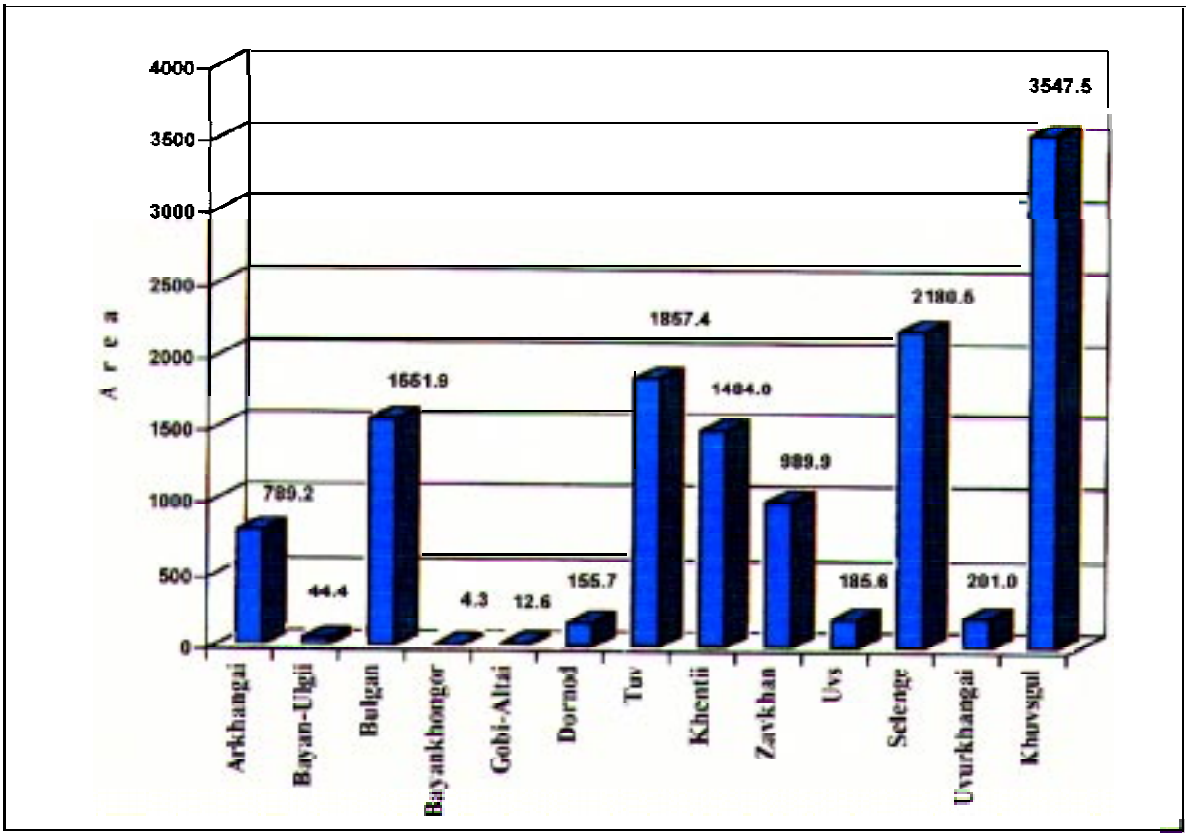



**3.2.1.2 Conservation of** Forests. A legal foundaton for forest protection in terms of the proper utilization of forest products and restoration was created through the establishment of the "Law on Forests" in 1995 and the "Law on Protection from Forest **and** Steppe Fires" in 1996 passed by the Mongolian Great State Khural. Furthermore, the enforcement of the "Law on Levying Fees on the Harvest of Timber and Firewood" strengthened the implementation of these two laws by creating an economic incentive for the conservation of forests. According to this law, not less than 70 per cent of income from timber harvesting shall be used for the protection and restoration of forests, as well as. for the prevention of forest fires and for the control of harmful insects in the forests.

At the same time, forest protection **policies were formulated in three fundamental** documents: "Basic Policy Orientaiton of the Government with regard to Ecology", "National Action Programme to Combat Desertification" and "National Action Programme on the Protection of Biodiversity" Accordingly, annual plans have been made on how to implement these Laws and put basic guidelines into practice.

Figure 8

Forested areas in various aimags (per 1000 ha)




During the last few years, as a result of extending the protected areas network. forest utilization has been restricted in ecologically important areas. Some of the most important forested aimags, like Selenge, Khentii and Arkhangai, have started to carry out forest surveys in order to get a scientific basis for the protection and sustainable use of forests in Mongolia. Moreover, in order to nurse the growth of rare tree species. a project to plant 70 thousand seedlings of 114 species belonging to 29 genera and 20 families has begun.

A study on planting rare and household trees such as *Populus diversifolia*, *Tamarix ramosissima*, *Haloxylon ammodendron*, *Elaeagnus moorcroftii* and some *Salix* species has started At the moment, fruit trees like *Hippophae* and *Ribes nigrum* have been planted in an area of 370 000 hectares.

On average. 2 2 million cubic metres of wood were cut yearly until 1990, and after this the figure changed to 800 000 cubic metres per year. The "Law on Forests" prohibited clear-cutting and replaced it with selective cutting in 1995 - this was an important legal act in maintaining the ecological balance in Mongolian forests.

In consideration of the number of forest fires caused by the warm and dry climate and careless human activities, measures on fire prevention and damage assessment have been taken Furthermore, as a result of conducting a study on species composition, biology and ecology of

harmful forest insects, **methods to control them have been** developed With the assistance of foreign countries and organizations in forest protection and restoration, work to enhance the results and the skills of the nationally trained cadres has started.

Within the framework of rhe project, **"Studies on** Forest Reserves". Japanese and Mongolian forest experts have carried out a remote sensing study, using Landsat data covering 4 280 000 hectares of area **in** the Selenge **aimag** with a grant from the Japanese Government during 1994-1997 which determined forest distribution and land use

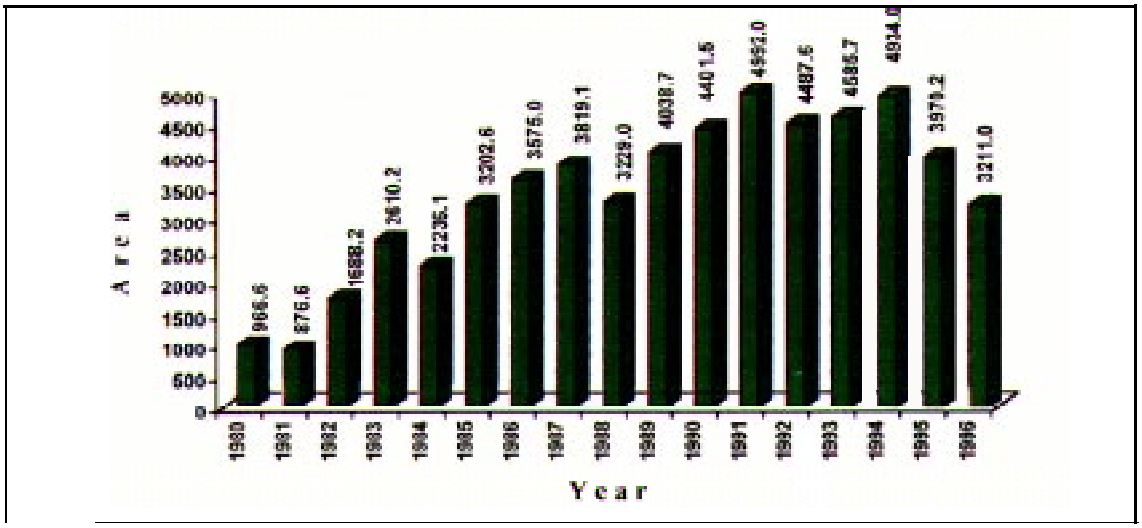
Studies on forest management and reserves in an intensively used area. covering 160 000 hectares. was carried out in Altanbulag in the Selenge aimag and in Tujiin Nars in the Eroo soum and as a result, a project on forest protection and management was initiated.

As a result of this study, maps of land classification and vegetation, as well as, maps of the forest soil. forest distribution and forest measurements, covering an area of 160 000 hectares, were drawn on a scale of 1 25 000

Simultaneously, a joint project between the **UNDP** and the Mongolian government, **known as** thc "Management of forest restoration and natural disaster reduction", is concerned with developing a national program to reduce the danger of natural disasters. and has founded a nursery, planted 2.4 million seedlings and reforested 350 hectares of burnt areas **in the** Selenge **and** Arkhangai aimags.

3.2.1.3 Restoration of Forests. As a result of taking the measures already discussed in the "Forest protection" part of this report. conditions for the natural restoration of forests have improved. In Mongolia. only forest utilization activities have been popular and restoration and reforestation activities have largely been abandoned **till the** end of 1960. Forest restoration started in 1970 but only very small areas were reforested starting from 1980. As a result of intensifying these activities according to the state plan, the scale of this sort of work is being gradually enhanced (Figure 9).

Areas Reforested (per ha)



During the last 4 years, about 4000 hectares of land were reforested. The state budget on reforestation has been: approximately 115 million tugruks in 1995, 128 million tugruks in 1996, and 196 million tugruks in 1997; a further 240 million tugruks will be spent in 1998.

As a result of increasing reforestation and reducing timber exploitation, the size of areas damaged by insects is getting smaller (Table 3).

Table 3

Forests damaged by timber exploitation, fires **and insects**

| Year | Timber exploitation areas, (per 1000 $m^3$) | Area **damaged by** fires, (per 1000 ha) | **Area damaged** by insects, (per **1000** ha) | Reforested **areas,** (per ha) |
|---|---|---|---|---|
| 1980 | 2130.2 | 107.2 | 115.0 | 966.6 |
| 1981 | 2173.5 | 4.6 | 150.0 | 876.6 |
| 1982 | 1939.1 | 153.6 | 150.0 | 1688.2 |
| 1983 | 2203.4 | 87.3 | 141.0 | 2610.2 |
| 1984 | 2068.1 | 156.2 | 105.0 | 2236.1 |
| 1985 | 2236.1 | 33.3 | 24.2 | 3202.6 |
| 1986 | 2205.3 | 28.6 | 26.6 | 3575.0 |
| 1987 | 1919.1 | 143.3 | 32.3 | 381Y.l |
| 1988 | 1800.5 | 2.3 | 24.0 | 3229.0 |
| 1989 | 1290.8 | 17.4 | 27.0 | 4038.7 |
| 1990 | 1200.0 | 649.8 | 33.1 | 4401.5 |
| 1991 | 892.4 | 63.9 | 25.2 | 4992.0 |
| 1992 | 854.8 | 390.7 | 29.1 | 44117.6 |
| 1993 | X56.6 | 205.2 | 32.6 | 4585.7 |
| 1994 | 864.5 | 120.0 | 135.0 | 4934.0 |
| 1995 | 636.2 | 34.1 | | 3970.2 |
| 1996 | 653.2 | 2300.0 | - | 3211.0 |

3.2.1.4 Forest **Products.** Forestry in Mongolia fulfils both domestic and export needs. Large sawmills were established in Eroo and Bugant **in** 1926, in Sukhbaatar, Dulaankhaan, and Ulaanbaatar in 1937, in Tosontsengel in 1959, in Hyalganat in 1970 and in Zuunkharaa in 1980. Furthermore, the number of sawmills and economic entities increased to about 60 in 1980. These units supplied processed wood products mainly to domestic markets.

Since 1990, large sawmills have ceased operating due to the Mongolian economic crisis and privatization; they have been replaced by about 500 small scale companies resulting in a sharp decrease in the harvesting volume. Considering the annual forest utilization, on average, 2 million cubic metres of wood were cut till the end of 1980; however, starting from 1990 until today, on average, 0.8 million cubic metres of wood have. been cut and used for commercial and export purposes (Figure 10).

**Since** 1990, boards and logs have been exported to China in large volumes and at 2 to 3 times cheaper than the world market price (Figure 11).

Figure 10

**Harvest volume (per 1000 m')**

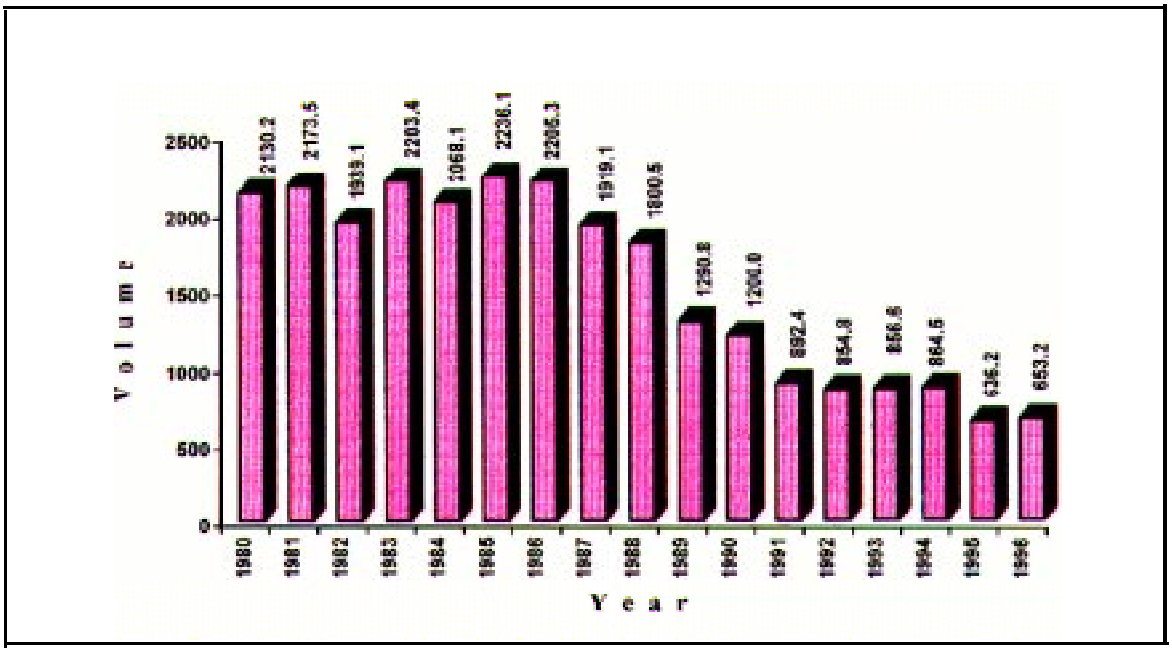
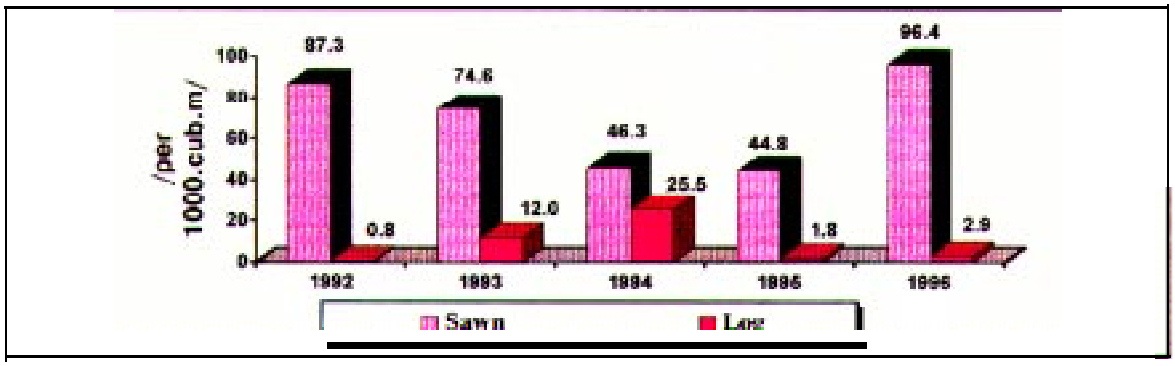



Figure 11

**Exported logs and timber products**




The Mongolian sawmills **waste** about 40% **of the wood** due to management inefficiency and out-dated technology. The need for wood and wooden products, however, is increasing. 1 3 million cubic metres of wood and about 1000 tonnes of Saxaul are used for household tires. annually, the population growth, as well as, the wood and shrub scarcity in the Gobi have increased demands for firewood and wooden products.

### 3.2.2 Composition, Distribution, Conservation and Use of Vascular and Lower Plants

Mongolian vegetation today presents those special features which have developed through time because of local landscape forms, the organic enviroment and climate in this part of the continent. Mongolia is a site of convergence and co-existence of flora which originates both from the Great Siberian Taiga and the Central Asian Steppe and Desert In addition, Mongolian flora has accumulated plant species from Manchuria in the east and from the Kazakhstan-Turan area in the west.

**3.2.2.1 Composition of Vascular and Lower Plant** Species. Alltogether, there are 2823 species of vascular plants in 662 genera and in 128 families, 417 **species** of moss belonging to 162 genera and 32 families, 930 lichen species in 133 genera and 39 families, 875 species, 136 genera and 28 families of fungi, 97 1 **species** and 221 genera in 60 families of algae have been found in Mongolia, so far (Figure 1, Table 1).

Figure 1

**Mongolian plant species assemblage**

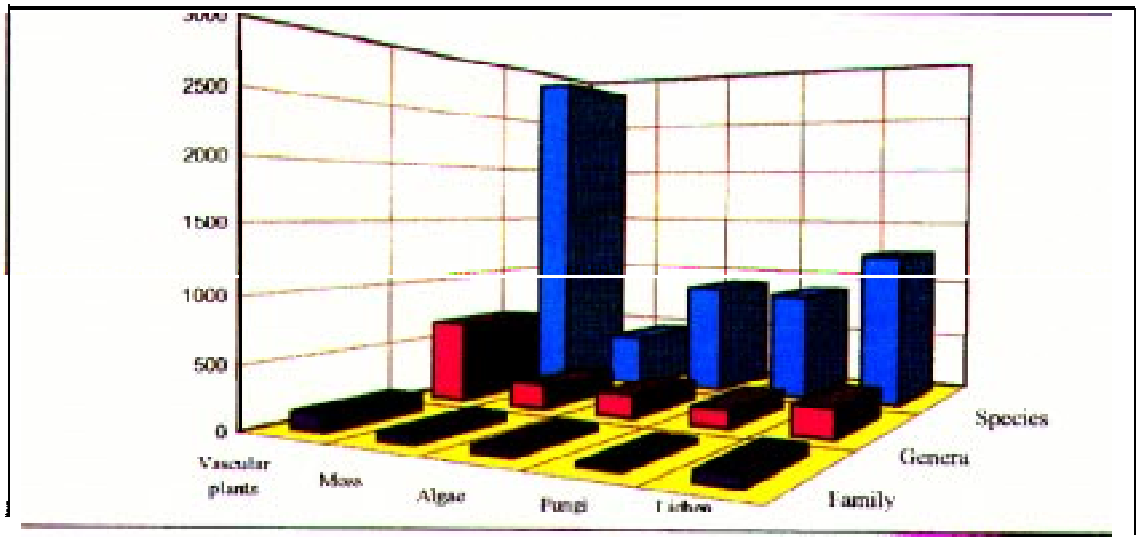



Table 1

**Composition of Vascular and Lower Plants**

| Classification | Family | Genera | Species |
|---|---|---|---|
| Vascular plants | 128 | 662 | 2823 |
| MOSS | 59 | 191 | 445 |
| Lichen | 53 | 175 | 930 |
| Fungi | 28 | 136 | 900 |
| Algae | 76 | 221 | 1236 |

The number and versatility of the Mongolian plant species assemblage will increase in the future, because accurate and detailed field studies have not been carried out dealing with either lower plants in the desert and steppe zones or the higher and lower plants in the mountainous regions known as Khentii, Khuvsgul and the Mongolian Altai, the rocky terrain of the Onon and Ulz rivers, the Borzon and the Jungarian Gobi Desert. The conclusion, based partly on unpublished data, is that some 3000 vascular plants can actually be found in Mongolia. Of these, 1800 species belong to large orders of vascular plants dominated by such families as Compositae: Asteraceae, 338 species; Fabaceae, 311 species; Stipa, Poa and Festuca, 227 species; Brassicaceae, 119 species; Carix, 129 species; Labiatae, 113 species; Ranunculaceae, 107 species; Chenopodiaceae, 89 species; Caryophyllaceae, 75 species; Rosaceae, 71 species; and, Scrophularisceae, 73 species. The order Umbrelliferae includes families like Apidceae, 5 1 species; Salicaceae, 5 1 species.

The Mongolian plant families are dominated by several genera of plants such as Cyperaceae, 85 species; Oxytropis, 82 species; Astragalus, 80 species; Artemisia, 78 species; Saussurea, 44 species; Potentilla, 43 species; Salix, 41 species; Pedicularis, 33 species; and Onion, 32 species.

Vegetation. The vastness and spaciousness of Mongolian territory together with its high mountain ranges, sudden depressions, rolling steppes and Gobi Desert, as well as, its extreme continental climate are factors influencing the country's vegetation cover.

The gradual transitional changes from the high mountain taiga through to the mountain forest steppe and flat grassy plains on to the semi-desert and true desert areas, represent the specific features of the world's three basic vegetation regions. This variety is also reflected in the change of precipitation and distribution of plants starting from the foot hills to the top of the mountain ranges in vertical belts. So, on the basis of such contrast in nature, Mongolia has been divided into the high mountain forest taiga, mountain forest steppe, rolling steppe, semi-desert and Gobi-desert areas (Figure 2).

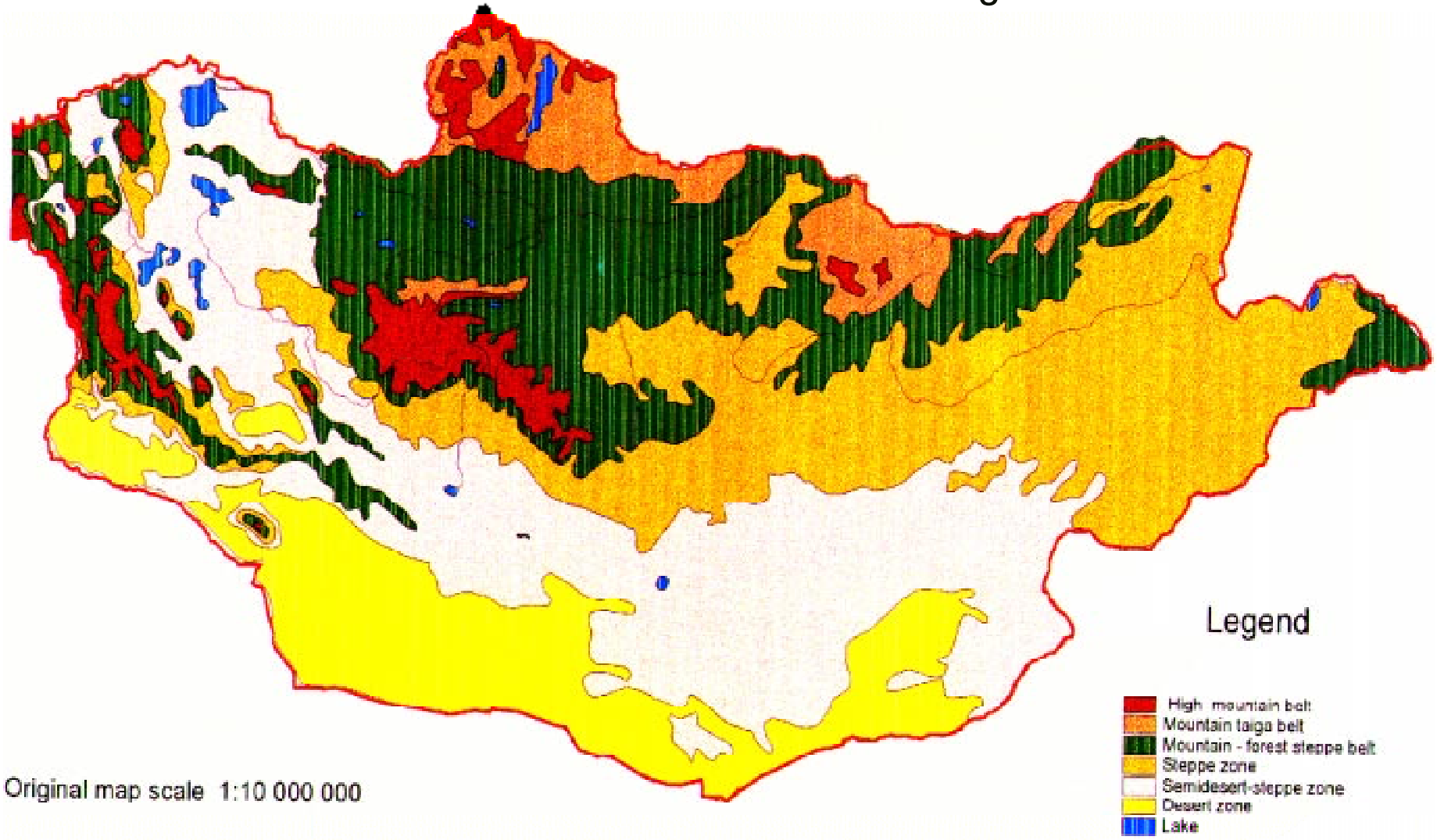
***High Mountain (Alpine) Belt.*** The High Mountain Belt is divided into four sub-belts: summits, lower summits, alpine and sub-alpine. The summits consist of perpetual snow-capped peaks (some their crevices filled with ice), barren rocks and gravel. The sub-alpine belt is a conducive growing area for crustome, lichen, moss, yernic (low birch), Dryas tundra, cryophytic *Kobresia, Carex-Kobresia* and *moss-Sedga* meadows along with the tundra plant communities. In addition, there are some scarce Pines *Pinus sibirica* and Larches *Larix sibirica.* These are the general features of the vegetation of the high peaks of the Mongolian Altai, Khangai, Khuvsgul, Khenti and some parts of the Govi-Altai mountains.

***Mountain Taiga Belt.*** The alpine and sub-alpine belts are dominated by Pines *Pinus sibirica* and Larches *Larix sibirica* combined with bunch grasses, dwarf shrubs and steppe grasses. The general term for these belts is "Taiga".

***Mountain Forest-Steppe.*** This belt comprises the convergence of high mountain, taiga and steppe plants, including *Poa, Koeleria* and their "cushion" communities. This belt is dominated by *Rhodicoccum, Carex, Koberisia,* Larches *Larix sibirica,* Birch species and the plants of steppe meadows and river banks.

Geobotanical classification of Mongolia

Figure 2.



***Arid-Steppe Zone.*** This zone has dry steppe plants, *Artemisa frigida*, *Caragana*, etc.. At the same time, it also has the plant species of transitional zones which are influenced by the Central Asian desert vegetation cover.

***Desert Zone.*** This zone is divided into three sub-zones: semi-desert, genuine desert and extreme dry desert. *Allium polyrrhizum*, *Stipa gobica* and some semi-dwarf shrubs grow throughout these sub-zones, especially along the boundaries of the steppe zone. The vegetation cover of the desert steppe is dominated by semi-dwarf and dwarf shrubs.

**Vegetation of areas not belonging to any belts or zones.** These are mainly hollows and valleys embracing rivers, streams, ponds and oases, meadows with woody shrubs (which are usually find in walleys), *Betula platyphylla* and *Populus* groves, and *Achnatherum splendens.* These landscape varieties occur in all belts and zones except in the alpine mountain belt.

**Vegetation Geographical Regionalization.** Mongolian territory is divided into *16* regions on the basis of physiography, soil and climate (Figure 3). The number of species and the types of vegetation of regions greatly differ from each other. The composition of the vegetation cover of the Mongolian Altai, Khangai, Khentii, Khuvsgul and Mongol Daguurian regions is comparatively richer than other regions (Table 2).

Table 2

**Vegetation regions, area percentages and number of species**

| Region | Area percentage | Number species |
|---|---|---|
| Khuvsgul Mountain Taiga | 4.96 | 886 |
| Khentii Mountain Taiga | 3.05 | 977 |
| Khangai Mountain Forest Steppe | 17.59 | 1214 |
| Daguur Mountain Forest Steppe | 6.6 | 946 |
| Khovd Mountain Steppe | 1.98 | 657 |
| Mongolian Altai Mountain Steppe | 7.02 | 1020 |
| Khangai Mountain Steppe | 0.87 | 465 |
| Middle Khalkha Steppe | 11.54 | 509 |
| Eastern Mongolian Steppe | 3.94 | 539 |
| Desert Steppe of Depression of Great Lakes | 6.11 | 666 |
| Desert Steppe of Valley of Lakes | 3.18 | 346 |
| Desert Steppe of Gobi-Altai mountains | 5.02 | 710 |
| Desert Steppe of Eastern Gobi | 9.35 | 327 |
| Alashaa Gobi | 6.43 | 183 |
| Trans-Altai Gobi | 5.72 | 326 |
| Jungarian Gobi | 1.62 | 483 |

* Data compiled by Dr. N.Ulziikhutag, 1989

***1. Khuvsgul Mountain Taiga region.*** The vegetation cover of this region is dominated by Larches *Larix sibirica* and Pines *Pinus sylvestris.* Additionally, there are mixed forests of Birch *Betula rotundifolia* and Pine *Pinus sibirica.* This region contains 886 species of plants, of which 768 are grass species, and 118 woody and shrub-like species (Figure 4).

2. ***Khentii Mountain Taiga region.*** This region is covered by mixed forests of Pine *Pinus silvestris,* Larch, secondary Birch and Aspen. The area harbours 977 species of vascular plants, of which 844 are various grass species and 133 woody and shrub-like plants.

Figure 3.

## Mongolian geobotanical regions

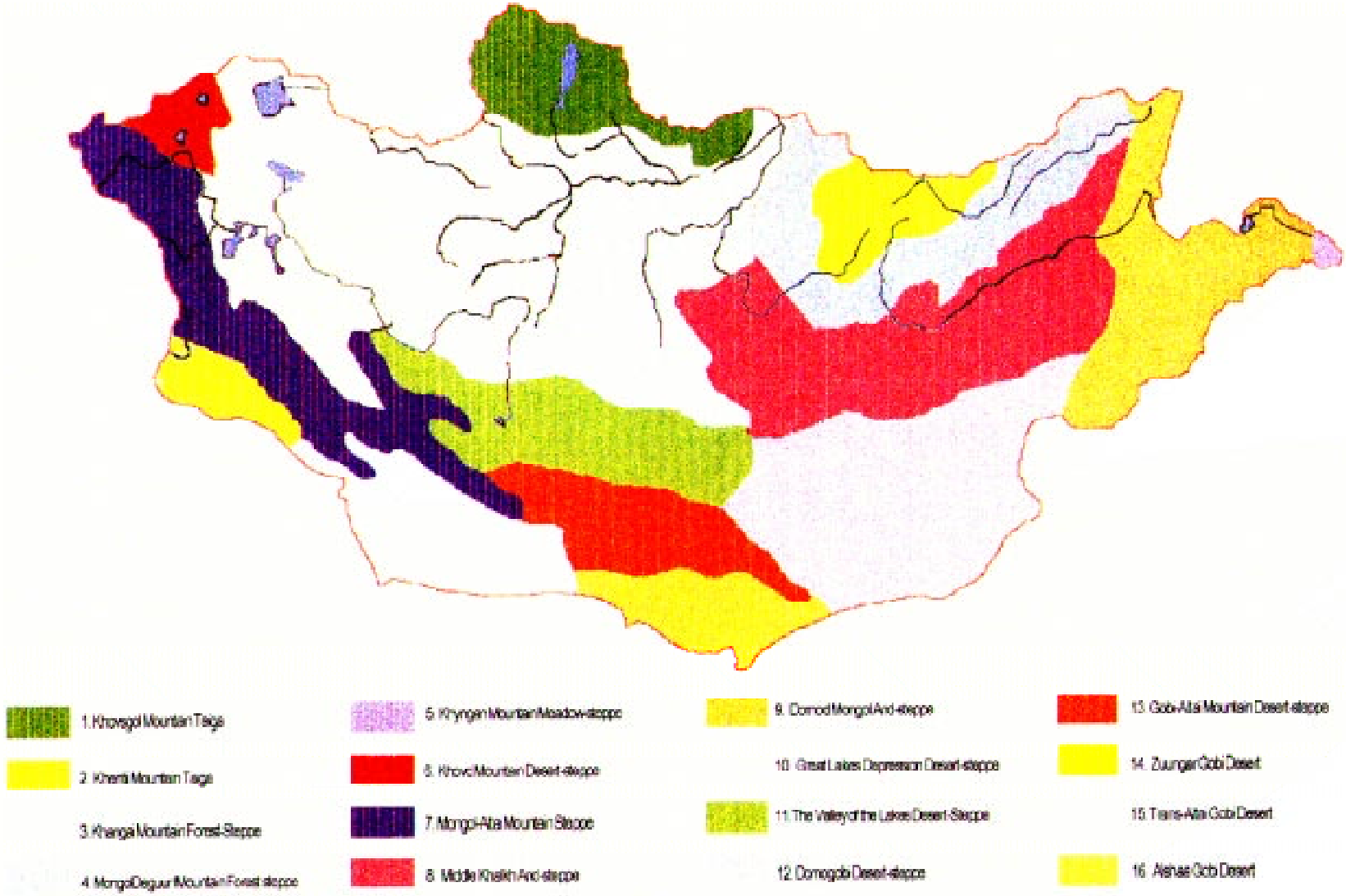
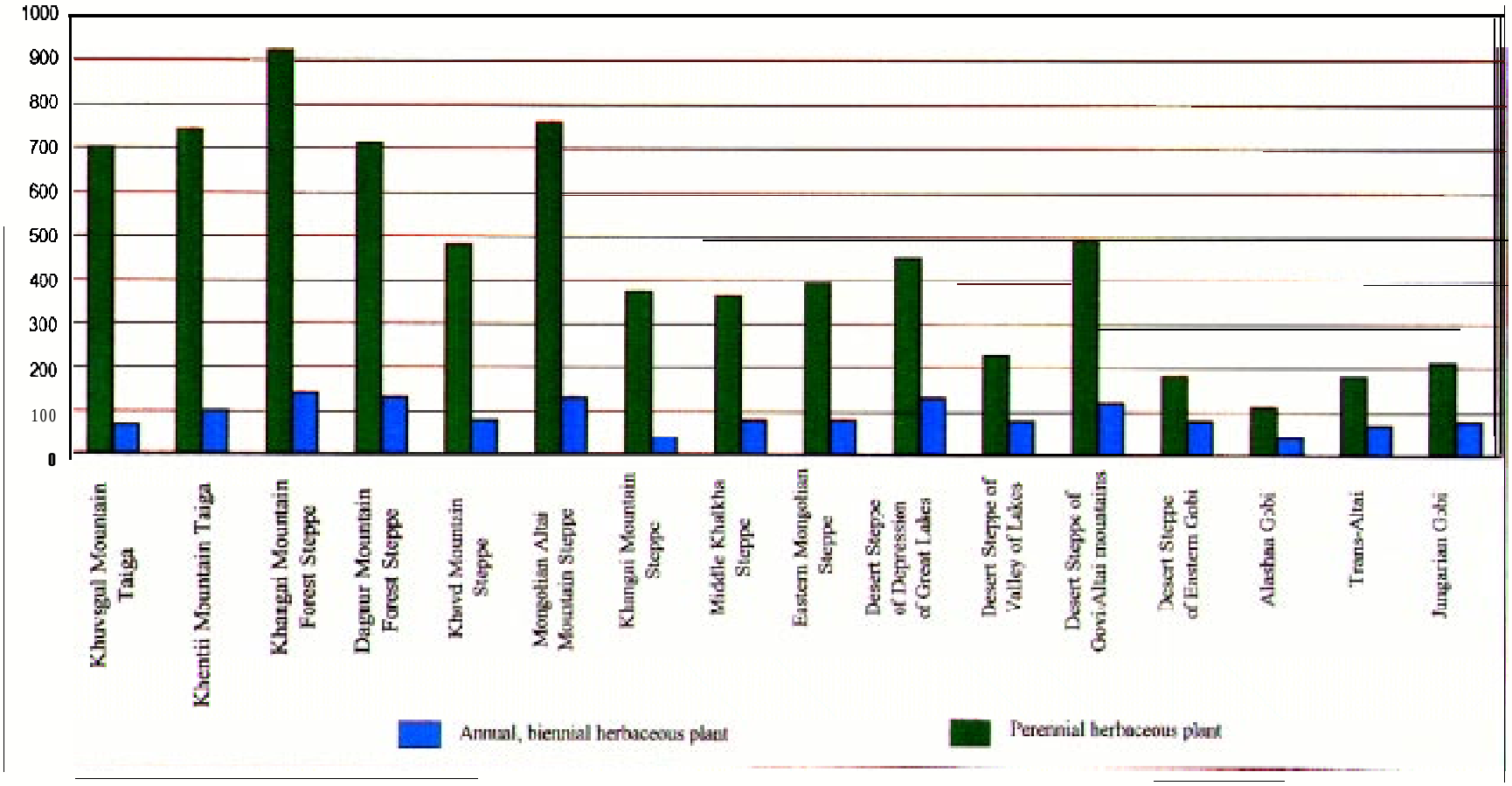


Figure 4

## Herbaceous plants distribution in Vegetation Regions



3. ***Khangai Mountain Forest Steppe region.*** This region includes a combination of plant species from the Great Siberian Taiga in the north, the Eastern Mongolian Steppe and the Daguurian mountain steppe in the south; 12 14 plant species, of which 15 1 are various types of grass and 1063, woody and shrub-like plants, are found in this region.

4. ***Mongol Daguurian Mountain Forest Steppe region.*** The vegetation cover in this area contains a variety of grasses, Larches *Larix sibirica,* and Pines such as *Pinus sibirica* and *Pinus silvestris.* The region, however, is dominated by plant species originating from the mountain steppe. 946 plant species, of which 83 1 are different types of grass and 115 woody and shrub-like species have been found here.

5. ***Khovd Desert Steppe region.*** This region is dominated by the grasses of the arid steppe. At present there are some 657 species registered; of these 559 are various kinds of grasses and 98 woody and shrub-like plant species.

***6. Mongolian Altai Mountain Steppe region.*** This region contains a mixture of plants fi-om the high Altai mountains, northern forests, desert and desert-steppe areas, and even the Kazakhstan-Turanian deserts and steppes. 1020 plant species have been found, and from this total, 889 are grasses, and 13 are woody and shrub-like species. The vegetation cover of this region is dominated by *Koberica, Carix, Stipa, Poa, Festuca,* Larches *Larix sibirica* and Pines *Pinus silvestris.*

*7.* ***Khyangan Mountain Steppe region.*** The vegetation cover of this region is dominated by Pines *Pinus*, Poplar *Populus*, Willow *Salix*, *Graminaceae* and *Filifolium sibiricum* meadows. 461 vascular plants have been listed; of these, 403 are grasses, and 58 woody and shrub-like plants. The Kyangan regions are dominated by plant species belonging to the Manchurian flora; there are some representatives of species from the Mongolian Daguur steppe, the Eastern Siberian Taiga, and the Central Asian deserts and steppes. There are many endemic and relic species in this region.

8. ***Middle Khalkha region.*** Most parts of this region are dominated by *Stipa baicalensis- Cleistogenes squarrosa, Stipa baicalensis-Artemisia frigida, Stipa baicalensis-Stipa duriuscula, Stipa krylovii-leymus chinensis, Stipa krylovii-Allium polyrrhizum, Caragana, Artemisia frigida.* This region has 509 vascular plants with 446 kinds of grass and 63 woody and shrub-like plant species.

9. ***Eastern Mongolian Arid-Steppe region.*** The vegetation cover in this region consists mainly of communities of *Stipa baicalensis* and *Koeteria cristata, Stipa cleistogenes, Filifolium sibircum, Filifolium sibiricum-Stipa sp., Leymus and Stipa and Stipa-Allium pollyrrhizum.* This region is influenced by the Daguurian species from the north, Mongolian species from the south, and Manchurian species from the east. The flora of this region consists of 539 vascular plants with 479 kinds of grass and 60 woody and shrub-like species.

10. ***Desert Steppe region of the Depression of Great Lakes.*** The vegetation cover of this region is characterized by the deserts and desert-steppe plants. For instance, the Hollow of Uvs Nuur sub-region is mainly covered by such communities of plants belonging to the Jungar-Turanian deserts of Kazakhstan as, for example, *Nanophyton, Ceratocarpus, Artemisia leucophulla, Artemisia schrenkiana, Salsola passerina* and *Stipa gobica.* The central part of the region includes *Stipa gobica-Salsola, Stipa gobica-Artemisia frigida, Stipa gobica, Stipa*

*gobica- Allium polyrrhizum.* In this region, 666 vascular plant species have been registered with 570 kinds of grass and 96 woody and shrub-like species.

***Il. Desert-Steppe Region of Valley of Lakes.*** This region is dominated by communities such as *Stipa-Allium polyrrhizum, Stipa, Cleistogenes, Stipa, Artemisia-Anabasis,* and *Caragana-Stipa.* At present, 346 species of vascular plants have been found in this region with 296 kinds of grass and 50 woody and shrub-like species. The special feature of this region is, that it has plant species from the desert, steppe and Khangai mountain, adapted to the dry climate.

12. ***Desert Steppe Region of the Gobi-Altai Mountains.*** This region has plant communities originating from the desert-steppe. *Stipa, Anabasis-Allium sp., Stipa gobica-Salsola passerina, Allium polyrrhizum* and meadows are dominated by the *Festuca* and *Koberisia-Carex* species. Although, the region is mainly dominated by plant species from the Gobi desert, connections with the Baikal-Daguurian flora from the ice age, especially in its mountain ranges, can be found. Accordingly, the higher sub-belts in the region have some elements which belong to the Altai-Sayan mountains and Tibetan High Land flora. 710 vascular plants including 596 kinds of grass and *114* woody and shrub-like species have been registered in this area.

13. ***Desert-Steppe Region of Eastern Gobi.*** This region is mainly covered with *Stipa pennata, Stipa-Cleistogenes, Stipa-Allium polyrrhizum,* and *Stipa-Ajania* species. Its sub-region, called Baynzag Hollow, includes almost all of those elements characterizing the Mongolian desert-steppe zone. In this region, 327 vascular plants including 259 kinds of grass and 68 woody and shrub-like plant species have been found.

***14. Desert Region of Alashaa Gobi.*** Common plant species in this region are *Salsola passerina, Anabasis, Potaninia, Zydophyllum, Iljinia, Ajania, Reaumuria, Haloxylon* and *Nitraria.* It is also the site of an ancient desert characterized by *Salsola laricifolia* originating from the Paleocene and Miocene periods. 183 vascular plants with 130 kinds of grass and 53 woody and shrub-like species have been registered here.

***15. Desert Region of Trans-Altai Gobi. 326*** vascular plants including 259 kinds of grass and 67 woody and shrub-like plant species have been found in this region.

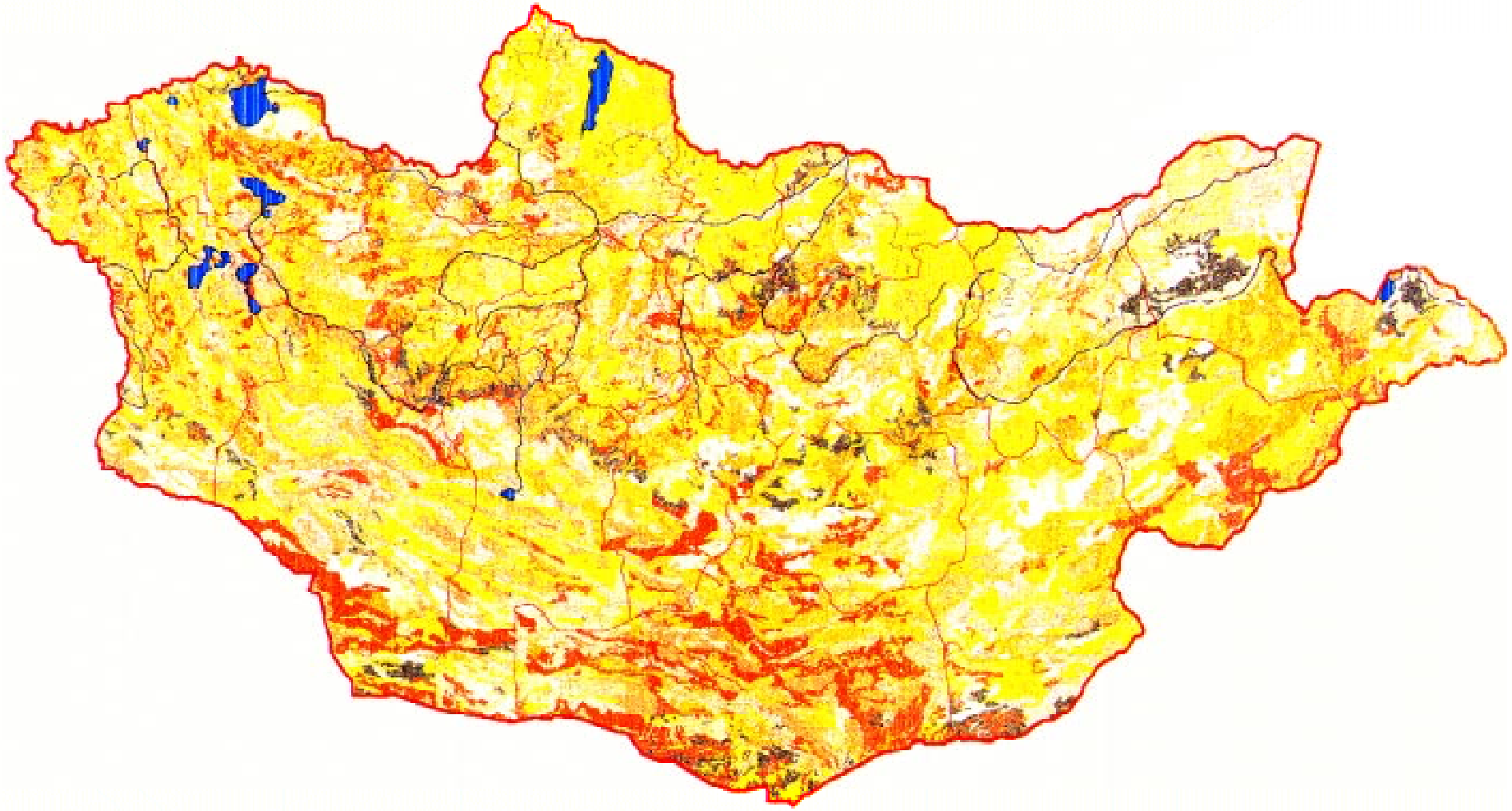
16. ***Jungarian Gobi Desert Region.*** This region includes a mixture of plant species common in the Gobi Desert and the Northern Turanian, Jungarian and Mongolian Altai areas. Altogether, 483 vascular plants including 402 types of grass and 81 woody and shrub-like species have been discovered.

A map drawn on a 1: 1 000 000 scale, shows Mongolian vegetation, pastures and hay making areas. This map is based on data collected during the past 50 years, and it is currently used as a basic scientific document justifying the conservation of plants and, also, their sustainable use (Figure 5).

The Mongolian seed plant flora includes 348 species of woody and shrub-like plants and 2095 species of grass. According to studies from 1989, Mongolia has 17 species of tall trees, 40 species of groves, 146 species of taller shrubs, 48 species of smaller shrubs, 91 species of bunch grass and 6 species of semi-heaths. The grass include 1765 species of perennials, 330 species of biennials and annuals (Figure 6).

# Vegetation map of Mongolia

Figure 5.



Original map scale 1: 1000 000

Figure 6

Distribution of life forms of Vascular **Plants**

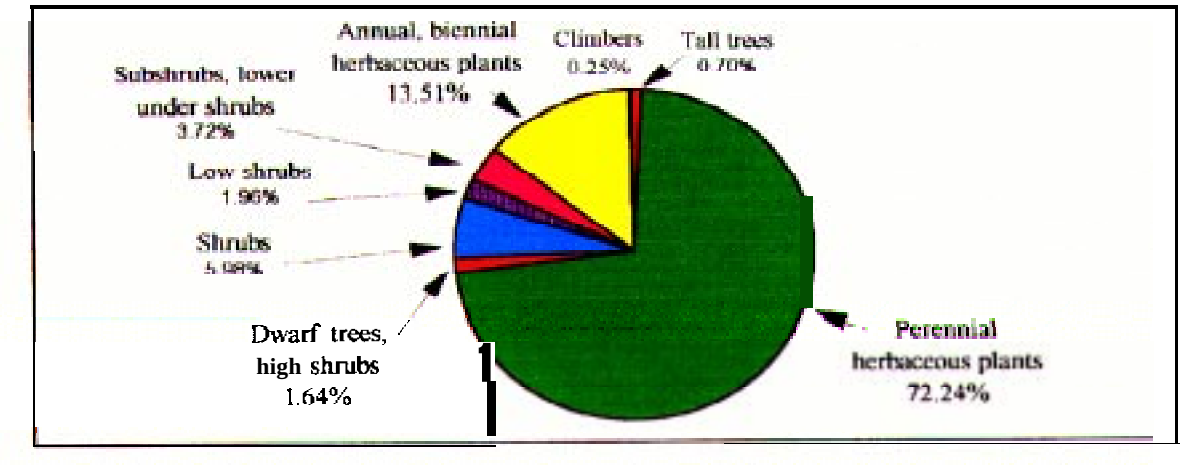
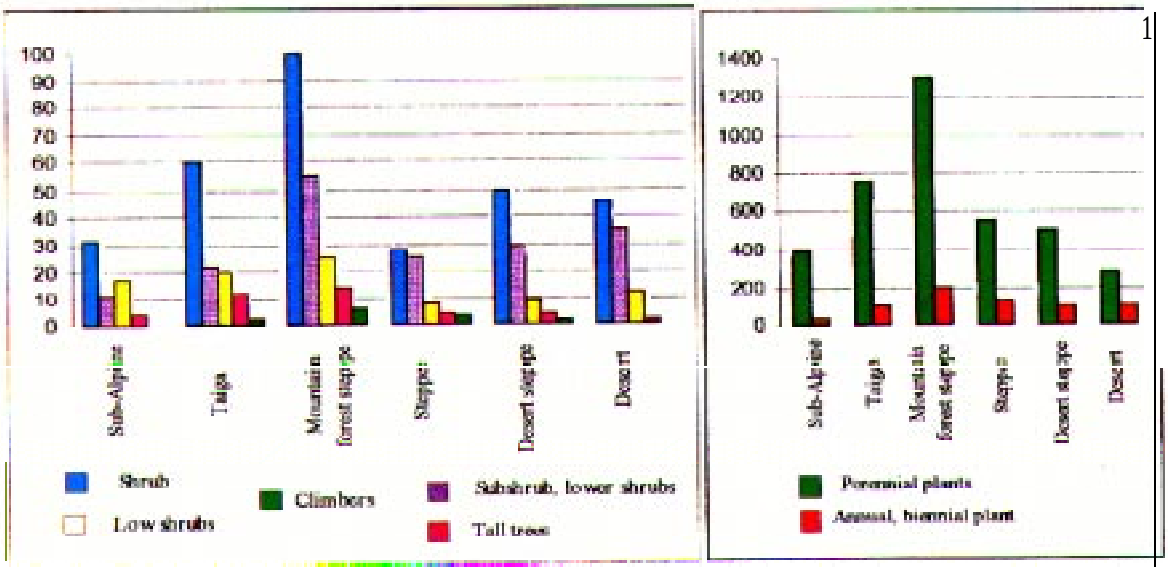



Figure 7 shows the distribution of different Mongolian plant forms. While the big trees usually dominate the mountain taiga region, they lose their position in the transitional zones and gradually disappear towards the steppe, desert steppe and desert zones. The same happens to the taller shrubs. In the steppe, desert steppe and desert zones, shrubs and dwarf shrubs form isolated communities or mixed communities, together with other plant species common in those regions (Figure 7)

Figure 7

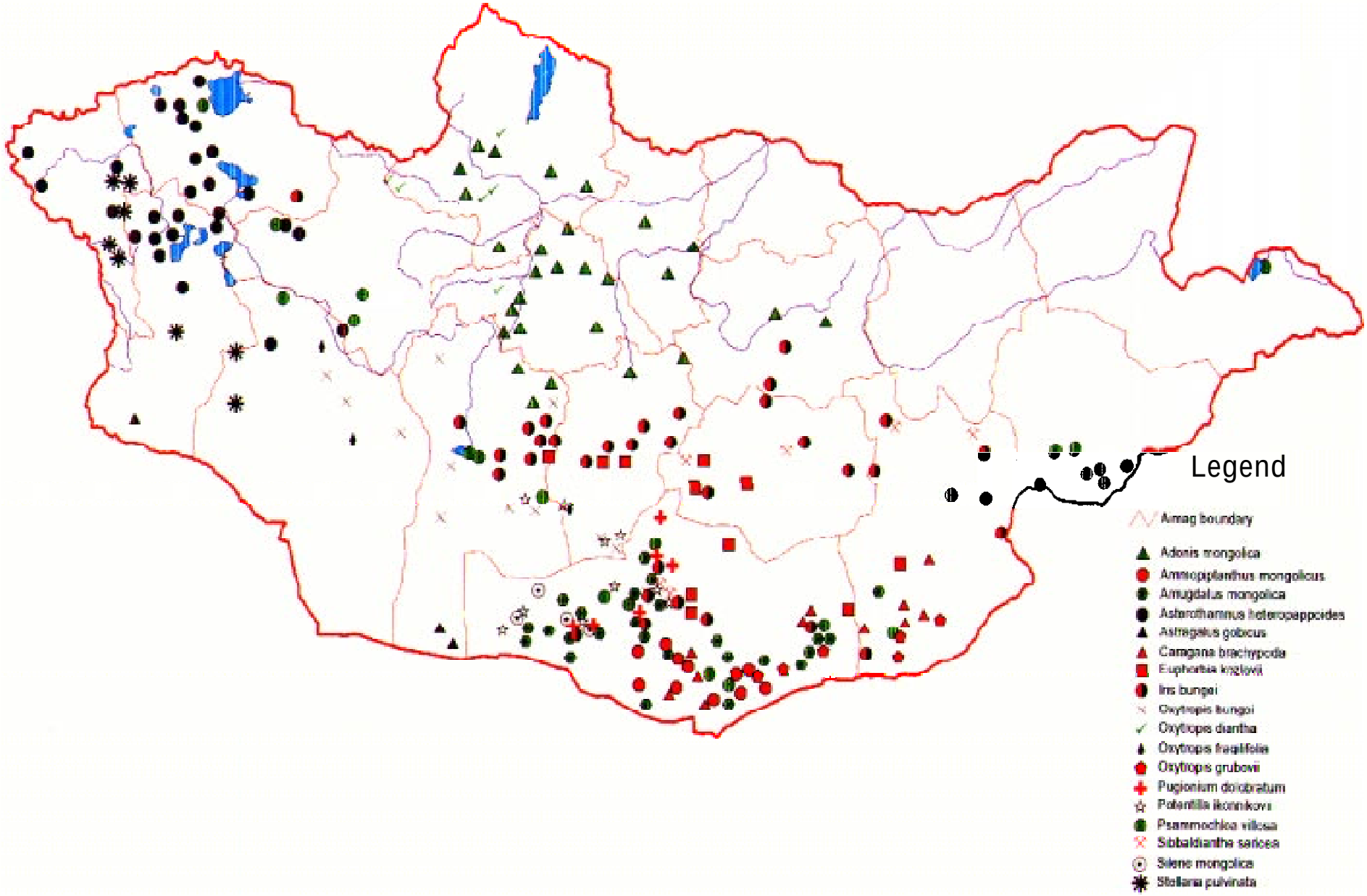
Distribution of different life forms of plants in various belts and **zones** of Mongolia




Primitive Plant Relics and Endemic **Species.** More than 100 species of primitive plant species have been found in Mongolia including *Ammopipthantus mongolicus*,

# Distribution of some endemic plants of Mongolia

Figure 8.



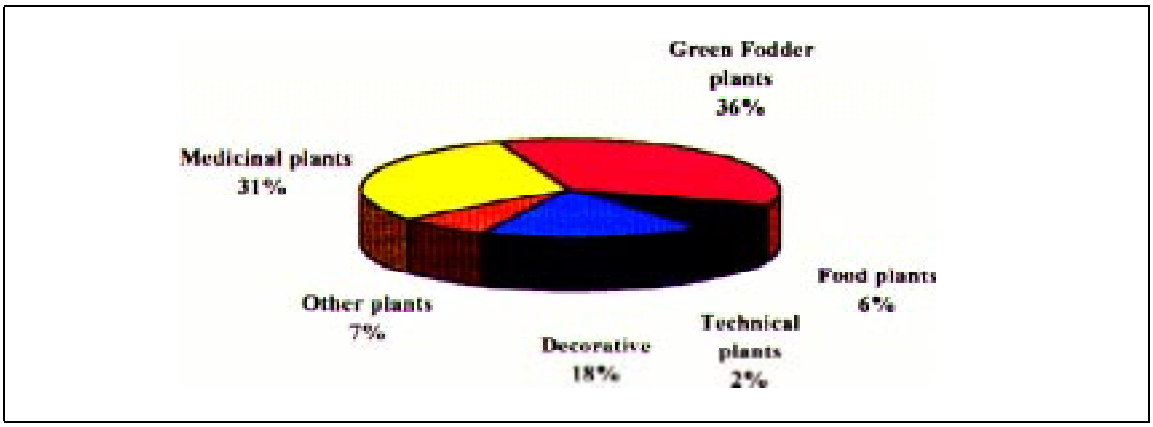
*Zygophullum xanthohylon, Ephedra przewalskii, Reaumurea soongarica, Ijinia regelii, Sympegma regelii, Populus diversifolia, Halimodendron halodendron, Oxytropis grubovii, Caragana tubetica, Caragana jubata, Lancea tibetica, Abies sibirica, Nymphaea candida* and *Nuphar pumila.*

There are relics from pre-historic deserts, forests, tertiary lakes, savannahs and the Ice Age, in particular. Many plant relics are endemic to Mongolia. There are about 150 endemic vascular and lower plants such as *Stipa mongolorum, Adonis monglica, Betula mongolica, Atraphaxis bracteata, Calligonum gobicum, Nanophyton mongolicum, Gymnocarpus przewalskii, Silene mongolica, Potaninia mongolica, Chesneya mongolica, Astragalus gobicus, Oxytropis ulzij-chutagii* and *Artemisia gobica* The Khangai, Gobi-Altai and Mongolian Altai regions are the most abundant regions, species-wise (Figure8).

Useful **plants.** Mongolia has 845 species of plants which are used in medicine, over 1000 species for fodder, 173 for food, 64 in industry, 489 decorative species and 195 for other purposes. Also, there are 1150 vitamin rich species, over 200 species which aid in fermentation, 281 species with high alkaloid content, 23 1 species with flavonoids, 65 species with rumarin and 68 species with soil restoration properties (Figure 9)

Figure 9

**Classification of useful plants**



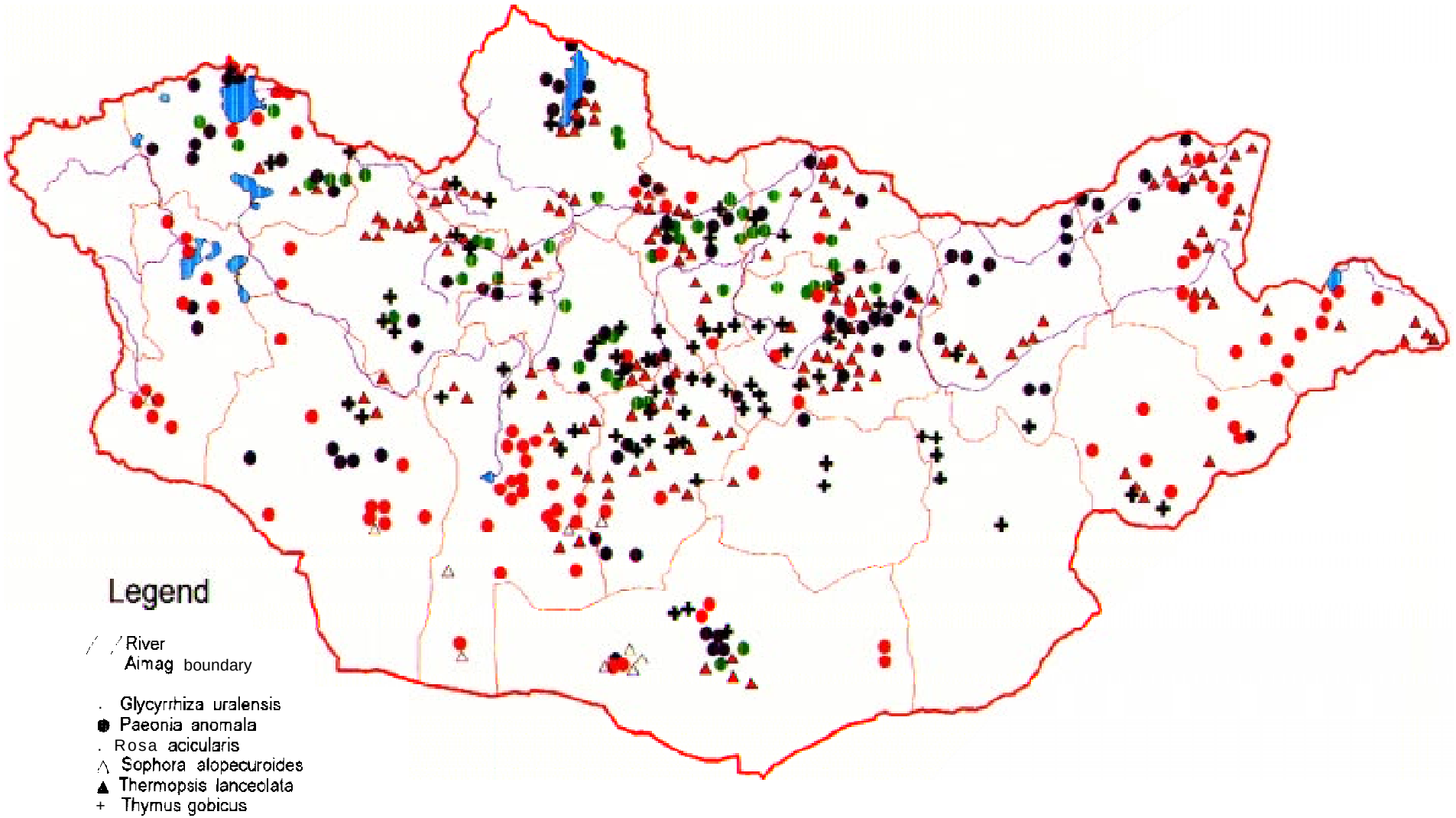

In this country, there are 547 species of plants which are commonly used by bees (belonging to 190 genera and 53 families). 23 of these 547 species are woody plants, 72 shrub-like species and 450 grass species (Figure 10).

**Endangered and Threatened Plant Species. The** subject of conservation, sustainable use and restoration of Mongolian plant species should be considered in the context of plant ecology and biology

86 plant species were registered as endangered and threatened in the first edition of the Mongolian Red Book; in the second edition (1997), the number was already 128 This group includes 75 medicinal spccics, 1 1 for food, 16 species used in industry, 55 decorative species

Figure 10

# Distribution of some medical plants in Mongolia



and 15 species used in the soil fixing process and in controlling pests. This group includes *Nitraria sibirica, Amygdalus mongolica, Populus diversifolia, Caragana bungei, Artemisia caespitosa, Sophora alopecuroides, Allium altaicum, Adonis mongolica, Saussurea involucrata, Agriophyllum pungens, Elaeagnes moorcroftii, Aves sibirica, Gemnocarpus przewalskii, Rhodiola rosea, Allium oliquum* etc.

**Weeds.** There are 438 species in 2 12 genera belonging to 49 families of weeds; of these 369 (84.3%) are local species (apophit) and 69 species (15.7 %) are "newcomers" (antro-pophit).

This group includes such species like *Amaranthus retroflexos, Polygonum convolvulus, Polygonum.aviculare, Fagopyrum tataricum, Avena fatua, Brassica campestris, Brassica juncea, Setaria viridis, Setaria glauca, Xanthium sibiricum* etc. that have colonized and damaged crop land. Specific features of Mongolian weeds include good adaptability to severe climatic conditions and strong resistance against dryness and strong winds (Figure 11).

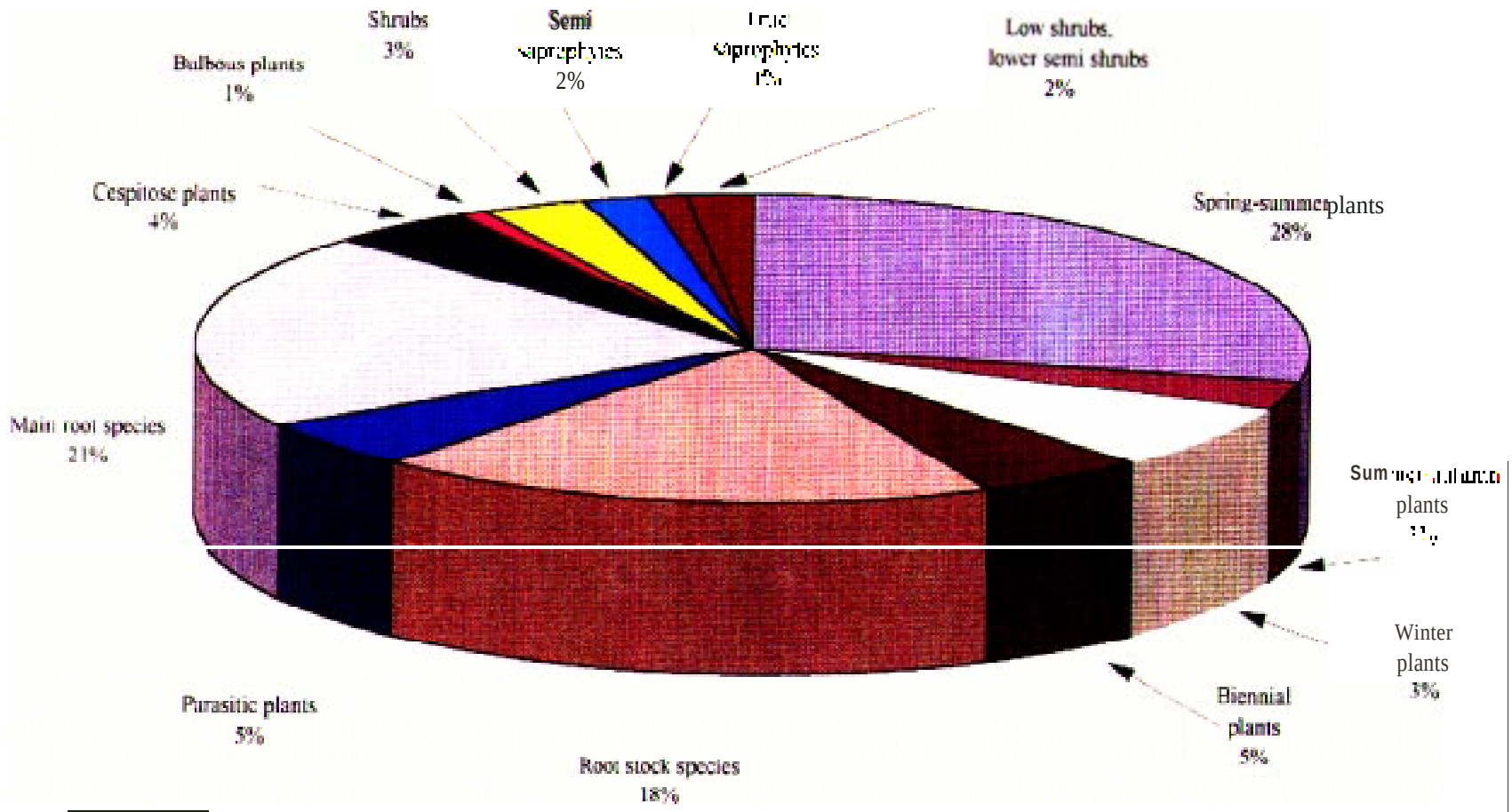
**3.2.2.2 Plant Protection and Restoration.** Measures have been taken under the "Mongolian Law on Natural Plants", the "Mongolian Law on Forests", and the National Biodiversity Action Plan, National Action Plan for Special Protected Areas, Governmental Guidelines on Ecology, National Security and other relevant documents to conserve, restore and use in a sustainable manner the plant species of Mongolia. As a result, the harvesting of 133 endangered species has been legally prohibited, and conditions for 128 vascular and lower plant species to grow and reproduce naturally were maintained by including these species in the Mongolian Red Book. Furthermore, 40 per cent of habitats of more than 400 endangered or threatened plant species is covered by the protected areas network. Due to legal prohibition of the exploitation of saxaul forests, which have dissappeared at a rate of 60 per cent during the last 50 years, these forests started to restore themselves naturally in the Shargyn, Galbi and Barzongiin regions of the Gobi Desert.

More than 20 projects are currently under implementation in Mongolia dealing with the structure, life forms, distribution, abundance, breeding, anatomy, physiology, embryology, paleontology, ecology and biology, and the special features of the flora with an annual budget of some 20 million tugrugs. These projects have identified the distribution of 130 plant species and there is an increasing abundance of some 50 species, in 10 areas, so far. In addition, the genus *Ephedra* has been studied in more detail in this country. The results show that this species covers 4 million hectares in Mongolia. Its estimated annual productivity seems to be around 500 thousand tonnes and industry uses 40 thousand tonnes of this species, annually. The annual yield of the *Ephedra* species is around 2.5 tonnes per hectare. Field studies have been carried out dealing with the capacity of *Ephedra* species to produce nectar for honey bees. These studies show that the annual yield of honey can, theoretically, reach the 2 043 million tonne level; furthermore, other species of plants can increase the honey yield by 612.9 tonnes, annually.

The same studies show that several wild berry species grow in the Khentii, Khangai and Khuvsgul mountains. These wild berry species include, for example, *Ribes nigrum, Ribes altissimum, Grossularia acicularis, Rosa acicularis, Vaccunium myrtillus, Vaccinium uliginosum* and *Rhodococcum vitis-idaea.* In addition, field studies show that the mean yield of

Figure 1

## Distribution of life Forms of Vascular Plants



these berries can be around 250.4 tonnes in a 1120 hectare area. In Mongolia, 85 species in 54 genera belonging to 26 families of decorative plants, have been grown on a trial basis and 45 species belonging to 35 genera and 17 families are currently growing in this country.

3.2.2.3. **Plant Use.** More than 100 species of plants are currently used for medicinal purposes, and more than 200 species are used for pharmaceutical purposes. Additionally, 20 species are used for tea, 50 species for food, and over 1000 species are important for livestock feed. It must be emphasised, however, that because of the intensive use of more than 80 species for food and other purposes, the numbers and the ranges of species like *Saussurea involucrata, Allium altaicum, Sophola alopecuroides, Glycyrrhiza uralensis, Gentiana alida, Cynomorium songaricum, Allium oliquum* and many others are decreasing rapidly today in Mongolia.

## 3.2.3 Moss

3.2.3.1 Composition and Distribution **of Moss Species.** Moss began to be studied in Mongolia in the beginning of the 1970s. Moss has been studied in much greater depth in the northern Khangai, Khuvsgul and Khentii mountain regions than in the southern steppe, desert steppe and desert zones.

At present, there are 445 species of moss belonging to 191 genera and 59 families in Mongolia. Among these 445 species, 53 species in 33 genera and 21 families belong to a group of moss called liverworts, and the other 392 species in 135 genera and 3 8 families belong to moss. It is evident that these figures will change in the future after new field research on unknown moss regions of the country is conducted. This part of the report contains data only on the moss species which have been studied in detail.

Table 1

**Species and large families of Moss**

| Family | Number of Genera | Number **of species** | Percen-**tage** | **Genera** | **Number of species** | **Percen-tage** |
|---|---|---|---|---|---|---|
| Dicranaceae | 15 | 38 | 10.0 | Tortula | 20 | 5.2 |
| Pottiaceae | 9 | 37 | 9.7 | Sphagnum | 17 | 4.5 |
| Amblystegiaceae | 10 | 36 | 9.4 | Grimmia | 17 | 4.5 |
| Trichostomaceae | 14 | 34 | 9.1 | Bryum | 16 | 4.2 |
| Bryaceae | 8 | 33 | 8.8 | Dicranum | 15 | 3.9 |
| Grimmiaceae | 6 | 29 | 7.6 | Barbula | 14 | 3.6 |
| Hypnaceae | 6 | 17 | 4.5 | Mnium | 13 | 3.3 |
| Sphagnaceae | 1 | 17 | 4.5 | Pohlia | 12 | 3.0 |
| Brachytheciaceae | 6 | 15 | 3.9 | Hypnum | 11 | 2.7 |
| Mniaceae | 2 | 14 | 3.6 | Drepanocladus | 9 | 2.4 |
| Polytrichaceae | 2 | 11 | 2.9 | Polytrichum | 9 | 2.4 |
| Thuidiaceae | 5 | 11 | 2.9 | Brachythecium | 9 | 2.4 |
| | 7 | 11 | 2.9 | | | |
| Total | 91 | 303 | 79.5 | Total | 162 | 42.5 |

The species composition of the large families show the same distribution pattern which characterizes moss communities in the cool Holarctic Taiga region, but the presence of the *Pottaceae, Trichostomaceae* and *Grimmaceae* families suggest a strong influence of the dry climate on this flora. Besides, while the *Amblystegiaceae*, *Sphagnaceae, Hypnaceae* and *Bryaceae* families exhibit taiga features, the *Pottaceae, Trichostomaceae, Orfhotriachaceae* families express similarities with the moss classes of the primordial sea region. The *Mniaceae*, *Thuidiaceae* and *Brachytaceae* families reflect links with the moss families of Eastern Asia, and the *Grimmiaceae* family resembles moss cummunities in the mountainous areas. The composition of the more prevalent species show more clearly mixed features,

The main taiga species, *Tortula* and *Barbula,* from arid areas, *Mnium, Brachytecium* and *Hypnum,* the deciduous forest species, and *Dicranum, Drepanocladus* and *Polytrichum* species from the cool taiga, are the most prevalent moss species in the flora. Such a mixed species composition which characterizes plant groups in the transient areas between the North-Asian taiga and the Central Asian desert and steppe, can be observed not only among higher plants, but even more clearly among moss groups.

In the steppe and Gobi desert zones, moss species are comparatively scarce. However, in the mountainous regions of Khangai, Khentei, Mongolian Altai and Khuvsgul, moss species are common; as with other plant groups, moss communities also exhibit specific features according to the zones and belts they exist in. Moss species are most abundant and common in the forested mountain belts where more than 80 per cent of all kinds of moss grow. Moss are forest generalists but they can be divided into ecological groups like top soil, epicsil and epilite species. The composition of the epicsil, etiphite and epilite moss species in the forest gradually change from the lowest level upwards, but the lower parts of the mountainous forest steppe or forests in the subtaiga contain more rock, epicsil and tree bottom moss species. From the middle parts of the mountain forest steppe belt upwards, the climate becomes cooler and more humid. In the forests, grass plants become sparse and moss species cover the ground. The number of some epicsil and tree bottom moss species decreases in these areas. The forests in the lower parts of the subtaiga in the forest belt contain a variety of grass but fewer moss species. The total number of plant species, however, is relatively high in the lower parts of the forest belt. In the taiga forests of the upper part of the mountainous taiga forest steppe, the moss cover increases up to 80 to 100 per cent, while the number of species increases and the species composition becomes more versatile.

The high mountain belt of Mongolia is inhabited by about 50 to 60 per cent of moss species. In this area, moss species dominate the mountain dales. In the high mountain and the forest steppe belts, there are many species which exist in both belts (they grow in rocky, swampy areas and along rivers), but there are also moss species which grow only in high mountains or exhibit forest features.

Moss species which exist in the steppe are scarce. But the mountain forest steppe moss species grow on rocks in mountain slopes and on mountain tops and cliffs. While in groups of the forest moss species, elements of taiga and deciduous forests dominate, in groups of the high mountain moss species, elements of Arctic high mountain and mountain moss dominate , instead.

Moss species exist in all zones and belts, where they have, depending on area, bigger or smaller roles in the vegetation. In all areas, however, the moss species are very important in natural water economy. The forest moss cover levels off extreme soil temperature fluctuations and maintains, for example, lasting conditions for permafrost in the ground. During the spring and summer, moss species are able to retain their moisture longer. By maintaining the temperature and moisture balance in the forests, they improve growing conditions for trees and other plant species.

3.2.3.2 **Conservation of** Moss. Moss-abundant areas in the Khentei, Khuvsgul, and Khangai mountain ranges and in the Mongolian Altai were put under special protection and four endangered species of moss were listed in the Mongolian Red Book. In addition, the use of 8 442 704 hectares of forest was restricted by the "Mongolian Law on Forests"

## 3.2.4 Lichen

3.2.4.1 Composition and Distribution of Lichen **species.** Out of more than 16 000 species of lichen known in the world, 930 lichen species belonging to 175 genera and 53 families have so far been discovered in Mongolia. Only the largest of these families have been included in Table 1.

Table 1

**Species composition of the largest families of lichen**

| | Lichen | Number of genera | Number of species | Percentage of lichen population |
|---|---|---|---|---|
| 1 | Parmeliaceae | 20 | 127 | 13.7 |
| 2 | Physciaceae | 11 | 81 | 8.7 |
| 3 | Lecanoraceae | 10 | 64 | 6.9 |
| 4 | Acarosporaceae | 6 | 60 | 6.5 |
| 5 | Verrucariaceae | 11 | 57 | 6.1 |
| 6 | Hymeneliaceae | 5 | 55 | 5.9 |
| 7 | Cladoniaceae | 1 | 53 | 5.7 |
| 8 | Collemataceae | 2 | 50 | 5.4 |
| 9 | Teloscbictaceae | 4 | 45 | 4.8 |
| 10 | Umbilicariaceae | 2 | 31 | 3.3 |
| 11 | Bacidiaceae | 6 | 31 | 3.3 |
| 12 | Peltigeraceae | 3 | 28 | 3.0 |
| 13 | Lichenaceae | 13 | 24 | 2.6 |
| 14 | Alectoriaceae | 2 | 18 | 1.9 |
| 15 | Phizocarpaceae | 2 | 18 | 1.9 |
| 16 | Pertusareaceae | 2 | 17 | 1.8 |
| | **Total** | **100** | **759** | |

70.9 per cent of Mongolian lichen belongs to 39 large genera, such as *Parmela*, *Cladonia, Aspicilia, Lecanora,* etc.. These large families include 659 species.

Mongolian lichen have the characteristics of Holarctic, Ancient Mediterranean and East Asian flora. Such families like *Physciaceae, Cladoniaceae, Peltigeraceae* and *Usneaceae* are Holarctic and some species belonging to the *Lecanoraceae, Acarosporaceae, Verrucariaceae, Collemataceae* and *Teloschictaceae* families have the characteristics of the ancient Mediterranean Sea lichen.

Almost all the species belonging to the family *Umbilicaria* and many other species belonging to *Paltigeria* are endemic and are distributed throughout the desert, desert-steppe and steppe zones in this country.

3.2.4.2 **Conservation of Lichen.** Studies on the distribution of lichen species in Mongolia have been conducted by Mongolian, Russian and German scientists since the 1960s. Data from these studies is important in the formulation of policies regarding the proper use and conservation of lichen in this country.

The "Forest Law", "Law on the Prevention of and Protection from forest and steppe fires", "Law on Natural Plants", and the executing and implementing bodies of Protected areas have contributed much to the conservation of lichen in Mongolia. The 12 species of lichen such as *Lobaria retigera, Rhizoplaca baranowii, Aspicilia esculenta, Cetraria steppae* etc. were listed as endangered and threatened species in the Mongolian Red Book.

Studies which have been carried out during the last few years have, for example, focused on reindeer lichen which is an important food resource for reindeer found in the extreme north of Mongolia. Based on these studies, scientists have published an instructional manual for reindeer husbandry.

## 3.2.5 Algae

The diversity of Algae and their distribution and abundance is of great ecological and economic importance because they are primary producers of food and fertilizers, which in turn sustain all life on Earth. One of the main objectives of science today, is to try to find new protein sources. Algae are rich in protein, vitamins, microelements and aminoacids. Many countries like, for example, Malaysia and Philippines cultivate *Chlorella* for food. Both of these countries harvest around 500 tonnes, and Taiwan, around 1500 tonnes of *Chlorella*, annually. *Chlorella* is a rich vitamin source.

The bluish-green Algae absorb nitrogen from the air and contain phosphorus and potassium. They are used as fertilizers; for example, in Mexico, 3000 tonnes of *Spirilla* are cultivated for fertilizing rice plantations, annually, and they can also be used as food.

*Chlorella* algae are cultivated and used as food and industrial raw materials in Japan, Canada, USA, France and Korea. The soil algae play an important role in maintaining environmental balance and protecting the soil from erosion and loss of moisture by absorbing mineral elements. In addition, their slimy shells promote soil density.

There are several valuable species of Algae in Mongolia like *Nematonostoc, flagelliforme, Chlorella,* and *Nostoc commune* which are used as food, *Spirulina, Calothrix,*

*Anabaena* and *Cylindrocystis* are used as fertilizers, and *Scenedesmus, Ankistrodesmus, Pediastrum* for the manufacture of drugs and fodder.

3.2.5.1 **Composition and Distribution of Algae Species.** Based on field research conducted in Mongolia in the 1970s, 1236 species and sub-species of algae were found in the soil and in different natural water reservoirs (Table 1).

Table 1

**Composition of algae species in lakes, rivers and soil**

| Algae | Families | Genera | Species & subspecies | Percentage |
|---|---|---|---|---|
| Bacillariophyta | 9 | 48 | 626 | 50.7 |
| Chlorophyta | 30 | 102 | 350 | 28.3 |
| Cyanophyta | 20 | 43 | 192 | 50.7 |
| Xanthophyta | 5 | 9 | 15 | 1.2 |
| Euglenophyta | 1 | 3 | 14 | 1.1 |
| Chysophyta | 4 | 5 | 12 | 1 |
| Dinophyta | 2 | 5 | 11 | 0.9 |
| Charophyta | 2 | 2 | 9 | 0.7 |
| Cryptophyta | 1 | 2 | 5 | 0.4 |
| Rhodophyta | 2 | 2 | 2 | 0.2 |
| **Total** | **76** | **221** | **1236** | **100** |

The Arctic Ocean Basin includes 20.6 per cent of Mongolian territory and 52.1 percent of Mongolia's water systems is situated only in this area. Although, the water collection capacity of the Arctic Ocean Basin, with regard to its area, is relatively small, the density of water systems and surface drainages is higher than in the areas of the other two water basins.

734 species or sub-species of algae were found through a study conducted on 13 lakes (for example, Khuvsgul, Terkhiin Tsagaan, Ogii, Deed Tsagaan, Duuren, etc.) and more than 20 rivers (for example, Orkhon, Selenge, Ider, Tamir, Eg, Delger, etc.)

The Pacific Ocean Basin brings water to 13.8 percent of Mongolian territory and encompasses 15.9 percent of the total surface water flow. 440 species or subspecies of algae were found in the Buir, Khokh and Tsagaan lakes and 17 rivers, including the Khurkh, Onon and Kherlen; 144 species or sub-species were found to be indigenous to this basin.

The Central Asian Inland Drainage Basin waters 65.6 percent of Mongolia's territory and contributes 32 percent of the surface water flow. The study on algae in this basin covered 15 lakes (Khorgon, Khoton, Achit, Boon Tsagaan, etc.) and 6 rivers (Tuin, Khovd, Ongi, etc.). 3 12 species, or 61.2 per cent of the 757 species found in Mongolia, were found in this basin.

Studies show that the Central Asian Inland and the Arctic Ocean Drainage Basins are relatively rich in a variety of algae species (Table 2). 59.2 per cent of the total number of algae species or sub-species occur in lakes, and among them, 45.3 per cent or 339 species or sub-species exist only in one lake. 15.1 per cent or 225 species or sub-species are found in rivers, and 18.2 percent exist in both lakes and in rivers (Table 3).

Table 2

**Number of algae species in different drainage basins**

| Algae | Arctic Ocean Drainage Basin | | Pacific Ocean Drainage Basin | | Central Asian Inland Drainage Basin | |
|---|---|---|---|---|---|---|
| | total | in basin | total | in basin | total | in basin |
| Bacillariophyta | 480 | 138 | 239 | 35 | 430 | 97 |
| Chlorophyta | 140 | 82 | 132 | 76 | 181 | 113 |
| Cyanophyta | 70 | 37 | 61 | 29 | 119 | 80 |
| Xanthophyta | 9 | 7 | 2 | 1 | 6 | 5 |
| Euglenophyta | 9 | 9 | | | 5 | 5 |
| Chysophyta | 9 | 7 | 3 | 1 | 3 | 2 |
| Dinophyta | 7 | 6 | 1 | | 5 | 4 |
| Charophyta | 2 | | 1 | 1 | 8 | 6 |
| Cryptophyta | 5 | 5 | | | | |
| Rhodophyta | 1 | 1 | 1 | 1 | | |
| **Total** | **734** | **292** | **440** | **144** | **757** | **312** |

Table 3

**Number of species of algae in lakes, rivers and soil.**

| Algae | Lakes | Rivers | Lakes & rivers | Soil | Aquaria | Streams | Total |
|---|---|---|---|---|---|---|---|
| Bacillariophyta | *464* | *35* | *126* | 1 | | | **626** |
| Chlorophyta | 139 | 160 | 67 | *16* | - | *18* | **350** |
| Cyanophyta | *85* | *37* | *27* | *29* | - | *14* | *192* |
| Xanthophyta | *4* | *7* | *2* | *2* | | | **15** |
| Euglenophyta | 12 | | 1 | | | 1 | **14** |
| Chysophyta | 8 | *3* | 1 | | | | 12 |
| Dinophyta | 11 | - | | | | | 11 |
| Charophyta | 7 | 2 | | | | | 9 |
| Cryptophyta | *2* | *2* | 1 | | | | 5 |
| Rhodophyta | | 1 | | | 1 | | **2** |
| **Total** | **732** | **187** | **225** | **58** | 1 | **33** | **1236** |

Of the total number of Mongolian algae species and sub-species, 3 1.8 percent or 394 species or sub-species are planktic, 41 .0 percent or 507 species or sub-species are benthnic, 23.1 percent or 286 species or sub-species are both planktic and benthnic and 49 species or sub-species are soil algae (Figure 1, Table 4).

Fresh water algae which are adapted to cold conditions, such as *Hydrorus foetidus, Batrachospermum moniliforme,* and *Cymbella stuxbergii,* are dominant in mountain rivers and lakes, whereas, *Cyanobacteria* and bluish-green algae are common in lowland lakes and rivers. *Zygnema, Spirogyra,* and *Scenedesmus* live in valley water basins and *Closterium* and *Cosmarium* belonging to the *Desmidiaceae* family, live in the low muddy areas.

**Algae studies** have covered so far only a small part of Mongolian wetlands. Studies on algae in the steppe and desert-steppe, taiga, and high mountain zones and belts have not yet been carried out

Figure 1

Ecological **composition of algae in lakes, riven and soil**

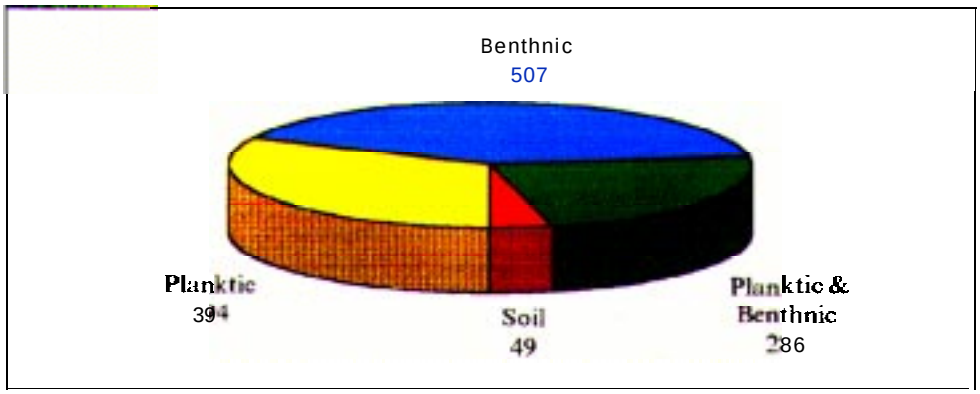



Table 4

**Ecological composition of algae in lakes, rivers and soil**

| Algae | Planktic | Benthnic | Planktic & Benthnic | Soil species | Total |
|---|---|---|---|---|---|
| Bacillariophyta | 87 | 384 | 154 | 1 | 626 |
| Chlorophyta | 191 | 55 | 80 | 24 | 350 |
| Cyanophyta | 74 | 53 | 44 | 21 | 192 |
| Xanthophyta | 7 | 3 | 2 | 3 | 15 |
| Euglenophyta | 8 | | 6 | | 14 |
| Chysophyta | II | I | | | 12 |
| Dinophyta | II | | | | 11 |
| Charophyta | | 29 | | | 9 |
| Cryptophyta | 5 | | | | 5 |
| Rhodophyta | | 2 | | | 2 |
| **Total** | **394** | **so7** | **286** | **49** | **1236** |

**3.2.5.2 Conservation of Algae species.** Several lakes like the Khuvsgul, Buir, Kharus. Dayan, Khorgo, and Terkhiin Tsagaan lakes, as well as several river tributaries and the environment **surrounding** these tributaries, have been subsumed in the special protected areas network during the last few years.

**The measures which have** been taken in these areas arc important for the protection of algae **diversity in Mongolian** wetlands. The export **and trade** of soil algae like *Nematonostoc flagelliforme* in some parts of Sukhbaatar and Dornogobi by locals have caused a decrease in the numbers of such algae in these areas. These species are included in the Mongolian Red Book

The site of Yoliin am in a national park in the Omnogobi aimag, which is *Nematonostoc flagelliforme* habitat serves as a model site for **the conservation of algae** in **this** country.

## 3.2.6 Fungi

**3.2.6.1 Composition and Distribution of Fungi Species.** The *Mycophyta* is obviously the less studied group of Mongolian flora. Since the 1960s, studies on saprophytic fungi have been conducted in Mongolia and as a result, 220 species of *Fuscinia* and 65 species of *Ustilago, 60* species of *Erysiphe* and 40 species of *Peronosporea* have been registered, The fungi survey succeeded in finding 389 species which include 243 species of *Bazydomycete* and 98 species of *Fomes, 3* 1 species of *Lycoperdon* and *16* species of *Bazydomycete.* The number of all registered species of fungi is currently 900.

Almost all Mongolian fungi grow on tree roots and trunks, decaying wood, forest floors and dung (Table 1).

Table 1

**Distribution of micromycetes fungi**

| Genera | Habitats | | | | |
|---|---|---|---|---|---|
| | trees | soil | forest floors | mycorhiza | dung |
| Bazydomycete | 45 | 83 | 27 | 75 | 12 |
| Fomes | 93 | 5 | | | |
| Lycoperdon | 3 | 28 | | | |
| Ascomycete | 3 | 5 | 8 | | |
| **Total** | **144** | **122** | **35** | **75** | **12** |

3.2.6.2 **Conservation of Fungi. 95** species or 24.4 per cent of 341 species of *Bazydomycetes* and *Lycoperdon* are edible fungi. Particularly, the *Tricholoma mongolica* is considered in the East as a medicinal plant and is widely used in many regions in Mongolia. Because of destructive human activities such as, injuring the mycelium of the *Tricholoma mongolica* during the harvest season and picking these fungi before they are completely mature, the *Tricholoma mongolica* distribution and abundance are declining.

A study on fungi conducted in the Binder and Batshireet centres of Khentii aimag and Sergelen centre of Tov aimag shows that the yield of the Steppe White Fungi is between 28 and 140 kilograms per hectare, The endemic fungi growing on fallen birch trunks in old mixed forests, is now threatened by the modern forestation methods.

Because of these reasons the following species of fungi such as *Leccinum, Lepista, Leucopaxillus, Tricholoma* have been put on a list of rare plants and are registered in the Mongolian Red Book..

At present, the cultivation of “useful” fungi is being carried out as a way of countering their disappearance from their natural habitats; this can be regarded as a positive measure towards the conservation of fungi in Mongolia.

# 3.3 Composition and Distribution of Micro-organisms

## 3.3.1 Composition and Distribution of Micro-organisms

There are about 570 species of micro-organisms belonging to 82 genera which have been registered in Mongolia today (Table 1). They were isolated from soils, ground water, berries, milk and bread and were found to be bacteria, ***Actinomycetes,*** microfungi and yeast. Most of them were isolated from soils. Among the microbes, there are 206 species of ***Streptomyces,*** 53 species of ***Penicillium,*** 42 species of ***Bacillus, 40*** species of ***Pseudomonas, 22*** species of ***Aspergillus,*** 18 species of *Candida*, 13 species of ***Fusarium,*** **11** species of ***Bacterium*** and 10 species of ***Chromobacterium.*** Other genera include less than 10 species. 156 species of cyanobacteria belonging to 45 genera were found in Mongolia. In addition, approximately 200 species of parasitic fungi were were found on various wild and cultivated plants; the following are a few genera belonging to this group: *Puccinia (80* species), *Leveillula* **(18** species), ***Uromyces*** (14 species), ***Ustilago*** and *Erysiphe* (13 species) and *Melampsora* (10 species). It should be noted that microbe names used in this text are taken directly from original scientific publications.

Table 1

**Micro-organisms (as determined so far) of Mongolia**

| Group | Number of genera | Number of species |
|---|---|---|
| Coryneform bacteria and Actinomycetes | 7 | 220 |
| Other bacteria | 23 | 147 |
| Yeast | 11 | 39 |
| Microscopic fungi | 41 | 161 |
| C yanobacteria | 45 | 156 |
| Plant parasitic mycoflora | 28 | 193 |
| **Total** | **155** | **916** |

96 species of bacteria, 60 species of ***Actinomycetes*** and **21 species of microfungi were found in** the soil of Eastern Khangai in the forest-steppe zone of Mongolia. In this region, meadow dark-coloured soil, black earth soil and dark-chestnut soil were very rich with microbes. 45 species of micro-fungi were found in the dark and light chestnut soils of arable land in Selenge and Central aimags. ***Penicillium, Aspergillus, Fusarium, Mucor, Rhizopus*** and ***Chaetomium*** were the prevailing in this area. Desert and desert-steppe zones are also quite rich in microfungi. For example, 25 species were isolated from the rhizosphere of desert plants and 47 species from the rhizosphere of desert-steppe plants. ***Penicillium*** and ***Aspergillus*** are found in abundance here, as well as, a few ***Fusarium*** species. ***Mucor*** is a rare species in the area.

In desert zone, 65 species of bacteria and ***Actinomycetes*** were detected in desert-steppe brown soils and 39 species of the same in desert soils (i.e., the desert-steppe soils are richer in

organisms in the surface soils of the lake shore was low (32 to 768 thousand cells per gram of soil) in comparison with Lake Baikal (hundreds of millions and milliards cells/g of raw soil). The water layer at a depth of 20 to 50m was rich not only with benthos but in bacteria, as well. *Actinomycetes* occurred in all samples. However, their amount was not very high (50 to 350 cells per gram of raw soil). Yeast, one of the main sources of protein and vitamins for fish feeding, was found in 6 samples (500 to 5 5000 cells per gram of raw soil).

### 3.3.2 Ex situ Micro-organism Conservation and Use

However, a problem of adequate preservation and conservation of micro-organisms *ex situ* is far from being solved. Microbe cultures isolated during examinations of soils, water, food and other sources have been stored in different institutions which maintain cultures according to their fields of specialization and interests. For example, Khunstech Corporation maintains lactic acid bacteria, the Chair of Biochemistry and Microbiology at the Mongolian State University maintains yeast, Biokombinat in Songino maintains animal pathogens, the Public Health Institute and Centre for Infectious Diseases maintains human pathogens and the Laboratory of Microbiology and Division of Biotechnology of the Institute of Biological Sciences at the Mongolian Academy of Sciences, maintain economically important micro-organisms which are isolated from natural environments. The Division of Biotechnology of the Institute of Biological Sciences maintains about 750 identified and non-identified microbe strains including *Actinomycetes,* bacteria, microfungi, yeast and microalgae. But due to the lack of chemicals and adequate equipment for long-term preservation proper preservation of strains cannot be carried out. Such a situation is observed in the sampling of cultures. Besides, there are no particular laws and regulations on the conservation of microbe diversity in Mongolia.

The use of microorganisms in the preparation of various fermented milk products such as airak (fermented mare's milk), tarag (yoghurt), shimiin arkhi (milk spirit) and aaruul (dried cheese-like product) is common practice among Mongolians.

Nowadays in Mongolia, the microbe strains are used for the production of dairy goods, beverages, fertilizers, veterinary vaccines and medical preparations. During the screening process of beneficial micro-organisms, a number of industrially important strains were discovered (Table 2). Among them were strains producing aminoacids, antibiotics and enzymes. Some of them can be applied towards the production of fertilizers and proteins, for reducing pollutants and mineral leaching. Several strains of *Bacillus thuringiensis* were isolated from the caterpillars of Siberian Bombyx which can be used in the production of bacterial insecticides.

Mongolian ecosystems are unique as the natural environment is still mainly in a pristine condition. Because of this, there is a strong probability that new micro-organisms, having unique properties or producing diverse compounds, will be discovered here. Several microbe strains used in the production of valuable compounds and microbe biomass have already been found here (Table 2).

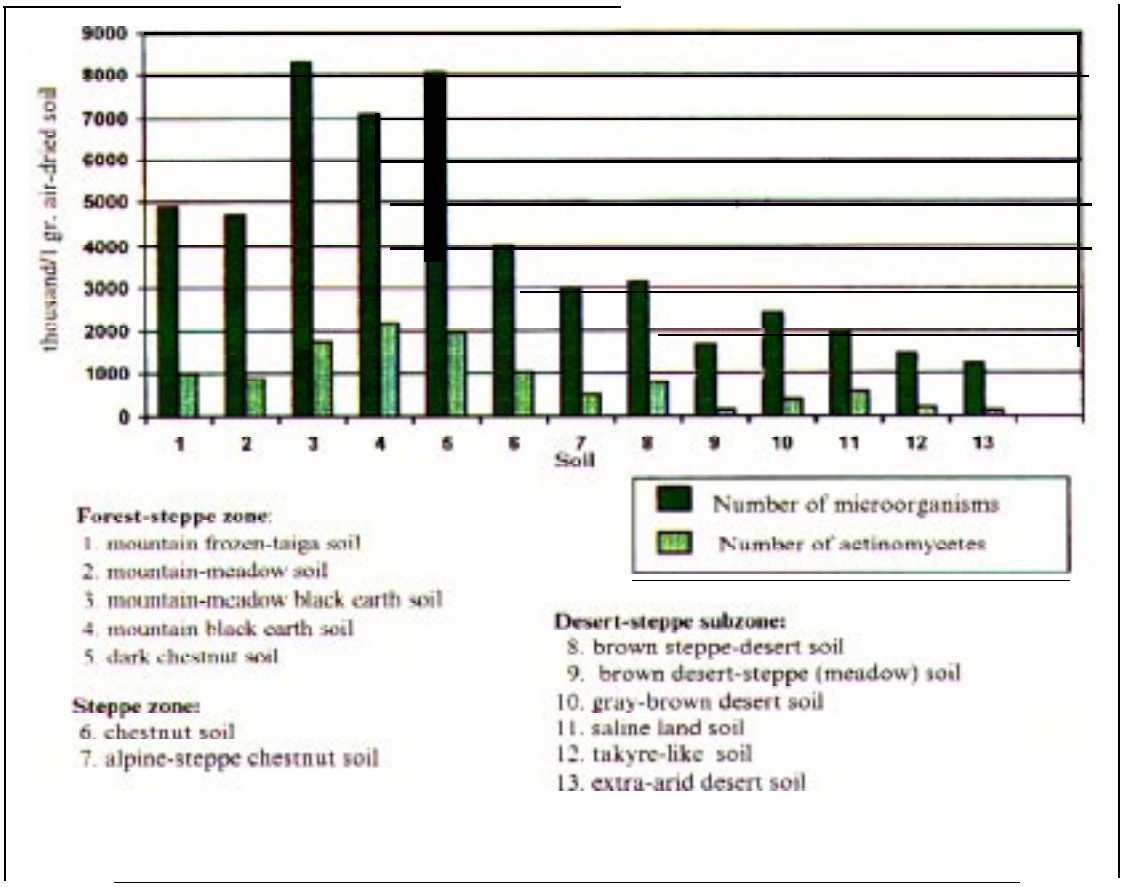
In addition to this, studies on *Actinomycetes* isolated from different samples of soil of Mongolia's main three natural zones (desert, steppe and forest-steppe) revealed that most of them were able to produce aminoacids and proteolytic enzymes (Table 2 and 3).

terms of microbe composition). Thre were 25 species of *Actinomycetes* (38%) and bacteria belonging to 17 genera and 6 families. *Bacillaceae* (32%) and *Bacteriaceae* (27%) were the more prevalent bacteria. 15 per cent of bacteria found in desert soils belong to the family *Pseudomonodaceae*.

*Actinomycetes* are one of the most widely distributed micro-organisms in Mongolian soils (Figure I) due to the resistance of their spores (especially of *Streptomycetes*) to dry conditions and powerful enzymatic systems. which help them to survive in extreme environments. *Actinomycetes* are pre-dominant in forest-steppe zone soils which are rich in humus. However, they are also quite abundant in the soils of the desert zone (7 9 to 26 4%) Figure 1 illustrates the percentage of the occurence of the *Actinomycetes* in the desert saline soil being almost equal to their presence in the chestnut soil of the steppe zone

Figure 1

Occurrence of **actinomycetes in different soils** of **Mongolia**




Little is known about the micro-organisms of Mongolian water reservoirs. No other groups of micro-organisms besides the small number of cellulolytic and sulphur-oxidising bacteria and denitritiers were found in the Shargaljut hot springs (92°C). Studies on the microflora of Lake Khuvsgul (a fresh water lake) revealed that the total number of micro-

organisms in the surface soils of the lake shore was low (32 to 768 thousand cells per gram of soil) in comparison with Lake Baikal (hundreds of millions and milliards cells/g of raw soil). The water layer at a depth of 20 to 50m was rich not only with benthos but in bacteria, as well. *Actinomycetes* occurred in all samples. However, their amount was not very high (50 to 350 cells per gram of raw soil). Yeast, one of the main sources of protein and vitamins for fish feeding, was found in 6 samples (500 to 5 5000 cells per gram of raw soil).

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Table 2

**Beneficial micro-organisms found in Mongolia**

| Name of micro-organism | Source of isolation |
|---|---|
| *Bacillus thuringiensis* | Insects |
| *Beauveria bassiana, Paecilomyces farinosus, P. elegans, P. fumoso-roseus, Paecilomyces sp., Cephalosporium lecanii, C. lefroyi, C.falcatum* | Soil and plant residue |
| *Trichoderma lignorum, Trichoderma koningii, Aspergillus terreus, Humicola gresia, Stachybotrys cylindrospora, Cellulomonas uda, Streptomyces sp.* | Soil |
| *Azotobacter chroococcum, Rhizobium japonicum, Rh. meliloti, Rh. leguminosarum, Azospirillum brasilence, A.lipoferum, B. megaterium var. phosphaticum* | Soil |
| *Thiobacillus ferooxidans, Thiobacillus thiooxidans, Leptospirillum ferooxidans* | Ground waters of copper mine |
| *Rhodotorula sp.* | Plant |
| *Dunaliella salina, D. viridis,* | Salt lakes |
| *Streptomyces phaeofaciens, S. rimosus, S. venezuelae* | Soil |
| *Bacillus brevis* | Industrial waste water |
| *Nematonostoc fragiliforme* | Soil |
| *Saccharomyces vini* | Home-made wine |
| *Lactobacillus bulgaricum, Streptococcus thermophilus* | Home-made fermented milk products |
| *Saccharomyces cerevisiae* | Home-made bread |
| *Lactobacillus bulgaricum, Streptococcus lactis, Saccharomyces cartilaginosus, Saccharomyces lactis* | Airak (fermented mare's milk) |

Table 3

**Number of actinomycete strains capable of producing aminoacids**

| Natural zone | Number of strains studied | Capability of producing aminoacids (%) |
|---|---|---|
| Steppe (Tumentsogt) | 172 | 73.8 |
| Forest-steppe (Mungnnmorit) | 93 | 78.5 |
| Desert (Ekhiin gol) | 119 | 34.4 |

Table 4

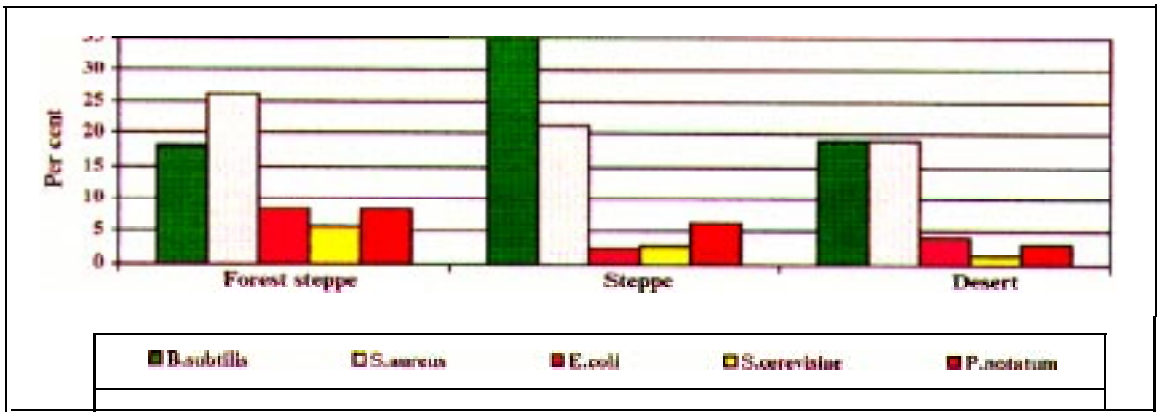
**Number of actinomycete strains capable of producing proteolytic enzymes**

| Natural zone | Number of strains studied | Capability of producing proteolytic enzymes (%) |
|---|---|---|
| Desert (Ekhiin gol) | 175 | 99.4 |
| Steppe (Tumentsogt) | 93 | 94.6 |
| Forest-steppe (Mungunmorit) | 122 | 100 |

Moreover, there were a lot of strains with antagonistic properties (i.e., able to produce antibiotics). About 60% of *Actinomycetes* isolated from extra-arid soil produced acid peptidase-enzyme which was able to curdle milk (Figure 2). Therefore, micro-organisms of Mongolia's natural environments could be a promising source for the screening of industrially important strains

Figure 2

Occurrence of aetinomycetes exhibiting antagonistic properties in soils of different natural zones of Mongolia.



# CHAPTER IV

# National Biodiversity Conservation Plan: Implementation, Output and Future Objective

## 4.1 Institutional Strengthening, Renewal of Legislation and Economic Undertakings of the Conservation and Proper Use of Biodiversity

By taking multi-faceted integrated measures to revamp the administrative structures, management, legislation and econ

omy of the country in order to implement the National Biodiversity Conservation Plan and the Convention on Biological Diversity, Mongolia is gradually developing favourable conditions to stop the further decrease in biological resources and to use them within the limits of their potential to restore themselves naturally. While doing so, Mongolia adheres to the principles of the global environmental policy and to the efforts of universal sustainable development towards achieving a proper balance between socio-economic development and the environmental resources' carrying capacity of the country.

### 4.1.1 Institutional Strengthening of the Conservation and Proper Use of Biodiversity

Since 1990, Mongolia has been in the process of making the transition from a centrally planned socio-economic system towards a free-market economy; consequently, fundamental changes have been taking place in the environmental conservation sector, especially in the structure of management, methods in protection, and the use of biological resources.

The supreme legislative organ in Mongolia is the State Great Khural (Parliament) which is elected for a term of four years and consists of 76 members. It has a Steering Committee on Rural Policy and Environment, which is in charge of matters pertaining to the natural environment. The state supreme executive power is vested in the Mongolian Government. The Ministry for Nature and the Environment is the Government's central administrative body which is directly responsible for matters regarding the environment.

Mongolia is divided into different administrative units known as aimags (provinces), soums (counties, or divisions of aimags) and bags (teams, or divisions of soums).

The capital of Mongolia, Ulaanbaatar, is administratively divided into duuregs (districts, which are divisions of the capital city), khoroos (sub-districts, which are further divisions of the districts).

Each administrative unit is led by a Governor who is in charge of taking measures to organize the implementation of laws and regulations passed by the State Great Khural, or decisions made by the Government and to provide instructions on how to practise them.

In addition, the corpus of Mongolian environmental laws from 1995 is playing an important role in the re-organization of the centralized administrative system, which was established for the intensive use of natural resources; furthermore, these laws promoted the organization and strengthening of self-governing local institutional systems in the conservation and proper use of natural resources. Since 1996, environmental laws have been complemented by the "Law on Government" and the "Law on Territorial Administrative Units and Their Guiding Principles" with their relevant Amendments. These laws contain clear and detailed divisions of responsibilities and rights of the State Great Khural, Central Government, Ministry for Nature and the Environment, as well as other Ministries, Khurals, executive governing bodies of Ulaanbaatar, aimags, soums, duuregs, bags, khoroos, as well as professional agencies, institutes and individuals in relation to the protection, proper use and restoration of Biodiversity. For instance, these laws have imposed on the State Great Khural of Mongolia, the great responsibility of completing the state policy on the protection, proper use and restoration of biological resources, to give careful considerations to levying fees and passing by-laws concerning biodiversity, and to control their implementation, as well as, to determine the maximum and minimum fees for the use of biological resources.

The Mongolian Government has the right to formulate and implement national plans to protect the biodiversity and ecological equilibrium of the country, to establish guidelines for plant and animal trade, to set up an environmental conservation fund and to decide its allocation, as well as, to plan ecological education at a national level.

The Ministry for Nature and the Environment of Mongolia as an executing agency of the Central Government, is responsible for all country-wide activities and matters in relation to the conservation of the environment.

The other governmental bodies have the right, within their jurisdictions, to accurately formulate the policy on the protection, proper use and restoration of biological resources (taking into account the special features in each sector's sustainable development), to implement environmental laws and regulations and to submit to the Central Government an annual report on the output of their activities.

Aimag representatives, Ulaanbaatar citizens in Khurals and the Governors of Ulaanbaatar and the aimags have the right to approve measures and budgets for environmental protection in their territories and to control their implementation, to set maximum limits for the use of natural resources within their administrative units, to decide on taking subjects under local protection and to ensure the implementation of the legislation on environmental protection, biodiversity and decisions made by the Government, to control the activities of local economic entities and organizations with respect to environmental protection, restoration and use of natural resources in their area, to take measures to eliminate violations, and when necessary, bring temporary injunctions against the activities of economic entities or organizations which have adverse environmental impacts, and to inform the authorized agencies so that favourable conditions for the work of environmental inspectors can be created.

Representatives of the soum and duureg citizens in Khurals and the Governors of the soums have the right to organize measures on the implementation of environmental protection legislation and decisions made by higher level organizations in their areas, to control activities of local economic entities and organizations concerning environmental protection, restoration

and the use of natural resources within their areas, to take measures, to eliminate violations and when necessary, set temporary injunctions against the activities of economic entities or organizations which have adverse environmental impacts and to inform authorized organizations to make decisions, to monitor the use of natural resources by citizens, economic entities and organizations and to take measures focusing on the reduction of environmental pollution, prevention of forest and steppe fires, restoration of damaged land, cultivation of endangered plant species and breeding of animal species threatened by extinction.

The bag and khoroo citizens via the "Public Khurals" and the Governors of the bags have the right to design and regulate schedules for the protection and use of hayfields, pastures and water sources which have not been designated towards possession or use by others, to organize the implementation of environmental protection legislation and decisions passed by the "Public Khurals" and other higher level organizations. In Mongolia, there are more than 20 laws, 180 regulations and resolutions which clearly reflect the duties and power of each administrative unit on environmental and biodiversity protection.

The organization for the conservation of the biodiversity within the protected areas is reflected partly in a report called the "Protected Areas Network in Mongolia". Although, measures have been taken to strengthen institutional capacities and to establish a legal foundation for the protection of the Mongolian environment and its biodiversity, there is still a shortage of professional staff, funding, sufficient skills and expertise to properly conserve and sustain the natural resources of this country.

Certain improvements have been noted in the natural resources surveys, ecological and economical evaluations, environmental impact assessment, selection of methods and techniques to protect, properly use and restore biological species, establishment of data bases, data analysis, and environmental control. In these areas, the scientific research institutes and higher educational institutions have played an important role. However, all these are in need of material and financial assistance in order to develop their activities. In addition, Mongolian non-governmental organizations, in spite of their limited potential, have contributed a great deal to the protection of species, raising of public awareness and distribution of information about the necessity to conserve the environment. The Mongolian Association for Conservation of Nature and the Environment (MACNE) is successfully involved in implementing Projects on the re-introduction of the Wild Horse in Mongolia and on Snow Leopard Research. In addition, The Mongolian Gazelle Protection Society, the Mongolian National Park Society and the Green Peace Movement are the most active NGOs in this country. The Mongolian Green Party is a political organization focusing on environmental issues. The enforcement of the "Law on Non-Governmental Organizations", passed by the State Great Khural in 1997, has introduced new opportunities for the Mongolian NGOs to actively participate in the protection of nature. There is, however, a need to assist those organizations in their capacity building, activities, staffing and fund raising.

In the recent years, some private organizations and economic entities have emerged and started working in the field of environmental training, consultancy, assessment, afforestation and wild animal culling. For instance, 6 such private economic entities have made important contributions to the reduction of environmental deterioration, limiting the use of biological resources by making assessments on the status of impacts on the environment through work

involving over 100 projects. Some private companies and economic entities are now efficiently working on the use of solar energy, wind power, filters for vehicle emissions, water meters, organic fertilizers, high quality burning stoves, etc.. The activities of these organizations have proved the importance of the involvement of private institutions in the protection of nature. That is why, the Mongolian Government and international agencies concerned, should consider the possibilities to support those private entities operating in the field of environmental conservation.

### 4.1.2 Biodiversity Policy and Planning

The basic guidelines for the protection of the environment and its natural resources are clearly formulated in such directives as the "Mongolia's National Security Policy Orientation" of 1995, the "National Development Strategy" of 1996 and the "Ecological Policy Orientation of the Mongolian State" of 1997. The ideas of these documents are expressed in detail in the corpus of environmental laws, the national program on the preservation of biodiversity, the program to combat desertification and the program on protected areas; the implementation of such programs is in progress. A national program on forest conservation, restoration and proper use is now under formulation. At the same time, environmental protection has become an important item in the "Action Plan of the Mongolian Government" and in the annual guidelines of the country's socio-economic development. Accordingly, all the administrative units plan their work at the ground level, focusing on wider involvement from the population.

The Regular Spring Session of the State Great Khural hears and discusses the Report on the current status of the environment which plays an important role in the protection of the biodiversity of Mongolia. In our work, we are also paying attention to all possible alternatives to develop multilateral and bi-lateral relations in the field of biological resources conservation, exchange of experiences and acquisition of new knowledge and technical know-how. All these activities are intrinsicly linked with the activities carried out to implement the provisions of the Convention on Biodiversity and Mongolia's commitments to the world community.

### 4.1.3 Renewal of Legislation on Biodivesity

In past years, the Mongolian state and governmental organizations have concentrated their efforts on the establishment of a legal foundation consistent with the environment protection objectives of the country. For example, in 1995 and 1996, the "Law on Natural Plants", "Law on Plant Protection", "Law on Hunting", "Law on Fees for the Harvest of Forest Timber and Fuelwood", "Law on Natural Plant Use Fees", and "Law on Hunting Reserve Use Payments, and on Hunting and Trapping Authorization Fees" have been passed and came into effect under the State Great Khural. In addition, over 30 Regulations and Resolutions have been endorsed to support those laws such as the "Rules for Forest Management", "Rules for Estimation of Damage caused by Forest and Steppe Fire", "Procedures for collection, stocking and selling Forest Seeds", 'Rules of Forest Seed

Laboratory", "Procedures for Afforestation, Planning and Funding of Forestry", "Instructions on Timber Felling", "Methodology to Define the Extent of Fire Damage", "Procedures to Transfer Planted Trees to the State Forest Fund and to Mobilize Manpower" and "Transportation to Combat Fire". Also, some 20 rules and instructions were formulated on the conservation of wild animals and plants.

The protection of natural resources and their proper use fall under the "Law on Environmental Protection", "Law on Water", "Law on Land', "Law on Protected Areas", "Law on Protection from Toxic Chemicals", "Law on Air", and "Law on Ground Mineral Resources", which shall be approved and perfected in the years to come. New amendments have been made to the "Law on Protected Areas" and draft revisions have been prepared with regard to some other Laws. New laws on fauna and pastures are currently under formulation. The new "Law on Assessment of Impacts on the Environment" is to be enforced in 1998 and will make important contributions to the improvement of environmental conditions in this country.

Mongolia has signed and ratified globally important documents in the field of Biodiversity conservation including the "Convention on Biological Diversity" (1993), the "Convention to Combat Desertification" (1994), the "Convention on International Trade in Endangered Species of Wild Fauna and Flora" (1996), the "Vienna Convention for the Protection of the Ozone Layer" (1996), the "Montreal Protocol on the Substances that Deplete the Ozone Layer" (1996), the "UN Convention on Combating Drought and Desertification" (1996), the "Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal" (1997) and the "Convention on Wetlands of International Importance especially as Waterfowl Habitat" (1997), and is preparing to sign the "Convention on Migratory Animals".

At the same time, the Mongolian government has been intensively developing bi-lateral cooperation on environmental protection with the governments of the People's Republic of Kirgizistan since 1993, with the Russian Federation since 1994, as well as, with many other countries. Currently, measures are being taken to improve the ideas of Mongolian legislation and the conditions of international bilateral agreements.

### 4.1.4 Economic Undertakings in Biodiversity Conservation

According to Mongolian Laws, all biological resources must be re-examined and determined periodically. For instance, forest resources shall be surveyed every ten years; animal and plant resourses shall be surveyed annually. As of today, the resources of about 100 plant species that exist in this country have been identified and preparations to define the animal resources are now underway. Ecological and economic assessments of forests and some animals have been conducted. Based on Mongolian law, animal and plant species are classified as threatened, endangered and abundant. As a result, 18 animal species and 133 plant species are under protection and they can be used only for the purpose of scientific research. There are some 18 animal species and 234 plant species considered to be limited resources and measures

shall be taken to restore their populations. The use of these animal and plant species shall be conducted on the basis of licensing and strict control.

Before the harvesting or culling of any species, all individuals, economic entities or organizations should have carried out an environmental impact assessment and have plans to restore these species at their own expense; those restored species can be registered as the private property of the individuals, economic entities or organizations which have restored them. Also, they shall enjoy the right to domesticate wild species if they have the intention of breeding or growing them, and their activities will not have a negative impact on the environment. Any individuals, economic entities or organizations who trap animal species for the purpose of re-introduction, eliminating populations from disease core areas or for research, shall be exempted from fees. The government uses these fees for breeding animals and growing plant species. According to law, 70 per cent of fees accumulated from the use of forests should be used for afforestation.

Those who violate Laws and Regulations are heavily fined in accordance with the relevant provisions of the legislation. So, there is consistent effort in developing the economic mechanism of Mongolian environmental protection.

### 4.1.5 Sources for Biodiversity Conservation

In Mongolia, there is an urgent need to make large scale investments with regards to the protection of biological resources from which we all gain the benefit of transferring the living legacy of nature to our children. On average, fees, equaling approximately one billion tugrugs are charged for the annual use of forests, animal and plant species. 30 per cent of these fees are returned for forests and species restoration. Besides, every year, the Mongolian Science and Technology Fund provides over 300 million tugrugs for the implementation of some 40 projects, and the Government uses the national budget to finance the institutes of higher education for conducting biological training. In addition, the Environmental Protection Fund allocates 7 to 10 million tugrugs, annually, for the breeding and rearing of endangered species and restoring other biological resources. A new Environmental Protection Fund has been established and its fund-raising involves the collection of fees for issuing licenses to tour operators, donations made by individuals, economic entities and other organizations. The Fund finances ecological training programmes and environmental protection activities. Now, efforts are made to create a legal basis for the activities of this newly established Fund.

In past years, the Environmental Protection Fund and the Endangered Species Fund have spent about 30 million tugrugs for the implementation of laws and regulations aimed at protecting biodiversity. There are also plans to support those individuals, economic entities and organizations who are able to introduce progressive methods and means to biological resources protection and restoration.

In addition, the newly established Mongolian Environmental Trust Fund will surely make notable contributions to funding the activities related to conservation of the nature and its biological resources.

At present, it must be emphasized that world organizations and the international community have started to recognize the importance of protecting the Mongolian natural environment and its biological resources. International funding sources in particular are showing a growing interest in increasing their support. For instance, with the assistance of international organizations such as the UNDP, UNEP, ADB, World Bank, and the governments of the Netherlands, Germany and Japan, several projects on environmental protection and biological resources are now under implementation.

The first phase of the Mongolian Biodiversity Project has been successfully carried out with the funding from Global Environment Facility (GEF) administered through the UNDP. The second phase of the project has just started, based on the experience and knowledge gained from the first phase. It should also be noted that the Biodiversity Project has worked with both the German Agency for Technical Cooperation (GTZ) and the World Wide Fund for Nature with regards to protected areas and their buffer zones. The Christian Oswald Foundation in Germany and the Boumann Foundation in the Netherlands and their representatives have played an important role in the implementation of two projects on the re-introduction of the Przewalskii's horse in the Gobi B Strictly Protected Area and the Khustain Nuruu Nature Reserve. As a result, the total number of wild horses has now reached 100 individuals. The International Snow Leopard Trust and The New York Zoological Society, The Wildlife Conservation Society (New York) have supported research on Snow Leopards. The Institute for Zoo Biology and Wildlife Research (Berlin) has helped to survey the Mongolian Gazelles.

## 4.2 Protected Areas Network in Mongolia

The Mongolian natural environment is relatively undisturbed despite of negative human activities, due to the long tradition Mongolians have in protecting the fauna and flora.

### 4.2.1 The Need for Protected Areas

Climate change and human activities are leading to the degradation of fragile ecosystems in nature, which ultimately also impact socio-economy. Protected areas play a key role in the restoration of the environment by maintaining ecosystems, mitigating the loss of biological diversity and creating conditions to naturally increase biological diversity; hence improving conditions towards the utilization of natural resources and the sustainable development of Mongolia. The Government of Mongolia has paid special attention to the recommendations made by IUCN for securing the maintenance of the ecological balance in a country (such as Mongolia) which experiences a continental climate and has fragile ecosystems.

There is a real necessity to establish more protected areas in order to implement the international conventions which Mongolia has already joined including the "Rio Declaration",

"Sustainable Development Concept", "Convention on Climate Change", "Convention on Biological Diversity" and United Nations "Convention to Combat Desertification". Moreover, articles of the National Constitution which say "Land, underground resources, forest, water, wildlife, plants and other natural resources are the property of the state" and "Citizens of Mongolia have the right to live in a safe environment that is to be protected from environmental degradation" will be implemented through the establishment of more protected areas.

Mongolia needs to extend the Protected Areas Network and improve the management of these areas in order to safeguard its statement made at the United Nations Conference on Environment and Development in Rio De Janeiro in 1992, which expressed Mongolia's desire to contribute to global environment protection by subsuming 30 per cent of its total territory in the Protected Areas Network. At the same conference, Mongolia took the historically noteworthy step of proposing that all of Mongolia should be accorded special status as a world biosphere reserve of special international significance.

### 4.2.2 Extension of the Protected Areas Network

The establishment of the Bodg Khan Mountain Protected Area in 1778 (one of the oldest protected areas in the world), resulted later in specific measures that have been carried out to secure more protected areas in Mongolia. For example, the Great Gobi Protected Area was established in 1957 in order to protect the Gobi ecosystems and its rare plant and wildlife species. Yoliin Am, Uran Uul and Khorgo were included within the protected areas in 1965. From 1965 to 1980, the establishment of additional protected areas was interrupted. New protected areas have, however, been founded since 1990, after the country began to make a transition to a free market economy and the government has since implemented sustainable development measures according to its policy. Earlier, there was only one category of protected areas - Strictly Protected Areas - meaning the highest restriction of the use of natural resources. This concept was changed according to the Law on Special Protected Areas approved by the Parliament of Mongolia in 1994, and now there are four categories of protected areas including Strictly Protected Area, National Park, Nature Reserve and Nature Monument in accordance with international categories of protected areas. Legislation for protected areas and protection regimes of zones within protected areas has been approved and is under implementation.

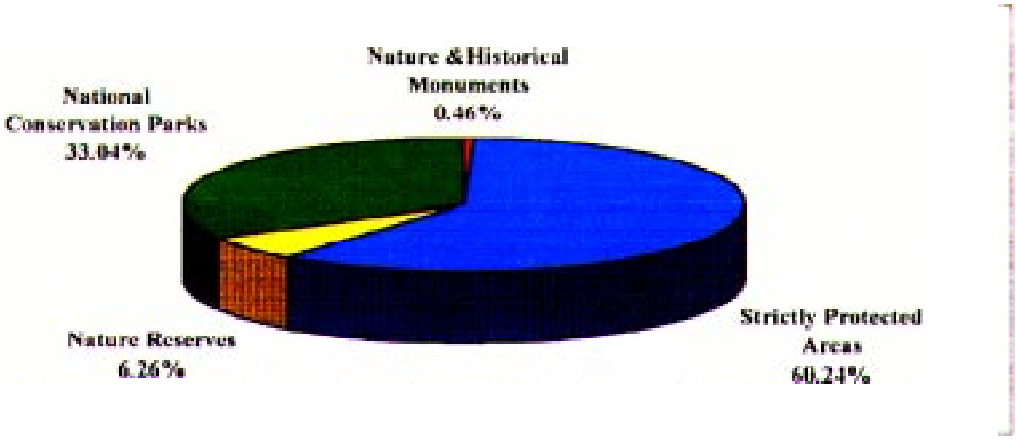
Approved by the Parliament in 1995 and 1996, the long term national policies on protected areas were identified in the Concept on the National Safety and Development and National Policy on Ecology. The National Action Plan on Protected Areas is in the process of being developed and will be submitted to the Parliament for approval with regards to implementing the policy on protected areas.

At the same time, objectives on the establishment of more protected areas, which will cover 30 per cent of the country and which is indicated in the National Action Plan on

Biodiversity Conservation for Mongolia, are under implementation at several stages. For example. protected areas such as Khan Khentii, Dornod Mongolia and Daguur Mongol were established in 1992, Uvs Basin Strictly Protected Area and Khustain Nuruu Natural Reserve in 1993, Small Gobi, Altai Tavan Bogd, Alag Khairkhan and Burkhan Buudai Protected Areas in 1996 and Khar Us Nuur and Khoridal Saridag Protected Areas in 1997. Currently, Mongolia has altogether 38 protected areas which cover 17.4 million hectares of land or 11.1 per cent of the country 12 Strictly Protected Areas, 7 National Parks, 13 Nature Reserves and 6 Monuments (Table I). According to their size, Natural Reserves and Strictly Protected Areas are the main components in Mongolia's Protected Areas Network (Figure 1).

Figure 1

Percentage **of various protected areas in 1997**




Preparation and justification for the establishment of new protected areas in Menen Steppe, Lag Lake, Onon and Balj Basins and Degee River which cover a total of 5 million hectares of land have been carried out and developed.

In the future, the Protected Areas Network should be extended to cover more areas which are potentially susceptible to human activities and climate change, which have a key role in maintaining ecosystems of different natural zones, as well as, belts and areas which serve as habitats for rare and endangered species (Figure 2). For example, 16.7 per cent of protected areas **belongs to the high mountain and mountain taiga zone, 13 per** cent to the forest steppe zone, 6.8 per cent to the steppe zone, 13.2 per cent to the desert steppe zone and 50.3 per cent belongs to the desert zone (Figure 3).

Based on this example, it can be said that the largest part of the fragile Gobi ecosystem which experiences a continental climate and is a habitat for rare and endangered species, is already included within the Protected Areas Network.

According to researchers and scientists, approximately 40 per cent of the habitats for rare and endangered **species of animals and plants of Mongolia is today included within the Protected Areas Network.**

# Protected areas of Mongolia

Figure 2.

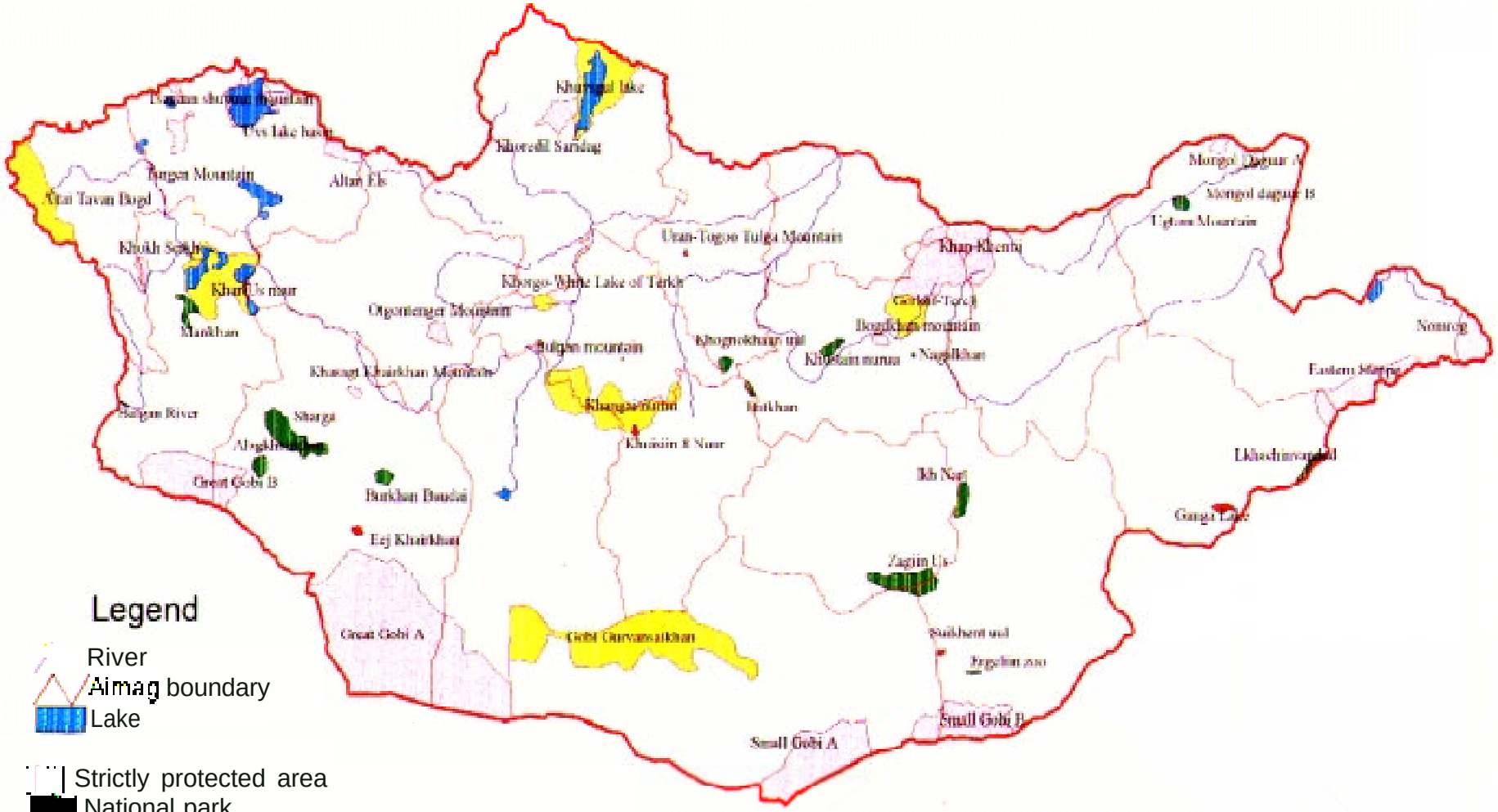


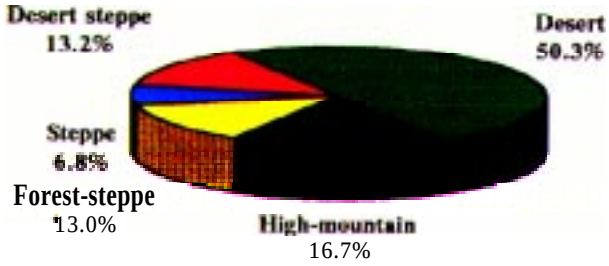
Table 1

**Protected areas of Mongolia**

| # | Classification & name | Area per 1000 ha | Year established |
|---|---|---|---|
| | ***I. Strict& Protected Areas*** | | |
| 1 | Great Gobi | 5311.7 | 1975 |
| 2 | Khukh Serkh | 65.9 | 1977 |
| 3 | Bogd Khan Uul | 41.6 | 1974 |
| 4 | Khasagt Khairkhan | 27.4 | 1965 |
| 5 | Khan Khentii | 1227.1 | 1992 |
| 6 | Numrug | 311.2 | 1992 |
| 7 | Dornod | 570.4 | 1992 |
| 8 | Mongol Daguurian | 103 | 1992 |
| 9 | Otgontenger | 95.5 | 1992 |
| 10 | Uvs Nuur Basin | 712.5 | 1993 |
| 11 | Small Gobi | 1839.1 | 1996 |
| 12 | Khoridol-Saridag | 188.6 | 1997 |
| | **Total area** | 10494.3 | |
| | ***ZZ. National Conservation Parks*** | | |
| 1 | Khuvsgul | 838.1 | 1992 |
| 2 | Khorgo-Terkhiin Tsagaan Nuur | 77.3 | 1965 |
| 3 | Gobi Gurvansaikhan | 2171.7 | 1993 |
| 4 | Gorkhi-Terelj | 293.2 | 1993 |
| 5 | Altai Tavan Bogd | 636.2 | 1996 |
| 6 | Khangai Numu | 888.5 | 1996 |
| 7 | Khar-Us Nuur | 850.3 | 1997 |
| | **Total area** | **5755.1** | |
| | ***ZZZ. Nature Reserves*** | | |
| 1 | Nagalkhan Uul | **3.1** | 1957 |
| 2 | Batkhan Uul | **21.8** | 1957 |
| 3 | Lhachinvandad Uul | **58.8** | 1965 |
| 4 | Bulgan Gol | **7.6** | 1965 |
| 5 | Khustain Numu | **49.9** | 1993 |
| 6 | ugtam Uul | **46.2** | 1993 |
| 7 | Sharga-Mankhan | **390.0** | 1993 |
| 8 | Zagiin Us | **273.6** | 1996 |
| 9 | Alag Khairkhan | **36.4** | 1996 |
| 10 | Burkhan Buudai | **52.1** | 1996 |
| 11 | Ergeliin Zoo | **60.9** | 1996 |
| 12 | Ikh Nart | **43.7** | 1996 |
| 13 | Khugnukhaan Uul | **47.0** | 1997 |
| | **Total area** | **1091.3** | |
| | ***IV. Natural and Historical Monuments*** | | |
| 1 | Bulgan Uul | 1.8 | 1965 |
| 2 | Uran-Togoo Uul | 5.8 | 1965 |
| 3 | Eej Khairkhan | 22.5 | 1992 |
| 4 | Khuisiin Naiman Nuur | 11.5 | 1992 |
| 5 | Ganga Nuur | 32.9 | 1993 |
| 6 | Suikhent Uul | 4.8 | 1996 |
| | **Total** area | 79.3 | |
| | **TOTAL OF ALL PROTECTED AREAS** | **17.420.0** | |

Figure 3

**Percentage of protected areas in various zones**




Specific measures for including historically and culturally important areas which play a key role in ecological maintenance, not only for Mongolia, but also for the world in the context of the Man and Biosphere Reserve and World Heritage Network, have been carried out to some extent The Great Gobi Strictly Protected Area was included in the Man and Biosphere Reserve Network in 1992 and Bogd Khan Mountain Strictly Protected Area in 1996. Currently, preparations to involve the Uvs Nuur Basin Strictly Protected Area within the Man and Biosphere Network and World Heritage is being carried out.

Brief introductions to protected areas including the Great Gobi and Uvs Nuur Basin Strictly Protected Areas arc included in this report

**Uvs Lake Strictly Protected Area**

*Description:* **There** are 5 main ecological zones in the Uvs Lake Basin: desert with permafrost, desert-steppe, steppe, tundra, mountain taiga, forest steppe and glaciers. This ancient lake depression of Asia has a length of 160 km from north to south and a width of 600 km from east to west This remote zone is unique with its combination of forest steppe with moist soil, salt pans, mobile and stable sand, mountains permanently covered with snow and both coniferous and deciduous forests. Because Uvs Lake contains an interesting collection of a variety of ecosystems which are important scientifically, it is one of the 10 sites in the world selected for a global environmental change study as part of the International Geosphere and Biosphere Programs. The Mongolian traditional extensive livestock production has not degraded the ecosystems of this area.

Uvs Lake has not been studied in depth either scientifically or culturally. Ancient tombs in each valley form an irreplaceable historical and cultural legacy

*Uvs Lake as "World Treasure"*

*Proofs of its pristine environment:* The fact that the natural environment of the Uvs Lake Basin has remained unspoiled until now can be linked to the absence of industrial development near the lake and the non-existence of canals which would disturb the flow of rivers. In the lake basin, there are over 2000 ancient Hunnu, Turkish and Mongolian tombs. These tombs have remained undisturbed until now because of the religious beliefs of the local people. In 1993, four strictly protected areas were established in this lake basin representing different ecological zones.

*Comparison with other sites:* There are only a few sites in the world covering such a small area with a great variety of different habitats which have remained quite pristine because of very little human activity.

**Great Gobi Strictly Protected Area**

*Description:* The Great Gobi Strictly Protected Area was established in 1976 in two parts, "A" and "B", in order to protect those endangered species which are unique to Central. Together, parts "A" and "B" cover 5.3 million hectares and is the fifth largest protected area in the world. Altogether over 150 bird species, 49 mammal species, 15 reptile species, 2 amphibian species and 410 plant species have been found in this area.

The wilderness of the Gobi to the south of the Altai Mountain Range with its drainage and valleys, offers the best habitat for some endangered species. For example, surviving members of the threatened Gobi Bear, *Ursus arctos gobiensis* and the Wild Camel, *Camelus ferus bactrianus* can be found here. Furthermore, the last members of the original herd of Wild Horses, *Equus przewalskii* inhabited Zuungariin Gobi. Today offspring of Wild Horses (Takhis) born in zoos in Germany, the Ukraine, Switzerland and Australia have been re-introduced in the same area.

*Great Gobi as "World Treasure"*

*Proofs of its pristine environment:* The environment in the Great Gobi has remained undisturbed because of the absence of human settlements and industrial development around it. It provides habitats for endangered species, which in turn, supports the undisturbed status of its nature. The Great Gobi Strictly Protected area was included in the UNESCO Biosphere Reserve Network in 199 1.

*Comparison with other sites:* The Gobi area in Mongolia is one the world's fewest sites which has a unique landscape, fauna and flora. Action has been taken to protect endangered plant and wildlife species in the Great Gobi Strictly Protected Area.

Fifteen protected areas of Mongolia are located along the state border and the extension of trans-boundary protected areas with neighbouring countries has been carried out in order to stop the loss of rare and endangered species of animals during migration between countries and to prevent ecological damage due to transboundary fires. For example, Daguurian Strictly Protected Area was established in 1994 between Russia, Mongolia and China.

The Fifth Meeting of East Asian Biosphere Reserve Network was held in Ulaanbaatar in 1997 under the title "Trans-boundary Protected Areas and Development of Ecotourism" in order to increase internationalism in environment protection. The Government of Mongolia ratified the "Ramsar Convention" in 1997 in order to support these activities.

**Gobi Gurvan Saikhan National Park**

*Definition:* The richest dinosaur digs are located in the Gobi Gurvan Saikhan National Park and its surrounding areas, including Bayanzag, Tugrugiin Shiree, Khanin khond, Uden sair, Ukhaa Tolgod, Nemegt, Altan Uul, Bugiin Tsav and Gyrliin Khooloi. *Veloseraptor* and *Protoseratops* skeletons attached together, Oviraptorsaura eggs, giant herbivore dinosaurs, whole Tarvosaurus and dinosaur skeletons were found in this area.

There are over 620 plant species in Gobi Gurvan Saikhan and 38 of them are rare. 52 wildlife species have been registered in this area and 8 of them are listed in the Mongolian Red Book. There are 240 bird species; 34 of them stay in Mongolia permanently, 99 are migratory and 70 bird species pass through this area..

*Gobi Gurvan Saikhan as World Treasure*

*Proofs of its untouched nature:* The presence of humans in this area is low; local herders use the area only seasonally. Dinosaur remains have been studied by scientists from Mongolia, USA, Russia, Canada and Japan since 1920.

*Comuarison with other similar areas:* Dinosaur remains from this area are comparable with those from Droumheller in Canada, Montana and Calorado in the USA. These findings show the different types of dinosaurs that existed, competition between different species, and the orders and structures of their nets, which can not be found anywhere else in the world.

**Khuvsgul National Park**

*Definition*: Lake contains 380 cubic kilometre water and is the fourteenth biggest lake in the world, in terms of its water volume and the second biggest in Asia, in terms of its area. Khuvsgul Lake contains 1 per cent of the world's white water. The deepest point of the lake is 262 metres. There are 96 rivers of different sizes which flow into the lake, but only one, the Egiin River, flows out of the lake.

The Egiin River flows into the Selenge River which then flows into Baikal Lake. Khuvsgul Lake is located at 1645 metres above sea level and is frozen from January till April (sometimes till May) There are 9 fish species in the lake like the Siberian Grayling *Thymalus arcticus* and *Brachymystax lenok.* The lake is surrounded by high mountains and taiga with 68 mammal species such as the Wild Mountain Sheep *Ovis* ammon,Siberian Ibex *Caprica sibirica,* Stone Marten *Martes foina,* Beaver *Castos fiber* and the Red Deer *Cervus elaphus, 244* bird species and 750 plant species.

The Tsaatan or Reindeer people who live in the taiga forest to the north west of Khuvsgul Lake are one of the minority groups of Mongolia. They speak a language included in the Tuva family called "Suha", which belongs to the Turkis branch of languages. Currently, there are 30-40 Tsaatan families who live herding reindeer. In their social organization, shamanism plays a main role and there are many things around the lake which symbolize the shamanist tradition. The Tsaatan people attract a lot of attention to their civilization which is rather similar to that of other Central Asian nomads. It also represents a life style which was common in Europe, Asia and North America many centuries ago.

*Khuvsgul Lake as World treasure*

*Proofs of its untouched nature:* Khuvsgul Lake is undisturbed with its sparse population and under developed industry. The Tsaatan people have lived here for 10 000 years. This area as a whole, contains rich archaeological and ethnographic findings relevant to shamanist traditions.

*Comuarison with other similar areas:* Species composition of wildlife and plants of the Khuvsgul Lake Basin is similar to that of Baikal Lake. The Tsaatan people who live near the lake have very specific traditions dealing with shamanism which was once common in Asia and North America.

**Bogd Khan Strictly Protected Area**

**Definition:** Bogd Khan Mountain was protected in 11 th and 12th centuries and was officially placed under protection first in 1778 according to the order of the Khaan or the King.

Bogd Khan Mountain covers 41.6 thousand hectares of the green zone of Ulaanbaatar. Tsetsee Gun, its peak, is 2268 metres high. The ruins of an ancient temple can be found here. This mountain is rich with natural and historical monuments. Manzshir temple, established in 1750 on the southern slope of Bogd Khan Mountain was a popular religious centre with 20 shrines and 360 monks who studied medicine, astrology and philosophy before it was destroyed in 1936. Historical monuments including rock paintings that date back to some 3000 years ago are common in this area. Bogd Khan Mountain area includes steppe, mountain forest-steppe, taiga and high mountain zones, although it is located in the most southern part of the Khentii mountain taiga. Therefore, representatives of both plant and wildlife species of these zones are found here. For instance, there are 9 species of mountain forest steppe and steppe trees, over 500 species of seed plants, 47 mammal species, 116 bird species, 4 reptiles and 2 amphibians. There has been a case where there were 3000 heads of Elk countable in this area. Bogd Khan Mountain was included in the World Biosphere Reserve in 1996.

There are 15 protected areas established along the international borders of Mongolia and some of the wildlife there often cross the border and become targets for poachers. Forest fires also occur along the international border, which has resulted in increased cooperation with neighbouring countries on the expansion of the protected areas network. For instance, the Dauria Strictly Protected Area was co-established with Russia and China in 1994. The Uvs Lake Strictly Protected Area has been proposed as a joint protected area between Mongolia and Russia.

With the aim to expand the international protected areas network, the fifth meeting of the Eastern Asian Biosphere Reserve Network known as, “Development of cross-boundary protected areas and ecotourism”, was organised in Ulaanbaatar.

### 4.2.3 Measures Aimed at Safeguarding Protected Areas

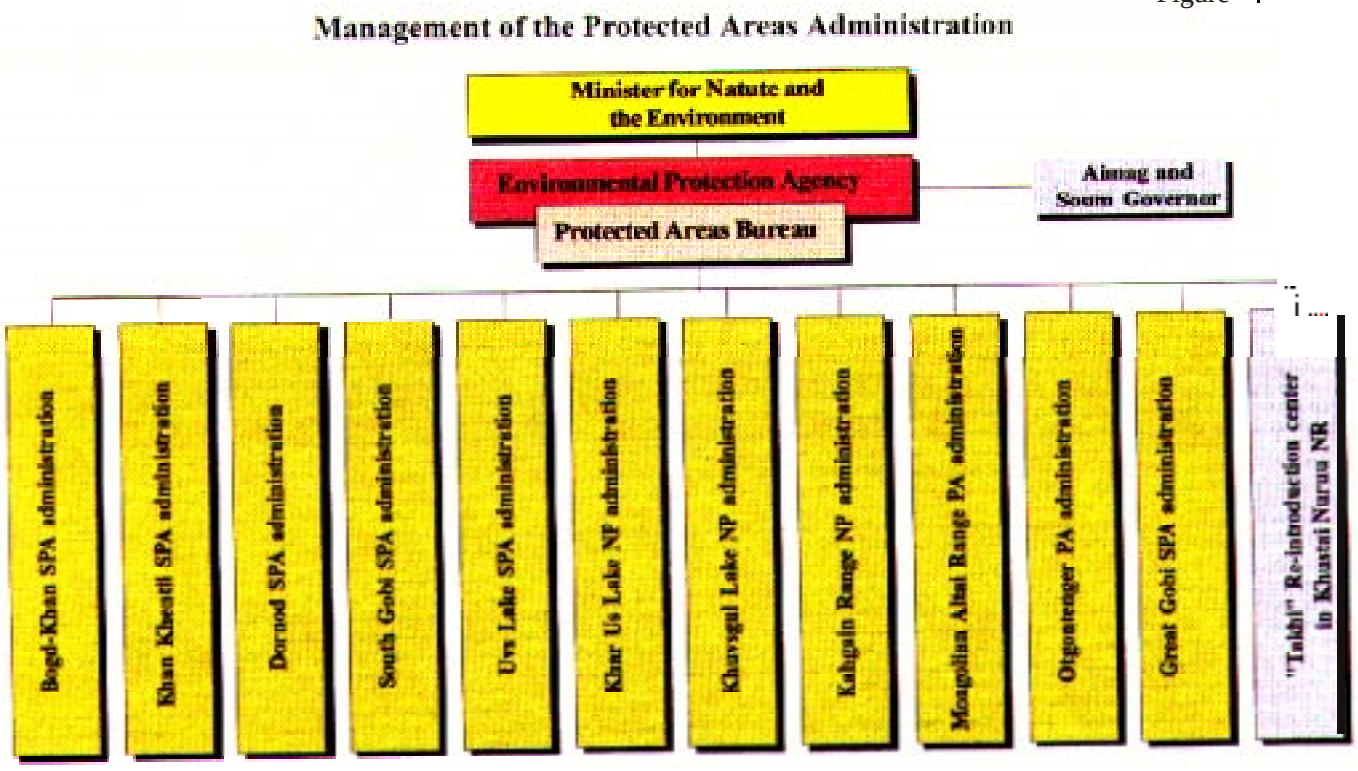
The following activities have been carried out in order to fulfill the objectives to improve protected areas management so that it will meet with international standards.

**4.2.3.1 Establishment of a Legal Foundation for Protected Areas.** The Mongolian Parliament determined a legal basis for the establishment, protection, proper use and restoration of protected areas through the adoption of the “Mongolian Law on Protected Areas” in 1994 and the “Mongolian Law on Buffer Zones of Protected Areas” in 1997. These laws define clearly the categories and boundaries of protected areas and their buffer zones, and regulate he activities of citizens and organizations with regards to the protection and limited utilisation of protected areas.

More than 20 regulations and rules were approved in order to enforce and implement the two laws. Examples of regulations and rules are: "General and Special Regime of Protected Areas", "Regulation of Research within Protected Areas". "Joint Regulation of Cooperation with the State Border Guard Office". "Regulation of Agreement Making on the Activities within Protected Areas", "Regulation of Tourism and Travel within Protected Areas". "Regulation of Controlling Wolf Populations and Hunting Feral Dogs". "Regulation of Culling Animals. Sample Taking, Animal Introductions and Hunting in Order to Prevent Diseases within Protected Areas". '-Several Resolutions on establishing of New Protected Areas". "Standards of Patrol Area Sizes for Rangers of Protected Areas" "Specific Regulation of Tourism and Travel within Protected Areas" and "Regime on Zoning within Protected Areas".

**4.2.3.2Structure** of Protected Areas. Environmental Protection Agency under the Ministry for Nature and the Environment (State Administrative Central Organization) is responsible for the implementation of the national policy on protected areas (Figure 4).

Figure 4




The Protected Areas Bureau is rerponsiblc for providing 10 Protection Administrative Offices of Protected Areas with practical instructions. Currently. altogether more than 200 people are employed by the protected areas administration. 28 million tugrugs were allocated towards the protection administration in 1994. subsequently. 3Y million tugrugs in 1995. 63 million tugrugs in 1996 and 85 million tugrugs in 1997 were administered to the same body.

Several countries and international projects play a key role in strengthening protected areas management by providing necessary equipment, strengthening institutional capacities, conducting training and public awareness, improving living conditions in local communities in the buffer zones, disseminating information on protection of rare and endangered species. For example, 163.3 million tugrugs have been spent for strengthening protected areas management within the framework of the Mongolian Biodiversity Project which is funded by the United Nations Development Program and Global Environmental Facility. The project also assisted in environmental lawmaking, institutional capacity and community support building, as well as, public awareness activities in environmental protection and the development of the National Action Plan on Biodiversity Conservation for Mongolia.

The Mongolian Biodiversity Project established the Small Projects Fund in order to increase the support for local communities within and around protected areas by improving their living conditions. Currently, more than 20 small projects are being successfully implemented within and around several protected areas (Table 2).

In addition, the Mongolian Environmental Trust Fund was established with support from the Mongolia Biodiversity Project in order to secure long term funding for conservation and environmental protection activities in Mongolia.

Table 2

**Schemes supported by the Small Project Fund**

| Name of sheme | Subject | Name of Protected Area |
|---|---|---|
| | ***Social service*** | |
| Enerel | Nomadic health centre | Uvs Nuur SPA |
| Bridge-97 | Restructure of community bridge | Altai Tavan Bogd NCP |
| Mongolian treatment | Traditional medical centre | Dornod SPA |
| Shower | Shower facilities | Great Gobi SPA |
| | ***Education services*** | |
| Mazaalai | Kindergarden | Great Gobi SPA |
| Ecological cabinet | Cabinet for ecological training & information | Khustai NR |
| | ***Environment protection*** | |
| Salex | Planting bushes | Uvs Nuur SPA |
| Warmth | Solar Energy | Great Gobi SPA |
| | ***Supplementary income Projects*** | |
| Jigd | Hand made carpet factory | Great Gobi SPA |
| Tourist | Tourist camp | Khuvsgul NCP |

The German Technical Assistance and Cooperation Agency is running a twelve year project, “Environmental Protection and Buffer Zone Development”, which is based on the treaty between the governments of Mongolia and Germany. Currently, the project is working on possibilities to improve the protection and management of the Khan Khentii Strictly Protected Area and Gobi Gurvan Saikhan National Park by developing management plans for these protected areas, providing the protection administrators with the necessary equipment and improving living conditions in local communities. For example, the project established the Small Projects Fund in order to help local communities to improve their living conditions and increase local community support in environmental protection activities. The Small

Projects Fund has made great effort in engaging the local communities in small industry, medical services and natural disasters mitigation.

A project which was created by the WWF in 1992, continues to assist in the development and implementation of a program on the Protected Areas Network, collecting information and data, as well as, advertising protected areas in Mongolia. The project has carried out research and developed scientific justifications for the establishment of protected areas in Gorkhi-Terelj, Gobi Gurvan Saikhan, Khorgo-Terkhiin Tsagaan Nuur and Eastern Mongolia. It has also actively participated in the development and implementation of more than 10 small projects focusing on the protection of certain natural resources. The personnel of environmental protection organizations participated in training courses and brochures on several protected areas of Mongolia have been published with the financial support from the project. These activities have been important in terms of changing people's views on and attitudes towards conservation activities.

The Project "Khustain Nuruu Natural Reserve" is funded by the Dutch Government and is carrying out studies on the Wild Horse, *Equus przewalskii,* which was reintroduced in Khustain Nuruu from Dutch zoos. These studies focus on the adaptation and behaviour of these horses but also on natural resources, in general, in the area (Figure 5 and 6).

This project is instrumental in improving protected areas management and creating wild populations of the Wild Horse in Mongolia. The Mongolian Association for the Conservation of Nature and the Environment, which is one of the oldest environmental NGOs in Mongolia, is implementing this project in cooperation with the Dutch Government. Several small projects have been implemented in Khustain Nuruu as part of the primary project in order to improve the health and living conditions of local communities around this area.

Based on such examples, it can be said that the Government of Mongolia is fulfilling its international obligations to protect biological diversity in Mongolia. In addition to this, objectives on protected areas indicated in the National Action Plan on Biodiversity Conservation for Mongolia are being currently implemented with some success.

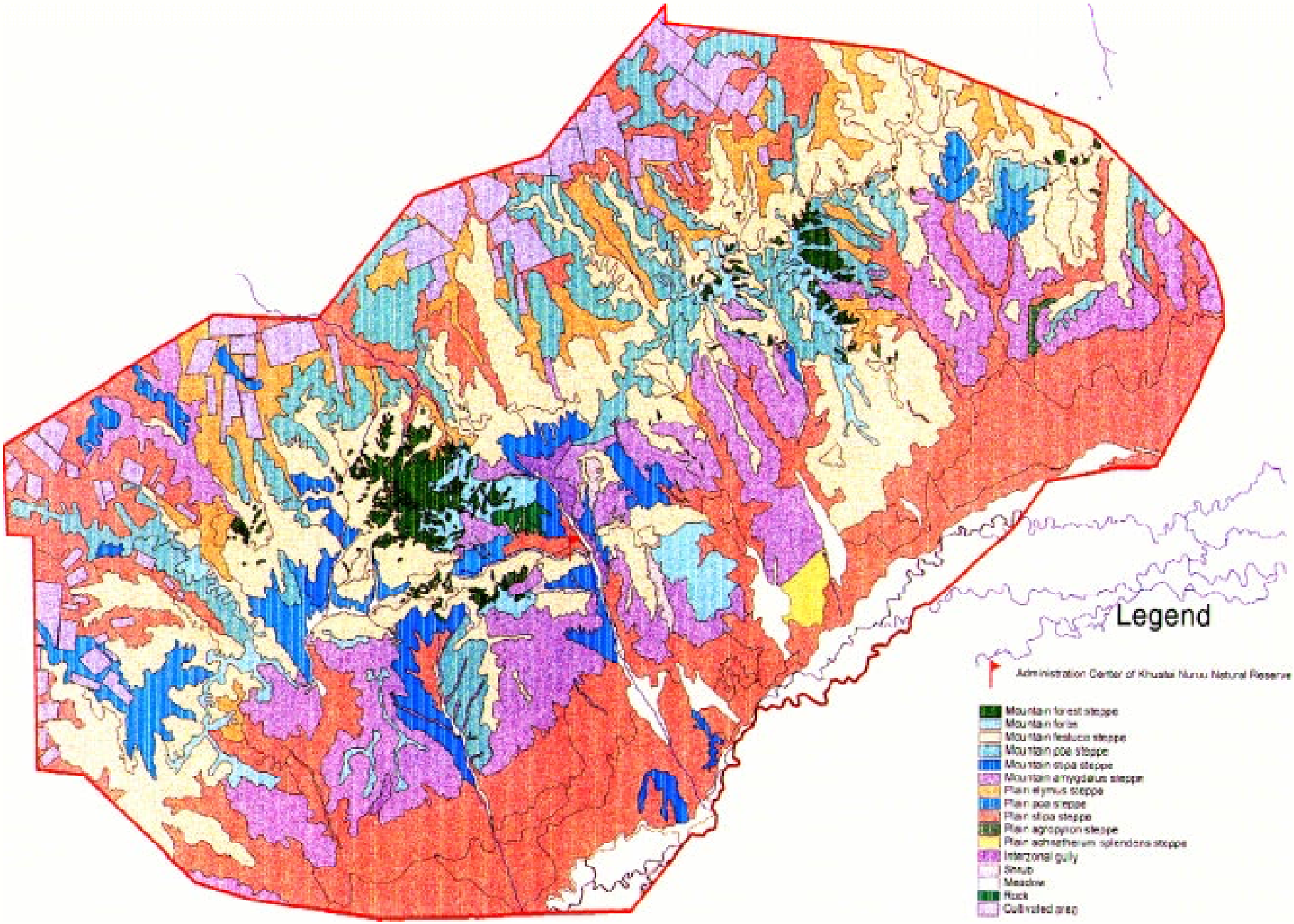
## 4.3 Measures Aimed at Limiting Negative Human Impacts on Biodiversity

Negative impacts on biodiversity advancing from the human population concentration, urbanization, industry and agricultural production are included in Section II of this report; measures that have been taken to protect, restore and properly use wildlife and plant resources are included in Section III of this report.

Activities conducted to coordinate state policies of Mongolia, improve the management, provide a legal and economic basis, expand the protected areas network and improve conservation management with the aim to limit the loss of biodiversity resources and habitat degradation are included in the early parts of this section.

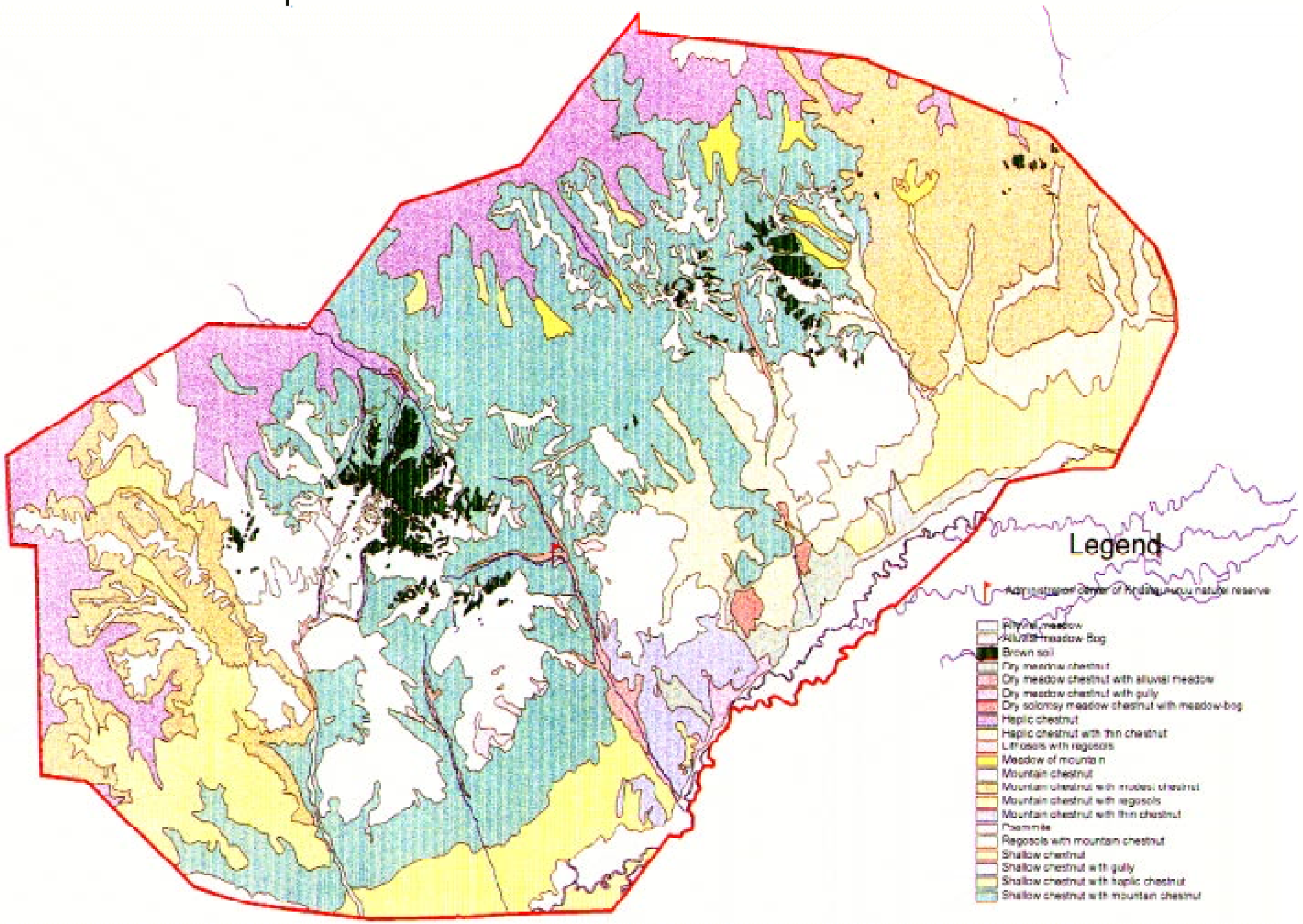
Map of vegetation of Khustai nuruu nature reserve

Figure 5.



Map of soil of Khustai nuruu nature reserve

Figure 6.



### 4.3.1 Measures Aimed at Decentralizing the Population

As urbanization becomes more intensified according to socio-economic needs, the environment starts to deteriorate and natural resources in some areas diminish due to the increased concentration of both human and livestock populations and natural resource use. Therefore, the government has developed objectives, and started to carry out activities to relocate the human population, decrease the pressure on the environment, develop policies to regionally improve the economy, provide a legal and economic basis and improve territorial and administrative organisations.

Policy documents and laws mentioned in the earlier sections of this report and other up-coming laws including the“ Law on land privatization for Mongolian citizens”, “Law on the private ownership of land of Mongolian citizens”, “Law on wildlife” and “Law on air payment”, and programmes on forests, air protection, waste management and environmental impact assessment will be important in limiting biodiversity and habitat degradation. In addition, the “Mongolian Action Programme for the 2 1 st century” and the Mongolian regional development policy have been prepared for deliberation by the Great Khural of Mongolia. These laws will provide a policy basis for environmentally sound socio-economic development strategies and will limit the population concentration.

Actions have been taken to limit urbanization and uncontrolled population concentration. Measures have been taken to develop regional infrastructure, improve territorial organizations of different regions, consider possibilities for economic development capabilities in the planning of regional centre development, make organizational assessments in cities and towns, efficlively limit human population increases in Ulaanbaatar, Erdenet and Darkhan, identify future development trends and resolve problems related to territorial organizations, population location and the policies on city planning. Possibilities to establish a system based on economic incentives in order to limit the human population concentration have been studied.

### 4.3.2 Protection of Biodiversity from Adverse Industrial Impacts

With rapid growth in the industrial and service sectors, the natural environment of Mongolia, especially its biodiversity, is starting to degrade. Therefore, pro-active measures to control negative industrial impacts have been determined through an environmental impact assessment of all industries and projects with the potential to harm the environment. Over 400 projects have already gone through the process of environmental impact assessment in the last few years. Within the framework of such an assessment, the government has been vigilant in terms of issuing permits to companies that have the potential to pollute the environment or when mining companies, in particular, employ new technology which may add to this.

In addition, activities to recycle, transport and bury waste carried out by the light industry have been improved. Export, import, transportation, preservation, use and burial of toxic chemicals used in this industrial sector are now regulated by the “Law on protection from toxic chemicals”. For instance, the operations of the “Erdenet” corporation were

monitored closely during the last three years and was fined US$ 500 000 per year for polluting the environment. The "Erdmin" corporation which used copper waste supplied by the "Erdenet" corporation, did not follow the measures outlined in its environmental impact assessment and consequently, its activities were stopped until the company started to employ environmentally safe practices with regards to reducing pollution.

The mining sector is currently under government inspection and there is new legislation which declares that mining activities should include nature conservation issues, especially where restoration activities are concerned; such activities entail the use of the companies' own finances. During past years, the operations of several economic entities which failed to carry out proper restoration activities have been stopped. However, the equipment and technology of power plants, although having had negative impacts on the environment, have ben sanctioned. Renewable energy, causing less damage to the environment and being generated from the sun, wind and water, is in the process of being widely introduced. Several small water plants have been established. Solar panels and wind generators have been installed in small urban centres and certain households.

### 4.3.3 Measures Aimed at Limiting Pasture Degradation

Species composition and distribution of the vegetation cover of Mongolia, as well as, the pasture carrying capacity and quality were assessed and the map of Mongolian pastures and hay making areas drawn on a scale of 1: 1000 000, was produced in 1996. This map has provided a scientific basis for proper pasture use and the restoration of deteriorated pastures. Current environmental legislation and policy documents, especially the "Law on Land Payment", the proposed law on "Land Privatization to Mongolian citizens and the Law on Pasture", have all contributed positively restoring damaged pastures.

Conditions have been determined to reduce population concentrations, to regulate livestock populations and to improve their breeds, to artificially increase fodder , to irrigate pastures in order not to exceed the carrying capacity of pastures; in short, to promote the sustainable use of pastures. Combatting harmful insects and rodents through environmentally sound ways has begun and will support the growth of grass and other plants in pastures. In addition, pasture rotation organized in some areas has promoted the process of natural restoration of these areas.

### 4.3.4 Restoration of Eroded and Degraded Lands

A legal basis for policy planning where the identification and restoration of degraded and eroded land is concerned, has been formed (these laws have been mentioned earlier in this report). Economic incentives for eroded land restoration are being developed. As a result, an experiment to restore 300 hectares of damaged land has been carried out successfully during the last 5 years; furthermore, 1000 hectares of eroded land are being re-forested annually. New biological technology to improve soil fertility has been developed and introduced.

### 4.3.5 Measures Aimed at Reducing Environmental Pollution

Pollution sources in large urban centres include smoke from power plants, heating sources and ger districts, toxins released by vehicles and sewage water. Over thirty legal acts and the "Law on Protection from Toxic Chemicals", "Law on Air, Law on Water", "Law on Land", "Law on Environmental Impact Assessment" and the "Law on Environmental Protection" are currently being enforced. Activities to limit environmental degradation, to restore and use natural resources properly have been implemented.

Mongolia signed an international convention on "Climate", "Ozone Layer Protection", "Prohibition of Chemical Weapon Production, Restoration and Utilization and Their Destruction", and "Cross Border Transportation and Removal of Toxic Wastes". It has been cooperating with other countries and international organizations and is supporting projects which have so far been successful.

The Laws on "Air Fee Payment and Water Pollution Payment" are being practiced, while the sources of the highest levels of environmental pollution are being researched. Cooperation on water analysis and hydrometeorology, as well as, measures to combat environmental degradation have been established with Russia and China. Their implementation is in progress.

Surveys on waste and chemical cleaning have been carried out since 1995 and further activities are in the process of being identified and implemented in cooperation with several Ministries. For instance, central sewage systems in several provinces were renewed and maintained in past years and have resulted in the decline of water pollution. Five hundret million tugrugs were spent to ensure the prohibition of releasing untreated water into natural sources of water; as a result, the release of such water has decreased by 20 million cubic metres in the last 3 years.

A National Committee to regulate toxic chemicals has been established. Pesticides to control harmful rodents and miscellaneous other chemicals are being reviewed by this committee to ensure that these substances meet international standards. A database of toxic chemicals and wastes has also been established. A list of toxic chemicals prohibited in Mongolia was developed and sent to the international organizations concerned with the protection of the environment.

Pollution sources in Ulaanbaatar were identified and assessed ecologically and a map depicting these sources was drawn on a scale of 1: 10000. It has had an important role in the decrease of pollution. For example, power plant #3 has been installed with dust filters and over 500 effectively burning stoves. Production technology using compressed fuel, which burns well, has been developed. A national index to determine the level of vehicle pollution has been developed based on the national vehicle survey of 1996. Also, the customs tax on imported second-hand vehicles was increased in 1997. The levels of air and water pollution have been measured in the biggest urban centers and a monitoring-investigation network has been established.

# 4.4 Public Education and Awareness trough Information Distribution and Monitoring Programs on Biodiversity Conservation

## 4.4.1 Training Programs on Mongolian Biodiversity

Actions to implement proposals aiming to improve environmental education and training, as stated by the National Environmental Policy, the Mongolian Environmental Laws and other official documents, are now taking place in Mongolia.

In 1997, the Mongolian government approved an environmental conservation program in the curricula of formal and informal education. The program is planned to grant a basic understanding of environmental protection for primary and secondary school students, and depending on the professional orientation of colleges, universities and professional training organizations, to arrange training on environmental conservation, to establish a scientific foundation for sustainable nature resource utilization and to introduce environmental regulations and laws.

Issues related to ecology, traditional environmental conservation and environmental regulations and laws have been transmitted through the mass media. In 1997, in every school, nature protection and environmental conservation were issues which were included into subjects like biology and forestry; introducing nature protection issues in terms of textbook revision and teacher training were carried out. New courses on ecology, environment protection and legislation, geography and tourism have recently been introduced in the "High Education Program". Several new classrooms designed for ecology training were established in the Biology Training Centre and other secondary schools.

Plans to improve the training quality through the introduction of new concepts and approaches in educational programmes, have been frought with difficulties because of the lack of qualified teachers, materials and financial support. Therefore, improving the skills of biology teachers and supporting students with the appropriate techniques, textbooks and information is of crucial importance. During the last few years, however, new biology textbooks have been published, short term training for teachers has been organized, university teachers and scientists have been sent abroad to further their studies and foreign specialists, as well as, local scientists have been invited to lecture at the universities.

The Mongolian State University, Pedagogical University, Medical University and the University of Agriculture have trained biologists from about 20 environmental organizations and related institutions. Training curricula on environmental subjects of these institutions have been renewed and extended. During the last three years, within the framework of cooperation between the Ministry for Nature and the Environment and international projects, more than 50 seminars and workshops, providing the latest knowledge on biodiversity, were organized; within multi- and bilateral cooperation, more than 50 specialists attended short and long term courses abroad.

### 4.4.2 Public Awareness of Biodiversity

There is increasing coverage of environmental issues in the media as a consequence of the serious attention paid by the government to environmental conservation and laws. There is, however, still a shortage of information based on actual facts, which makes these issues difficult for editors, and a shortage of books and information, which would meet the needs of public interests and awareness. Although there are enough research materials on biodiversity, no evaluation on its suitability for public awareness has been done. Between 1995 and 1997, a reasonable amount of books, magazines, policy documents on environmental issues like the "Mongolian Environmental Laws", "Report on Nature and Environment in Mongolia", "Mongolian Red Book", "Mongolian Wildlife Heritage", "Explanation, criticism and proposals on Environmental Laws", "Nature and Children", "National Biodiversity Action Plan", "Nature and Environment" (a magazine), "Nature" (a newspaper) and handouts, information bulletins and visual materials have been published and become available as a source for community information needs.

The "Environmental Public Awareness Project" assisted by the Ministry for Nature and the Environment and supported by Dutch Government and United Nations Development Program in introducing Biodiversity information to the public has been effective in acquinting the general public with conservation issues. Besides, this project is encouraging environmental and public organizations to present the national environmental policy to the community. More than 50 organizations are involved with 67 small projects going on successfully. As a result the Environmental Information Fund was established and more environmental information has become more available to the public.

The required legal foundation to establish an Environmental Information Fund emerged in 1995. The creation of a data base was the primary step in collating information on Mongolian biodiversity.

The information needed for biodiversity conservation can be received trough the:

1. Collection of biological information on individuals, populations, communities and ecosystems of all kinds of animals and plants,
2. Collection information on the natural environment such as geology, geomorphology, climate, water quality and soil conditions, as well as, air, water and soil pollutants,
3. Collection of all available information related to environmental laws, regulations, training and education, nature resource conservation, restoration and land use, which then can be included in the information fund.

The Information and Computer Centre of the Ministry for Nature and the Environment has assisted in the biodiversity data collection process. The centre is equipped with software, GIS equipment, and inter-net. The Centre provides weather information services by receiving and sending meteorological data from abroad and Mongolia. All collected and analyzed information is available and used widely in environmental protection, proper utilization and restoration of nature resources, and in processing of government policies. Besides, the centre provides information on the environment to individuals and organizations. For instance, visual data based on the NOAA satellite data on forest and steppe fires, as well as, snow and grass covers has been available to the public (Figure 1,2 and 3).

Based on this information, ecological monitoring and control measures on environment pollution and natural disasters have been carried out. The Information and Computer Centre has set up a network of scientific organizations and 21 aimags which are currently developing a consolidated environmental data base.

The Information Department of the Mongolian Academy of Sciences and the Geo-information Centre have started to work on remote sensing and satellite data in connection with natural resources conservation monitoring.

Since 1996, the project known as, "the strengthening of land use in Mongolia", supported by the Asian Development Bank has based on land cadastral surveys, mapping and ecological control and research. Within the framework of Jaica "Forest resource study in the Selenge aimag" project, 4 280 000 hectares of forested area were surveyd with the high accuracy Landsat satellite. With the support of the Danish International Development Agency (DANIDA), the "Pastures management" program was implemented in Arkhangai and Dornogobi aimags, and the project has gathered a large amount of information using remote sensing techniques and methods. Analysed information is used in applying the geographical information system in the pastures use and management.

Scientific organizations and universities are working actively on processing, summarizing and classifying collected information. Results from implemented projects are to be used in environmental training, publications, policy making and planning.

### 4.4.3 Environment and Biodiversity Monitoring

There has been a rapid increase in the exploitation of biological resources because of Mongolia's transition to a market economy. Although causes for this are commonly related to the growing economic crisis and declining standards of living, the lack of long term environmental policies, planning, legislation and stable economic mechanisms are also responsible.

As a result of the weak enforcement of environmental laws, poaching and over-logging are occurring regularly. The status of environmental protection and nature conservation greatly depends on public awareness, conservation knowledge, education, organizing and managing abilities of the leaders, experienced staff support and skills, financial capacity and strong cooperation between central and local organizations.

Based on today's environmental status, the Government of Mongolia is taking actions to strengthen the control of environmental laws and their implementation, by providing legal, economic and organizational foundations to such work. The rights and obligations of state inspectors, rangers and their authorized use of firearms and other self-defense tools were clarified in these laws. Actions relating to the determination of prison sentences, as well as, fines have also been considered.

Furthermore, in 1997, the areas to be protected were classified on the basis of population concentration, natural resources, status of utilization, distribution of rare animal and plant species. The state inspectors and rangers were nominated by the local governing

organizations. In 1997, there were 5 chief state inspectors, 371 state inspectors and 556 rangers operating in this field.

Besides the border police, customs officers, veterinarians and the personnel of the disease control centre, plant quarantine centre and mining inspection office, have been responsible in authorizing environmental regulations.

For instance, border police are responsible for arresting poachers, while custom officers and plant quarantine inspectors control wildlife trade and the spread of harmful insects and rodents, as well as, diseases, which enter Mongolia through the import of foodstuffs.

The Government appoints the State General Environmental Inspector upon the recommendation of the Minister of Nature and Environment; The Minister of Nature and the Environment appoints the State Chief Inspector, as well as, other State Administrative Central Organization State Inspectors, and Aimag and Capital City State Inspectors; Aimag and Capital City Governors appoint Soum and Duureg State Inspectors upon the recommendation of the State Chief inspector; Soum and Duureg Governors appoint rangers upon the recommendation of the Soum and Duureg State Inspectors according to the norms established by the Government. These nomination proceedings make it possible for inspectors to operate independently, that is, free from any administrative influences, and this allows inspectors in all levels to have equal authority. State Inspectors and rangers are financed by state or local budgets.

For the purpose of developing inspectors' and rangers' knowledge and skills, more than 40 training seminars and courses were held in the last three years, and about 3000 environmental staff were trained in dubled counting. Inspectors and rangers were given the necessary equipment and means of transport to carry out this survey. Further plans to support local inspectors and rangers in this manner is underway.

The implementation of these initiatives has improved environmental conservation and positive results are expected. During the past three years, progress has been made in the area of waste water treatment through the introduction of new techniques and technology in water cleaning systems. Under the guidance of the Ministry for Nature and the Environment and other related organizations, regular control has been applied to water supply hygiene, exploration, storage of toxic chemicals and their usage. Consequently, companies have been prohibited to operate because their activities have damaged the environment in some way.

According to the statistics from the last three years on environmental law inspection, 14 799 violations were identified and 52.5 per cent of them were related to illegal felling and 14.6 per cent to hunting. These figures show that more concentrated efforts are needed to protect forests and threatened animals.

In 1995 and 1996 a special investigation on biodiversity law implementation was directed by the Minister for Nature and the Environment in the Selenge and Khentii aimags, which were identified as the worst areas for the violation of forest and hunting regulations. Individuals and business entities involved in such illegal operations; were tried and fined. Moreover, about 200 electrical wood saws that were damaging to the forest were tested and, subsequently, the use of such mashinery was prohibited.

In the last five years, environmental impact assessment was carried out on 400 projects and based on the results, an environmental inspection agency is working on reducing environmental deterioration and pollution and the proper utilization of natural resources, especially concerning biological diversity.

## 4.5 Biodiversity Conservation Strategies

### 4.5.1 Sustainable development policy of Mongolia

The main trend of Mongolian development in the 21 st century is based on the principles of sustainable development.

In order for Mongolia to reach sustainable development it has to shape a social economic policy which will provide a sustained growth in its GDP; this can be achieved through the introduction of ecologically sound technology and the production of quality products that can meet the needs of the population.

In 1997, government policy on ecology was developed and deliberated by the Parliament. The document is aimed to establish legal and economic bases for achieving ecological balance which is a central ideal of Mongolian sustainable development for the next twenty years. The establishment of conditions to explore natural resources through the application of waste-free, ecologically friendly, advanced technology, and the production of ecologically pure, high quality market competitive goods, is the aim of State policy.

Consequently, Mongolia's sustainable development policy goals with regards to its socio-economy and natural environment is as follows:

***Economic well-being:***

- Improving productivity and quality of agricultural products and maintaining stable trading,
- Increasing the yield of agricultural products through the implementation of progressive technology and the supply of good quality seeds and fertilizers,
- Introducing progressive technology in power plants including renewable energy sources like the sun, wind and water to achive environmentally friendly energy sources and to reduce energy waste,
- Privatizing land ownership or establishing long term leasing,
- Developing a competitive market system,
- Valuing natural resources,
- Creating' and exercising wise utility mechanisms,
- Modernizing production technology and applying ecologically clean technology.

***Economic growth:***

- Increasing productivity of livestock and improving quality of dairy products,
- Providing sustainable increases in agricultural products,

- Charging leasing fees,
- Expanding the service industry scope and increasing the quality of services provided to consumers,
- Conducting cost efficient activities,
- Supporting cost-effective production,
- Assisting and promoting policies which maintain sustainable production and utilization,
- Assisting in the export and import of ecologically pure technology.

***Social development:***

To alleviate poverty, decrease unemployment and coordinate effective population policies so that an acceptable standard of living can be achieved for all Mongolians.

- Decentralizing public services,
- Increasing the value of the tugrug,
- Developing the educational status of the population, paying special attention to children of local communities,
- Protecting the health of the population, providing special health care to children and mothers,
- Providing guarantees on the legal right to ownership,
- Bettering citizens' living conditions, especially in the countryside towns and rural settlements,
- Providing guarantees on land ownership in terms of the legal and economic status of the owner,
- Involving local communities in the proper utilization of natural resources and protection activities.

***Ecological Policies and Provisions:***

*To begin using natural resources in sustainable manner:*

- Giving priority to the policies which ensure the protection and proper utilization of natural resources,
- Determining the monetary value for all natural resources,
- Conserving biodiversity,
- Implementing environmentally-sound policies,
- Improving natural resources management.

*Environmental protection:*

- Increasing the monetary value of scarce natural resources,
- Determining the amount of tines for illecal natural resources exploitation,
- Providing guarantees on the quality and sources of clean water,
- Implementing chemically safe environmental management policies,
- Following the "polluter pays" principle,

*Environmental disasters reduction.*

- Arranging environmental impact assessment,
- Improving the structure of a preliminary information system,

- Increasing the capability of disaster reducing activities,
- Extending international mutual cooperation

These ideas have served as guidelines to shape sustainable development in Mongolia. Sustainable development enables society to improve its standard of living, by assuming a balance between informed economic decisions and the careful use of natural resources.

### 4.5.2 Objectives for Biodiversity Conservation, Utilization and Restoration

The objectives to protect, restore and properly use Mongolian biodiversity are clearly formulated in such important documents as the National Security Policy Orientation of Mongolia and the State Policy on Ecology. These policies have been instrumental in the shaping of conservation activities in Mongolia.

4.5.2.1 Objectives for Biodiversity Conservation and Restoration. The State of Mongolia set forth the following objectives to advance the activities on the protection and restoration of biological resources:

- To perfect the legal and economic basis of biodiversity conservation and to strengthen it institutionally;
- to develop human resource skills and expertise for working in the field of biodiversity;
- to accurately define compositions and distributions of animal and plant resources for the purpose of making ecological and economic assessments;
- to analyse the consolidated scientific research data on biodiversity collected in past years, and to meet the needs of foreign and domestic clients who are interested in biodiversity protection and restoration;
- to develop and introduce advanced means, ways and technology not detrimental to the environment, in protecting animal and plant species from diseases, harmful insects and rodents;
- in order to preserve the genes of animal and plant species endangered or threatened with extinction; to include their habitats in the protected areas network, to enhance their protection management, to develop and introduce methods and technologies to breed or propagate them. There is an urgent need to protect the genes of such wild species as the Gobi Bear (*Ursus arctos gobiensis*), Wild Camel (*Camelus ferus bactrianus*), Otter (*Lutra lutra),* Mongolian Saiga Antelope (*Saiga tatarica),* Wild Dog (*Cuon alpinus*) and Wild Boar (*Sus scrofa nigripes*);
- to establish a gene bank of Endangered Animal and Plant Species;
- to further experimental research on animal and plant genes, selections and biotechnology, to improve equipment, facilities and data supply of biological scientific research institutes, higher educational establishments, public organizations and private economic entities;

- to create favourable conditions for the vegetation cover to naturally restore itself by way of cultivation of plants, aforestation and prevention of pastures from further degradation, thus aiming at the overall restoration of deteriorated areas;
- to employ the use of trees and shrubs that are important for the protection of soil covers, water and preventing sand shifts;
- to establish such mechanisms and conditions so that every user of biological resources is committed to the protection and restoration of the environment;
- to take measures aimed at comprehensive ecological (biological) education and to pass down to the younger generation, the Mongolian tradition of nature conservation;
- to improve the quality of protection, restoration and the proper use of biological resources, and to increase the involvement of the population in this aspect;
- to eliminate and decrease environmental pollution where biological species exist.

4.5.2.2 **Objectives for Proper Use of Biodiversity.** To use biological resources with care and consideration while maintaining an effective economic system:

- to fully meet the needs of the population through the sustainable way of use of biodiversity resources;
- to take measures in meeting the requirements of the population and economy by way of establishing legal, economic and rewarding mechanism for the breeding of endangered animals and cultivation of plants which are important to industry but exist in limited numbers;
- to intensify the process of manufacturing ecologically clean products that can compete on the world market; these products will be developed through methods which will use raw materials, producing no waste or pollutants;
- to set up a proper management system for the protection, restoration and use of biological resources, and to use modern methods for the assessment of biological resources;
- to implement measures in the near future to eliminate activities aimed at the excessive and selective use of biological resources.

## Endangered animals and plants included in the Mongolian Red Book published in 1997

# ANIMALS

### Mammals - Mammalia - Хөхтөн

| | | |
|---|---|---|
| 1. Alaschan Groundsquirrel or Souslik | *Citellus alaschanicus* | ЗУРАМ, ГОЗООРОЙ |
| 2. Asiatic Wild Ass | *Equus hemionus hemionus* | ХУЛАН, МОНГОЛ |
| 3. Asiatic Wild Dog | *Cuon alpinus* | ЧОНО ЦӨӨВӨР |
| 4. Bactrian Camel | *Camelus bactrianus ferus* | ХАВТГАЙ |
| 5. Beaver | *Castor fiber birulai* | МИНЖ, ТӨВ АЗИЙН |
| 6. Daurian Hedgehog | *Erinaceus dauricus* | ЗАРАА, ДАГУУР |
| 7. Eastern Bat | *Vespertilio superans* | САРМААХАЙ, ДОРНОДЫН |
| 8. Elk or Moose | *Alces alces pfizenmayeri* | ХАНДГАЙ, ШИВЭР |
| 9. Eurasian Otter | *Lutra lutra* | ХАЛИУ, ГОЛЫН |
| 10 European Wild Cat | *Felis lybica* ( *Felis silvestris)* | ЦООХОНДОЙ |
| 11 Forest Dormouse | *Dryomys nitedula* | УНТААХАЙ, ОЙН |
| 12 Gobi Bear | *Ursus arc tos go biensis* | МАЗААЛАЙ |
| 13 Goitered Gazelle | *Gazella subgu tturosa* | ЗӨӨР ХАР СҮҮЛТ |
| 14 Ibex | *Capra sibirica* | ЯНГИР |
| 15 Kozlov's Pygmy Jerboa | *Salpingotus kozlovi* | АТИГДААХАЙ, ЭЛСНИЙ |
| 16 Long-eared Jerboa | *Euchoreutes naso* | АЛАГДААГА, СООТОН |
| 17 Marbled Polecat | *Vormela peregusna* | ХҮРНЭ, ЭРЭЭН |
| 18 Mongolian Saiga Antelope | *Saiga tatarica mongolica* | БӨХӨН, МОНГОЛ |
| 19 *Musk Deer* | *Moschus moschiferus* | ХҮДЭР |
| 20 Przewalski's Horse | *Equus przewalskii* | ТАХЬ |
| 21 Reindeer or Caribou | *Rangifer tarandus* | БУГА, ОЙН ЦАА |
| 22 Saiga Antelope | *Saiga tatarica tatarica* | БӨХӨН, СОРГОГ |
| 23 Satunin's Jerboa | *Cardiocranius paradoxus* | АТИГДААХАЙ, ТАВАН ХУРУУТ |
| 24 Siberian Mole | *Talpa altaica* | ЧАЦУУЛИН, АЛТАЙН |
| 25 Snow Leopard | *Uncia uncia* | ИРВЭС |
| 26 Tamarisk Gerbil | *Meriones tamariscinus* | ЧИЧҮҮЛ, СУХАЙН |
| 27 Thick-tailed Pygmy Jerboa | *Salpingotus crassicauda* | АТИГДААХАЙ, ӨӨХЛӨГ |
| 28 Ussurian Elk or Ussurian Moose | *Alces alces cameloides* | ХАНДГАЙ, ХАР МӨРНИЙ |
| 29 Wild Boar | *Sus scrofa nigripes* | ГАХАЙ, ЗЭГСНИЙ |
| 30 Wild Mountain Sheep | *Ovis ammon* | АРГАЛЬ, АЛТАЙН |

### Reptilia - Reptiles - Мөлхөгч

| | | |
|---|---|---|
| 1. Gobi Naked-toed Gecko | *Cyrtapodion elongatus* | ГҮРВЭЛ, ГОВИЙН НҮЦГЭН ХҮРҮҮТ |
| 2. Slender Racer | *Coluber spinalis* | МОГОЙ, НАРИЙН |
| 3. Stepperunner or Racerunne | *Eremias arguta potanini* | ГҮРВЭЛ, ТОЛБОТ МОГОЙ |
| 4. Sunwatcher | *Phrynosephalus helioscopus* | ГҮРВЭЛ, ТОЙРМЫН |
| 5. Tatary Sand Boa | *Eryx tataricus* | МОГОЙ, ТЭМЭЭН СҮҮЛ |

## Aves - Birds - Шувуу

| | | | |
|---|---|---|---|
| 1. | Altai Snowcock | *Tetraogallus altaicus* | ХОЙЛОГ, АЛТАЙН |
| 2. | Asiatic Dowitcher or Asiatic Snipe | *Limnodromus semipalmatus* | ЦУУЦАЛЬ, АЗИЙН |
| 3. | Baer's Pochard | *Aythya baeri* | ШУМБУУР, УХАА |
| 4. | Baikal Teal | *Anas formosa* | НҮІ-АС, БАЙГАЛИЙН |
| 5. | Bar-headed Goose | *Eulabeia indica (Anser indica)* | ГАЛУУ, ХЭЭРИЙН |
| 6. | Black Stork | *Ciconia nigra* | ӨРӨВТАС, ХАР |
| 7. | Chinese or Reed Parrotbill | *Paradoxomis heudei* | ХУРГАЧ БОР |
| 8. | Common or Ring-necked Pheasant | *Phasianus colchicus* | ГУРГУУЛ |
| 9. | Dalmatian Pelican | *Pelecanus crispus* | ХОТОН, БОРЦГОР |
| 10 | Eurasian or White Spoonbill | *Platalea Ieucorodia* | ХУШУУТ, ХАЛБАГАН |
| 11 | Eurasian Penduline Tit | *Remiz pendulinus* | УРАН ШУВУУ |
| 12 | Great Black-headed Gull | *Larus ichthyaetus* | ЦАХЛАЙ, ИТЭЛГЭН |
| 13 | Great Bustard | *Otis tarda* | ТООДОГ |
| 14 | Great White Egret | *Egretta alba* | ДЭГЛИЙ, ЦАСЧ |
| 15 | Henderson's Ground-Jay | *Podoces hendersoni* | ХУЛАН ЖОРОО |
| 16 | Himalayan Griffon | *Gyps himalayensis* | ХАЖИР, ЦАСНЫ |
| 17 | Hodgson's Bushchat | *Saxicola insignis* | ШУЛГАНАА, ӨГӨӨЛЭЙ |
| 18 | Hooded Crane | *Grus monacha* | ТОГОРУУ, ХАР |
| 19 | Japanese White-naped Crane | *Grus vipio* | ТОГОРУУ, ЦЭН |
| 20 | Macqueen's/Houbara Bustard | *Chlamydotis undulata* | ТООДОГ, ЖОРОО |
| 21 | Mandarin Duck | *Aix galericulata* | АНГИР, ХАЛЗАН |
| 22 | Mute Swan | *Cygnus olor* | ХҮН, ХУРУУТ |
| 23 | Oriental White Stork | *Ciconia boyciana* | ӨРӨВТАС, ХАР ХУШУУТ |
| 24 | Osprey | *Pandion haliaetus* | САР, ЯВЛАГ |
| 25 | Relict Gull | *Larus relictus* | ЦАХЛАЙ, РЕЛИКТ |
| 26 | Siberian White Crane | *Grus leucogeranus* | ТОГОРУУ, ЦАГААН |
| 27 | Swan Goose | *Cygnopsis cygnoides (Anser cygnoides)* | ГАЛУУ, ХУШУУ |
| 28 | White-headed Duck | *Oxyura leucocephala* | НҮІ-АС, ЯМААН СҮҮЛІТ |
| 29 | White-tailed Sea-Eagle | *Haliaeetus albicilla* | БҮРГЭД, УСНЫ ЦАГААН СҮҮЛІТ |
| 30 | Whooper Swan | *Cygnus cygnus* | ХҮН, ГАНГАР |

## Amphibians - Amphibia - Хоёр нутагтан

| | | | |
|---|---|---|---|
| 1. | Green or Middle Asiatic Toad | *Bufo danatensis* | БАХ НОГООН |
| 2. | Siberian Salamander | *Salamandrella keyserlingii* | ГҮЛМЭР ШИВЭР |
| 3. | Asiatic Grass Frog | *Rana chensinensis* | МЭЛХИЙ, ДОРНОДЫН |
| 4. | Japanese Tree Frog | *Hyla japonica* | МЭЛХИЙ, МОДНЫ |

## Amathans - Agatha - Дугуй амтан

| | | |
|---|---|---|
| 1. Arctic or River Eight-eye Lamprey or Lamprey Eel | *Lampetra japonica* | НОМХОН ДАЛАЙН МОГОР |

## Fishes - Pisces - Загас

| | | |
|---|---|---|
| 1. Siberian Sturgeon | *Acipenser baeri baicalensis* | ШИВЭР ХИЛИМ |
| 2. Amur Sturgeon | *Acipenser schrencki* | ХАР МӨРНИЙ ХИЛИМ |
| 3. Taimen | *Hucho taimen* | ТУЛ |
| 4. Arctic Cisco | *Coregonus autumnalis migratorius* | МОНГОЛ ОМОЛЬ |
| 5. Tench | *Tinca tinca* | ҮХЭРДЭЙ |
| 6. Haitej Sculpin | *Mesocottus haitej* | ЗАНТАХАЙ ЗАГАС |

## Insects - Insecta - Шавьж

| | | | |
|---|---|---|---|
| 1. | | *Aeshna juncea mongolica* | СОНО, ДАМНУУРГА ЦЭНХЭР |
| 2. | | *Bombus subbaicalensis* | ҮХЭР ХЭДГЭНЭ, БАЙГАЛИЙН |
| 3. | | *Bombus modestus* | ҮХЭР ХЭДГЭНЭ, МОДЕСТУС |
| 4. | | *Bombus sporadicus* | ҮХЭР ХЭДГЭНЭ, СПОРАДИКУ |
| 5. | | *Bombus muscorum* | ҮХЭР ХЭДГЭНЭ, ХӨВДНИЙ |
| 6. | | *Scarabaeus typhon* | ЦОХ, ШҮТЭЭН |
| 7. | | *Satanas gigas* | ЯЛАА, ИХ ЭРЛЭГ |
| 8. | Apollo | *Pamassius apollo* | АПОЛЛОН |
| 9. | Elephant Hawk-moth | *Deilephila elpenor* | ШУМБУУР, ИНЖИРИЙН |
| 10. | Emperor Moth | *Eudia pavonia* | ТОГОСОН ОДОТ, БАГА |
| 11. | Eversmann's Apollo | *Parnassius eversmanni* | ДЭВҮҮР, ЭВЕРСМАННЫ |
| 12. | Humming-bird Hawk-moth | *Macroglossum stellatarum* | ШУМБУУР, ЭГЭЛ ХОШУУЛАГ |
| 13. | Musk Beetle | *Aromia moschata orientalis* | ЭВЭРТ ЦОХ, ДОРНЫН ЗААРТ |
| 14. | Narrow-bordered Bee Hawk-moth | *Hemaris tityus* | ШУМБУУР, БЭР ЦЭЦЭГЧ |
| 15. | Privet Hawk-moth | *Sphinx Iigustri* | ШУМБУУР, ГОЛТ БОРЫН |
| 16. | Small Apollo | *Pamassius phoebus* | ДЭВҮҮР, ФЭБ |
| 17. | Stubbendorf s Apollo | *Parnassius stubbendorfi* | ДЭВҮҮР, ШТУББЕНДОРФЫН |
| 18 | Swallowtail | *Papilio machaon* | ДЭВҮҮР, МАХАОН |
| 19 | Tenedius Apollo | *Pamassius tenedius* | ДЭВҮҮР, ЗҮҮН СИБИРИЙН |

## Crustaceans - Crustacea - Хавч хэлбэртэн

| | | |
|---|---|---|
| 1. | *Cambaroides dauricus* | ХАВЧ, ГОЛЫН |
| 2. | *Leander modestus* | ХАВЧ, ХАР МӨРНИЙ |

## Molluscs - Molluska - Зөөлөн биетэн

| | | |
|---|---|---|
| 1. | *Dahurinaia dahurica* | ХЯСАА, ДАГУУРЫН СУВДАН |
| 2. | *Cristaria plicata* | ХЯСАА, ДЭЛТ ТАНАН |
| 3. | *Anodonta sedakovi* | ХЯСАА, МОНГОЛ ТАНАН |
| 4. | *Middendorffinaia mongolica* | ХЯСАА, СЭЛЭНГИЙН ТАНАН |

# PLANTS

## Plants - Plantae - Дээд ургамал

| | | | |
|---|---|---|---|
| 1. | Lance-leaf Moonwort | *Botrychium lanceolatum* | ЮЛДЭН ШҮҮДЭР ОЙМ |
| 2. | Alpine Clubmoss | *Lycopodium alpinum* (*Diaphasiastrum alpinum* | ТАГИЙН ШИВЭРС |
| 3. | Common Clubmoss | *Lycopodium clavatum* | БАЛУУН ШИВЭРС |
| 4. | Ground Pine or Ground Cedar | *Lycopodium complanatum* (*Diaphasiastrum complanatum*) | ХАВЧГАР ШИВЭРС |
| 5. | Siberian Fir | *Abies sibirica* | СИБИРЬ ЖОДОО |
| 6. | Dahurian Larch | *Larix dahurica*. (*Larix gmelinii*) | ДАГУУР ШИНЭС |
| 7. | Dwarf Siberian Pine or Japanese Stone Pine | *Pinus pumila* | ОДОЙ НАРС |
| 8. | Codati-Mao | *Ephedra equisetina* (*Ephedra nebrodensis* Guss.subsp. *equisetina*) | МОРИН ЗЭЭРГЭНЭ |
| 9. | | *Juniperus pseudosabina* | ХУУРАМЧ ХОНИН АРЦ |
| 10. | Sabine Juniper | *Juniperus sabina* | ХОНИН АРЦ |
| 11. | | *Populus diversifolia* | ЭЛДЭВНАВЧИТ УЛИАС |
| 12. | Brittle Budara | *Iljinia regelii* | РЕГЕЛИЙН БУДРАА |
| 13. | Forked Stitchwort | *Stellaria dichotoma* | АЦАН АЖИГАНА |
| 14. | Przewalski's Gymnocarp | *Gymnocarpos przewalskii* | УЛААН ТҮЛЭЭ |
| 15. | Shining Water Lily | *Nymphaea candida* | ЦАВЦАГААН БӨЛБӨӨ |
| 16. | Least Water Lily | *Nymphaea tetragona* | ДӨРВӨЛЖИН БӨЛБӨӨ |
| 17. | Dwarf Dock | *Nuphar pumila* | БЯЦХАН СААХУУЦЭЦЭГ |
| 18. | Mongolian Pheasant's Eye | *Adonis mongolica* | МОНГОЛ ХУНДГАНА |
| 19. | Siberian Pheasant's Eye | *Adonis sibirica* | СИБИРЬ ХУНДГАНА |
| 20. | Pink Peony | *Paeonia anomala* | ЯГААН ЦЭЭНЭ |
| 21. | Chinese or White Peony | *Paeonia lactiflora* | ЦАГААН ЦЭЭНЭ |
| 22. | Naked Bishop's Cap | *Mitella nuda* | НҮЦГЭН ТОВЬЦЭЦЭГ |
| 23. | Marsh Saxifrage | *Saxifraga hirculus* | ЯМААН СЭРДЭГ |
| 24. | Roseroot | *Rhodiola rosea* | АЛТАН ГАГНУУР |
| 25. | Great Sundew | *Drosera anglica* | АНГЛИ ҮСТХИГ |
| 26. | Common Sundew | *Drosera rotundifolia* | ТӨГРӨГНАВЧИТ ҮСТХИГ |
| 27. | Mongolian Almond | *Amygdalus mongolica* | МОНГОЛ БҮЙЛЭС |
| 28. | Mongolian Potanin | *Potaninia mongolica* | ХУЛАН ХОЙРГО |
| 29. | False Spirea | *Sorbaria sorbifolia* | ТЭС НАВЧИТ ТЭСМЭГ |
| 30. | Mongolian Ammopipthanthy | *Ammopiptanthus mongolicus* | МОНГОЛ МӨНХХАРГАНА |
| 31. | Locoweed | *Astragalus dschimensis* | ЖИНИЙН ХУНЧИР |
| 32. | Red Pea Shrub | *Caragana brachypoda* | ХОЙРОГ ХАРГАНА |
| 33. | Gobi Pea Shrub | *Caragana gobica* Sancz. | ГОВИЙН ХАРГАНА |
| 34. | | *Gueldenstaedtia monophylla* | ГАНЦНАВЧИТ САЛЬЖИР |
| 35. | Halodendron Salt Tree | *Halimodendron halodendron* | МӨНГӨЛӨГ ХОНХОТХАРГАНА |
| 36. | Tsengel's Hedysarum | *Hedysarum sangilense* | ЦЭНГЭЛИЙН ШИМЭРС |
| 37. | Prickly Milk-Vetch | *Oxytropis acanthacea* | ШИВҮҮРТ ОРТУУЗ |

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| 38. | Fragile-leaved Milk-Vetch | *Oxytropis fragilifolia* | ХЭВРЭГ НАВЧИТ ОРТУУЗ |
| 39. | Mongolian Milk-Vetch | *Oxytropis mongolica* | МОНГОЛ ОРТУУЗ |
| 40. | | *Oxytropis grubovii* | ГРУБОВЫН ОРТУУЗ |
| 41. | Yellow Pagoda Tree | *Sophora flavescens* | ШАРАВТАР ЛИДЭР |
| 42. | Tsydeni's Vetch | *Vicia tsydenii* | ЦЭДЭНГИЙН ГИШ |
| 43. | Wild Rue or Harmal Schrub or Syrian Rue | *Peganum harmala* | ЭГЭЛ ӨМХИЙӨВС |
| 44. | Gas Plant | *Dictamnus dasycarpus* | БАВГАРҮРТ АГЧААХАЙ |
| 45. | Moorcroft's Oleaster | *Elaeagnus moorcroftii* | МУРКРОФТЫН ЖИГД |
| 46. | Red Goyo | *Cynomorium songaricum* | ЗҮҮНГАРЫН ГОЁО |
| 47. | | *Ferula ferulaeoides* | ЗАЛААРХАГ ХАВРАГ |
| 48. | Adam's Rhododendron | *Rhododendron adamsii* | АДАМСЫН ТЭРЭЛЖ |
| 49. | Golden Rhododendron | *Rhododendron aureum* | АЛТАН ТЭРЭЛЖ |
| 50. | Daurian or Chinese Rhododendron | *Rhododendron dauricum* | ДАГУУР ТЭРЭЛЖ |
| 51. | Ledebour's Rhododendron | *Rhododendron ledebourii* | ЛЕДЕБУРЫН ТЭРЭЛЖ |
| 52. | Small-leaved Rhododendron | *Rhododendron parvifolium* | ЖИЖИГНАВЧИТ ТЭРЭЛЖ |
| 53. | Bilberry or Blueberry | *Vaccinium myrtillus* | ХАР НЭРС |
| 54. | Long-leaved Jasmine | *Androsace longifolia* | УРТНАВЧИТ ДАЛАНТОВЧ |
| 55. | White Gentian | *Gen tiana algida* | ЦАГААН ДЭГД |
| 56. | Mongolian Caryopteris | *Caryopteris mongolica* | МОНГОЛ ДОГАР |
| 57. | | *Physochlaina albiflora* | ЦАГААН ХҮНХОРС |
| 58. | Tibetan Lancea | *Lancea tibetica* | ТӨВД БАЯГЗАВАА |
| 59. | Potanin's Trumpet Flower | *Incarvillea potaninii* | ПОТАНИНЫ УЛААНТУЛАМ |
| 60. | Desert Cistanche | *Cistanche deserticola* | ЦӨЛИЙН АРГАМЖИНЦЭЦЭГ |
| 61. | Manchurian Elder | *Sambucus manshurica* | МАНЖ ГАНДИГАР |
| 62. | Mongolian Arrow-Wood | *Viburnum mongolicum* | МОНГОЛ БҮРЭЛГЭНЭ |
| 63. | Sargent's White Rod | *Viburnum sargentii* | САРЖЕНТИЙН БҮРЭЛГЭНЭ |
| 64. | Common Valerian | *Valeriana officinalis* | ЭМИЙН БАМБАЙ |
| 65. | Stone Sagebrugh | *Artemisia Iithophila* | ЧУЛУУСАГ ШАРИЛЖ |
| 66. | Gobi Brachantheria | *Brachanthemum gobicum* | ГОВИЙН ТОСТ |
| 67. | Mongolian Brachantheria | *Brachanthemum mongolorum* | МОНГОЛ ТОСТ |
| 68. | Emarginate Chrysanthemum | *Chrysanthemum sinuatum* | ОНЬТ ТОНХҮҮ |
| 69. | Mongolian Jurinea | *Jurinea mongolica* | МОНГОЛ ЧОНОГОНО |
| 70. | | *Krylovia eremophila* | ЦӨЛИЙН ӨНЧИНЦЭРЭВ |
| 71. | Knapweed | *Leuzea carthamoides* | МӨГӨӨРСХЭЙ ХОНГОРЦГОНО |
| 72. | White-leaved Olgaea | *Olgaea leucophylla* | ЦАГААННАВЧИТ ХАСЗУЛ |
| 73. | Lomonosov's Olgaea | *Olgaea lomonosowii* | ЛОМОНОСОВЫН ХАСЗУЛ |
| 74. | | *Saussurea dorogostaiskii* | ДОРОГОСТАЙСКИЙН БАНЗДОО |
| 75. | | *Saussurea involucrata* | НӨМРӨГТ БАНЗДОО |
| 76. | Mongolian Tugarinovy | *Tugarinovia mongolica* | МОНГОЛ ШАРДАЛАН |
| 77. | | *Allium altaicum* | АЛТАЙН СОНИ-МНО |
| 78. | | *Allium macrostemon* | ТОМДОХИУРТ СОНГИНО |

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|---|---|---|---|
| 79. | | *Allium obliquum* | САРМИСАН СОНГИНО |
| 80. | | *Anemawhena asphodeloides* | ТАНСАІ- НОМИЛГОНО |
| 81. | | *Convallaria кeiskei* | КЕЙСКИЙН ХОНХОННОР |
| 82. | | *Lilium dahuricum* | ДАГУУР САРААНА |
| 83. | | *Tulipa uniflora* | ГАНЦЦЭЦЭГТ АЛТАНЗУЛ |
| 84. | | *Zygadenus sibiricus* | СИБИРЬ АГДАРГАНА |
| 85. | Calypso | *Calypso bulbosa* | БУЛЦУУТ ТҮВДЭНХАВ |
| 86. | Coralroot Orchid | *Corrallorhiza trifida* | ГУРВАЛСАН ШҮРЭНҮНДЭС |
| 87. | Yellow Lady's Slipper | *Cypripedium calceolus* | ШАР САДГАНЦЭЦЭГ |
| 88. | Grand Lady's Slipper | *Cypripedium macranthon* | ИХ САДГАНЦЭЦЭГ |
| 89. | Ghost Orchid | *Epipogium aphyllum* | НАВЧГҮЙ ООЧГОНО |
| 90. | Kamchatka Neottia | *Neottia camtschatea* | КАМЧАТЫН ЦҮНХҮЙ |
| 91. | Cucullated Neottianthe | *Neottianthe cucullata* | ХӨХӨӨ ЦҮНХРЭГ |
| 92. | Fuch's Orchid (Common Spotted Orchid) | *Orchis fuchsii* | ФУКСИЙН ЦАХИРАМ |
| 93. | Military Orchid | *Orchis militaris* | ДУУЛГАВЧИН ЦАХИРАМ |
| 94. | Lesser Butterfly-Orchid | *Platanthera bifolia* | ХОСНАВЧИТ ШӨНИЙН НИЛ |
| 95. | Sweet-Flag | *Acorus calamus* | ЭГЭЛ ГОДИЛ ӨВС |
| 96. | | *Carex parva* | БАГА УЛАЛЖ |
| 97. | | *Carex selengensis* | СЭЛЭНГИЙН УЛАЛЖ |
| 98. | | *Kobresia robusta* | ИХ БУШИЛЗ |
| 99. | Komarov's Fescue | *Festuca komarovii* | КОМАРОВЫН БОТУУЛ |
| 100 | Mountain Melick | *Melica nutans* | БӨХӨГӨР ШОГШРОГО |

## Mosses - Bryophyta - Хөвд

| | | |
|---|---|---|
| 1. | *Pterygoneurum kozlovii* | ПТЕРИГОНЕУРУМ, КОЗЛОВЫН |
| 2. | *Aongstroemia julacea* | ОНГСТРЕМИ, ЭЭМГЭРХҮҮ |
| 3. | *Oreas martiana* | ОРЕАС, МАРЦИУСЫН |
| 4. | *Trematodon brevicollis* | ТРЕМАТОДОН, БОГИНОХҮЗҮҮТ |

## Algae - Algae - Замаг

| | | |
|---|---|---|
| 1. | *Nematonostoc flagelliforme* | УС, ГАЗРЫН |
| 2. | *Tolypothrix mongolica* | ТОЛУФОТРИКС, МОНГОЛ |
| 3. | *Dynaliella viridis* | ДУНЕЛЛА, НОГООН |
| 4. | *Oocystis mongolica* | ООЦИСТИС, МОНГОЛ |
| 5. | *Cladophora kozhowii* | КЛАДОФОР, КОЖОВСКИЙН |
| 6. | *Batrachospermum moniliforme* | ВАТРАХОСПЕРМУМ, ЭРХЭН |

## Lychenes - Lychens - Хаг

| | | |
|---|---|---|
| 1. | *Lobaria retigera* | САРХИЛЖ, ТОРЛОГ |
| 2. | *Rhizoplaca baranowii* | БӨӨНГӨНӨ, БАРАНОВЫН |
| 3. | *Squamarina pamirica* | ТЭВГЭНЭ, ПАМИРЫН |
| 4. | *Aspicilia changaica* | ШИГМЭЭ, ХАНГАЙН |
| 5. | *Aspicilia esculen ta* | ШИГМЭЭ, ХҮНСНИЙ |
| 6. | *Asahinea scholanderi* | ШОЛАНДЕРИЙН АСАХВН |

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|---|---|
| 7. *Cetraria alvarensis* | ТАГИЙН ХӨВДӨЛ |
| 8. *Cetraria komarovii (Nephromopsis komarovii)* | ХӨВДӨЛ, КОМАРОВЫН |
| 9. *Cetraria potaninii (Allocetraria stracheyi)* | ХӨВДӨЛ, ПОТАНИЙН |
| 10. *Cetraria steppae* | ХӨВДӨЛ, ХЭЭРИЙН |
| 11. *Usnea longissima* | СОГСОРГОНО, УРТ |
| 12. *Cladonia kanewskii* | БУТАНЦАР, КАНЕВСКИЙН |

## Other Fungi - Мөөг

| | |
|---|---|
| 1. *Leccinum aurantiacum* | ТААХАЙ, УЛИАНГАРЫН |
| 2. *Lepista caespitosa* | ГАНДМАГ, ШИРЭГНИЙ |
| 3. *Leucopaxillus giganteus* | ЦҮЛДМЭГ, ТОМ |
| 4. *Tricholoma mongolicum* | ХҮРЭЭМЭГ, МОНГОЛ |
| 5. *Inonotus obliquus* | ОНГОЛ, ЖИНХЭНЭ |
| 6. *Endoptychum agaricoides* | ЭНДОПТИХУМ, ШИЛБЭТ |