MONGOLIA:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCES

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Note by FAO

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CHAPTER 1
INTRODUCTION

Mongolia is 1,565,000 sq km in area, the 18th largest country in the world. Nearly 90 per cent can be used for agricultural or pastoral pursuits, 9.6 per cent is forest and 0.9 per cent is covered by water. Less than one per cent has no effective use.

Climate is the over-riding element of Mongolian agriculture. The period of grazing, the growth and quality of cultivated and natural plans, the timing and methods of performing many animal and crop production tasks depend directly on climatic and weather conditions.

Mongolia is suited between latitude 41.33 deg and 52.06 deg North. The average annual temperature fluctuates between -5.3 deg C and +4.0 deg C. In the mountainous northern and north-western parts it is below zero and in the south and south-east it is above zero. The lowest temperature recorded so far is -53 deg C and highest is 41 deg C.

Short summers and sharp falls in temperature and frosts during the warm period make agriculture very difficult. Climatic stress, particularly unseasonal frosts, can cause harvest losses of between 10 and 30 per cent of crops. For successful agriculture under conditions of potential climatic stress it is necessary to:

- Use short season varieties of grains and vegetables.
- Harvest grain and vegetables in the shortest possible time.
- This requires considerable mechanization.
- Use the best available technology of sowing, growing and harvesting of grain and vegetables.

Common Development Needs of country.

- Land-locked (no direct access to hardbours or major land transportation centres),
- low density of population,
- low degree of industrial development and poor infrastructure scarce number of cultivable areas,
- economic activity mainly comprising of animal husbandry and basic agricultural activities (nomadic-pastoral form of agriculture),

- a climate with extreme temperatures varying per season and per day and night,
- rich in mineral resources (but due to poor infrastructure only a small part of the resources has been explored and exploited),
- dependent on more economically developed (adjacent) coastal areas and/or centres of industry,
- difficulty to attract capital funds for its social and economic development because of one or more of above features,
- mostly inhabited by traditional societies based on ecological principles of harmony with nature.

1.1 PHYSICAL RESOURCES

The northern mountain regions of Hovsgol similar to eastern Siberia, the hangai Hentil and Altai Mountains each having different climatic conditions and creating different zones between. As the weather systems are forced to rise over mountains from east to west the same rainfall level occurs at progressively higher altitudes and the occurrence of Tundra and Taiga alpine zones becomes less. The Altai are relatively drier, the main body of the Steppe and Gobi are considered part of the central Asian Steppe geo-climatic area.

There is a large rain shadow geo-climatic area between the Gobi Altai and the Altai Hangai Hovsgol Mountains known as the Valley of Lakes or Great Lake Depression. This area has a high percentage of the country's sand dune systems which have grown at 0.8%.

1.2 ECOLOGICAL RESOURCES

Mongolia possesses some 10-15 million ha of standing forests almost 50% of which are considered accessible being on grades less than 22%. Harvests are estimated to be less than the sustainable yield of about 9.9 million in 3 per year.

Mongolia is rich in mineral resources much of it yet unexploited including one of the largest known phosphate deposits in Asia and significant energy resources of some 20 million tonnes of coal. Mongolia has large relatively undisturbed wild life areas covering a broad range of habitats. Most of the nation's land can be considered to be in a semi-natural state where wild life and domestic livestock have co-existed for millennia. The modern development of roads and firearms may be changing this long term situation

of co-existence particularly around the larger urban areas. However Mongolian's have pride in their documented conservation efforts e.g. the Bogd Mountain Reserve which dates back to 1,200 AD. This cultural factor has importance in planning for environmental protection in the future.

1.3 HUMAN AND ECONOMIC DEVELOPMENT

Mongolia had one of the highest population growth rates in Asia at 2.5% per annum between 1988-1990 and the rate is said to have increased further since. However it has a very low population density and perhaps 60-65% live in urban areas including sum/local town/centres. Consistent with this high growth rate a high percentage of the population is under 25.

The recent fall in GDP due to the cessation of CMEA aid has placed great strain on this urban population and many have taken up livestock raising in near urban areas.

1.4 AGRICULTURE

Geography influences agriculture both positively and negatively. Positively, the location of Mongolia in the centre and east of the Asian Continent with dry and temperate climatic conditions and co-evolvement with large herbivores favoured the development of steppe grazing lands that are highly productive and resilient to grazing by large herbivores. the presence of north west to south east oriented mountain ranges in the western portion of Mongolia and the arid Gobi in southern Mongolia provides zonal vegetation capable of providing winter, summer and spring-fall transitional pastures for domestic and wild grazing herbivores. However, alignment of topography also funnels Siberian cold fronts to Southern Mongolia and increases the stress on livestock during winter and spring.

Total land area of Mongolia is 1,565 million ha of which 1,260 million ha (80%) is capable of agricultural production (primarily extensive livestock production). Arable land occupies 1.35 million ha of total area. Over 57% of total arable land is located in the north-central aimags of Tuv and Selenge and the north eastern aimag of Dornod. The aimags forming the Gobi third of Mongolia have 1% or less arable land. Other aimags have amounts of arable land ranging between 1.1 and 9.5 %. Arable soils are characteristically dark chestnut and chestnut soils and are typical of soils that evolved with grass steppe vegetation. Organic matter content is 3 to 4%, with pH of 6.0 to 7.0. Soils are shallow (average of less than 30 cm) even in the crop producing aimags of Tuv and Selenge aimags where conditions are most suited for

intensive agricultural production. In these aimags, only valley bottom land and lower slopes of hills on primarily north aspects are cultivated because of greater soil depth and higher soil moisture retention. The principal crops produced on cultivated land are cereals (of which wheat has comprised approximately 80% since 1960); other cereals are barley, rye and oats used primarily as greenchop silage for feeding dairy cattle), potato and vegetable areas opened up for cultivation have risen rapidly since 1955 Steppe grazina land comprises 28.0% of the total grazing land area and occurs primarily in the north eastern and north-central aimags. Desert-steppe comprises 28.3% of grazing land area and occurs primarily at lower elevation of the north western aimags and in the northern part of the southern Gobi aimags. Desert comprises 16.2% of grazing land area and occurs primarily in the southern part of the Gobi aimags along the border with the Inner Mongolian Autonomous Region of China. The distribution and occurrence of major grazing land types in Mongolia have in the past provided optimal conditions for transhumant grazing management strategies.

Native grazing land occupies 1,257,76 million ha (94%) if area considered suitable for agricultural production. High mountain (including alpine) grazing land comprises 4.6% of total grazing land area and occurs primarily in the north western and south western aimags. Forest-steppe grazing land comprises 22.9% of total grazing land area and occurs primarily in north western and north-central aimags.

1.5 LIVESTOCK

The five major kinds of livestock of using grazing land are camels, horses, sheep and goats. Livestock are distributed through all aimags with camel and goat production emphasized in the southern Gobi aimags, horse production emphasized in the north and south central and eastern aimags, and cattle production emphasized in the northern aimags. Sheep production is relatively evenly distributed throughout the country. In 1994 the total number of livestock was 26.8 million head. This represents the highest number of livestock since 1940 although livestock numbers have generally been high during the previous 40 years. the number of camels (0.54 million) is at its lowest since 1930 and is expected to continue to decline. Horses at 2.26 million head have increased since 1980 and are approaching the 1965 high numbers of 2.43 million head. Cattle at 2.85 million head and sheep at 15.08 million head are at their highest numbers since 1930. Goats at 5.13 million head are at their highest numbers since 1960. Yaks and reindeer are also grazed in some areas. Principle products produced from the livestock sector include live animals for export, meat, hides, wool (cashmere and sheep), mohair and dairy products (milk, cheese, butter and wine).

1.6 QUALITY OF LIFE VALUES

Mongolians have a conservative and conservationist approach to life and economic endeavour. the nation has resources of scenery, open spaces and natural resources that provide confidence of a prosperous future once the present socio-economic changes have been absorbed. Social services have been among the best in Asia although this has fallen recently. Literacy and public health standards are high.

CHAPTER 2
Natural Resources

2.1 GENERAL

Mongolia, a landlocked country, is located in Central Asia bordered by Russia to the north and the People's Republic of China (PRC) to the east, west, and south, Kazakhstan approaches Mongolia to the west but has no common border. Mongolia is about half the size of India covering a total area of 1,566,500 square kilometers (sq km) and is elevated at altitude ranges between 560 meters above sea level (masl) and 4,374 masl, with an average altitude of 1,580 masl. The closest access to the sea is the port of Tianjin located in China, some 1,000 km by railway from the Chinese-Mongolian border. Due to the gauge differential of the railway track, however, the Trans-Siberian route to the ports of Vladivostok or Nakhodka, though over 2,000 km, is more frequently used.

2.2 CLIMATE

The short growing seasons, low precipitation and high evapotranspiration are the overriding constraints of Mongolian agriculture. The continental climate is characterized by sharply defined seasons, high annual diurnal temperature fluctuations and low rainfall. Because of the high altitude, Mongolia's climate is generally colder than that of other countries of the same latitude, with mean annual temperature between -6,2°C in the North to about + 4°C in the Gobi desert. A particular climatic constraint is the occurrence of unseasonal frost, especially in late spring and early autumn. This reduces dramatically the length of the growing season which ranges between 70 to 130 days in various parts of the country. It is possible to have a frost on any day of the year and in 1992, a frost in early July badly affected grain production in wide areas. Semi-arid and arid conditions are major limiting factors in about 40 per cent of Mongolia's land area. Only few areas in the country [Mongolia Altai Region] receive more than 450 mm precipitation, mostly though as heavy summer rainfalls. For example in 1991 and 1992, heavy rainfalls occurred in late summer during the grain harvesting season, hindering ripening and resulting in reduced yields and quality. In contrast, the eastern and southern regions receive less than 200 mm precipitation, thus limiting the possibilities of non - irrigated crop production. The annual average relative humidity of the air varies from 45 to 75 per cent. High evapotranspiration rates aggravate the situation. Strong seasonal winds are widespread and cause severe soil

erosion and are a particular problem for cereal cropping. In the month of April heavy dust storms are a common feature in large part of the country. All of these climatic features combine to significantly limit the availability of renewable natural resources in Mongolia. Abundant water resources exist only in certain areas in the north of the country. The rates of hutus production, vegetative regeneration and growth, and consequently livestock productivity are very low throughout the country in comparison to other countries in the region. Natural ecosystems are relatively fragile, highly susceptible to degradation by human activities and slow to recover. In the south, desertification is a problem, disturbed areas often become permanent sandy desert areas.

2.3 SOILS

The national soil survey conducted during 1983-1985 in cooperation with Soviet scientists records 34 soil types in Mongolia. The principal soil type is dry-steppe chestnut soils which covers some 40 per cent of the national area. Other major soil types are brown desert-steppe (17 per cent of total area) and gray brown desert soils (9 per cent). Arable soils are generally dark chestnut and chestnut soils, which are typically light and silty, around 30 cm deep with high organic matter content of 3 to 4 per cent, and are moderately acid to neutral with pH of 6.0 to 7.0. Usually these soils are rich in calcium, but deficient in terms of phosphate. The relatively light nature of the soils results in low moisture retention and soils are more prone to erosion, The impact of human activities has led to increasing soil erosion not only on cultivated land but also on pasture, which has created one of Mongolia's most serious environmental problems.

2.4 LAND RESOURCES AND LAND USE

The total land area comprises five major agro-ecological zones: Hangai-Khuvsgul, Selenge-onon, Mongolian Altai, Central and eastern Steppe, and Gobi Desert. The division of the country into five distinct agro-ecological zones is clearly reflected by the distinct geographic pattern of agricultural production and has to be taken into account by any national agricultural and rural development strategy.

The Hangai-Khuvsgul region covers about 17 per cent of the country's total land area in the north-west of Mongolia. As a mountainous region of high elevation and deep valleys with some forest and arid steppe, livestock production is limited to harvesting forage with grazing animals including yaks, cattle, sheep and reindeer. Agricultural activities other than pastoral

grazing include a limited amount of fodder harvest, early-ripening cereal production and greenhouse activities in the steppe areas of the region. Climatic and physical factors influencing agricultural production include high elevation between 2,000 and 3,000 masl; mean annual temperature between -6°C and 1°C with pronounced seasonal differences; 70 to 100 free days, and annual precipitation between 200 to more than 400 mm. Aimags forming the region include Arkhangai, Khuvsgul, Bulgan, and Dzavhan.

The Selenge-Onon Region in north-central Mongolia covers about 17 per cent of the country's land area and is the principal cropping area provides the most favorable natural conditions for non-irrigated crop production. It is a basin with drainage to the north and is the location of intensive agricultural production, cereals, dairying, fodder, potatoes and other vegetables, and pigs and poultry. Production of these commodities was largely on the former State Farms. Most cropping activities involve rainted cultivation of cereal grains (wheat, barley, rye, and oats) some vegetables. Under the command economy, dairying was a primary focus of State Farms in this region with grain and silage as the principal winter feeds and forage obtained from summer-fall pastures the principal dairy feed during the summer milking season. Other than Friesian dairy cattle, native or hybrid cattle and sheep are the primary grazing animals and are managed using pastoral grazing strategies. Climatic and physical factors influencing agriculture production in the Selenge-Onon Region include average elevation around 1,800 masl; mean annual temperature is about 3.75°C in most parts of the region with pronounced seasonal differences; 90 to 110 frost free days: and average precipitation of about 325 mm. Aimags forming the Selenge-Onon Region include Tuv (Central), Selenge and Bulgan.

The Mongolian Altai Region, covering about 11 per cent of Mongolia's land area, is the high mountain region in western Mongolia. Agricultural production in the northern and central part of the region is limited to using mainly sheep and goats, but also cattle and yaks to harvest grazing land forage with pastoral grazing management strategies. In the southern Altai Region, irrigated fruit, berries, and melons and limited fodder production is possible. Climatic and physical factors influencing agricultural production of the region include elevation between 1,750 and 4,250 masl; mean annual temperature of 1.25°C; 70 to 130 frost free days; and relatively high precipitation of 450 mm per annum. The Altai Mountain Region comprises the aimags of Uvs, Baya Olgiy, Hovd, Dzavhan, and Gobi Altai.

The Central and eastern Steppe Region are the broad, essentially treeless plains of central and eastern Mongolia, covering about 18 per cent of the total land area. Agricultural production, except for limited rainfed cereal grain and fodder crop production consists of extensive grazing using sheep goats, and also cattle to harvest grazing land forage using pastoral grazing

management strategies. Much of the area has limited surface water resources which restricts livestock carrying capacity and as a result, surface feed is harvested as pasture hay and transported to fodder deficit areas. Most former State Fodder Farms (20 in 1991) are located in the Eastern steppe Region. Harvest of hay from native pasture is a major agricultural activity and the source of much of the hay transferred to fodder deficient Gobi aimags. Climatic and physical factors influencing agricultural production in the Central and Eastern Steppe region include elevation between 800 and 1,450 m; mean annual temperature of 1.25°C; 130 to 225 frost free days; and annual precipitation of 200 mm. Aimags forming the region include Dornod, Hentii, Sukhbaatar, Dornogobi, and Dundgobi.

The Gobi Region covering about 38 per cent of total land area is the largest agro-ecological region and includes the semi-arid and arid southern section of Mongolia. In this region, moisture availability and arable soils are the magor limiting factors to agricultural production. Except in irrigated oases suitable for the production of vegetables and melons, agricultural production is limited primarily to using sheep, goats and camels to harvest grazing land forage. The Gobi Region is the center of the cashmere goat industry. A major limiting factor for livestock production in the Gobi Region is the need for winter supplementary feed for livestock in a region that has little inherent capability to produce such feed. Climatic and physical factors influencing agricultural production in the Gobi Region include elevation between 850 and 1,150 m; mean annual temperature above 2.5°C; more than 130 frost free days; and annual precipitation of less than 100 mm. Aimags forming the Gobi Region include Gobi Altai, Bayanhongor, Ovorhangai, Dundgobi, Omnogobi, and Dornogobi.

While the agricultural land is vast (125.5 million ha or 80 per cent of total land area), it is notable that the area of araable land is very limited, only one per cent (1.3 million ha) of total agricultural area. This figure seems to be small and it has been argued that it may be partly a reflection of the past pattern of development, based on large-scale state farms, and smaller areas suitable for efficient crop production under a different ownership pattern of production are not included. More important causes for the limited arable area, however, are physical constraints, such as climate, high altitude (25 per cent of total area are above 2,000 meters), and slopes (21 per cent of total area has more than 20 degrees of slope). Prior to 1957, total area of cultivation was around 40,000 ha. Between 1957 and 1960, 0.5 million ha of pastoral land was brought into cultivation and this area expanded steadily to 1.3 million ha in 190, mostly in the form of large state farms. However, the steady expansion was achieved primarily by bringing under cultivation progressively poorer virgin lands and the stagnation of crop yields seems to bear this out. Thus, an increase of agricultural output will have to be achieved by investments in increased land productivity, not in land expansion. Only

about half of the arable land is actually cropped (0.7 million ha in 1991). In 1991, 86 per cent of cropped land was allocated to cereals, 11 per cent to green production, and 1.8 per cent to potatoes and vegetable production. In 1987; about 34,000 ha (2.5 per cent of arable land) was irrigable. The cultivated land is mainly located in the north-central part of the country (Selenge, Orhon and Kherlen river basin).

About 122 million ha of pasture land are distributed throughout the country, although the most productive pasture land is in a band from the north-western corner and through the central part of the country north of the Hangai range. While there has been some shift of land from grazing to arable use, the total pasture area has not changed significantly during the last decade. The national herd size varied significantly, as shown by a dramatic fall from peak 26.2 million head in 1940 to 20.0 million head in 1945, and a marked increase from 22.5 million head in 1985 to 25.7 million head in 1992, mainly induced by the privatization of livestock. Increased pressure on land with consequent degradation is reported, but may in fact not be caused by increased livestock numbers but by uncertain land tenure and climatic fluctuations. Hay producing zones increased from about 1.2 million ha in 1970 to 2 million ha in 1990. Hay producing areas are mainly located in the northern part of the country, in the Selenge River basin and the north east corner of Mongolia.

2.5 WATER RESOURCES

The average countryside precipitation of 220 mm per annum translates into an average of 360.1 cubic kilometers (cu km) of rainwater supply per annum. Of the total nationwide precipitation, roughly 90 per cent is lost to evapotranspiration. This is an extremely high evapotranspiration loss compared to other regions in similar latitudes and is caused by the continental climate. Of the remaining 10 per cent of total precipitation not lost to evapotranspiration, 37 per cent infiltrates into the soil and contributes to sub surface reserves and flow, while 63 per cent is surface runoff. Most of this surface runoff component (95 per cent) flows out of the country, while a small portion (5 per cent) flows into lakes and basins within Mongolia. Thus, of total annual precipitation, only about 6 per cent is transformed into available water resources in surface water bodies, while the balanca flows out of the country without being utilized. Roughly 3 to 4 per cent of total precipitation becomes potentially available as a water resource in the form of soil moisture or ground water. This proportion of potentially usable water is low compared to the water balances of other regions in similar latitudes, in which 30 to 40 per cent of total precipitation remains available.

The country's largest watershed is the Selenge River basin in the north. Its major subbasins are the E'Gyin, Ider, Orhon and Tuula rivers, The Selenge River flows north into Lake Baikal, and ultimately to the Arctic Ocean. In contract, the Onon and Kherlen rivers in the north east flow ultimately to the Pacific Ocean. Rivers in the south and north west of the country flow into the Central Asian Endoreic Basin or into the Gobi region, mostly ending in salt lakes with no outlets.

There are approximately 3,500 lakes in Mongolia with a total surface area of about 15,600 sq km. About 54 per cent of the surface is located in the Gobi region, mainly in the form of small shallow or salty lakes. These smaller lakes have proven to be especially susceptible to impacts associated with human use of water resources and human activities in their watersheds. Many of them are now severely depleted or dry, as is the case with several of Mongolia's previously largest takes. The largest of the fresh water lakes is Lake Khuvsgul. This deep lake, located in the northern mountain regions, is valued as an unique ecological resource and also supports the country's main waterway and several industries on its shores. Total ground water resources are estimated at 12.6 cu km. In 1990, 283.2 million cubic meters (cu m) or 2.25 per cent of total resources were withdrawn for various uses. Although these ground water resources are clearly important and widely exploited. They remain insufficiently investigated. Little data are available on aqufer boundaries or sizes, recharge areas, flows, rates of recharge, or other parameters. Many Mongolian aquifers exhibit significant mineralisation. In East Mongolia and in the Valley of the Lakes, mineralisation ranges from 0.5 to 3.0 grams total dissolved solids per liter.

CHAPTER 3
Sociopolitical and Administrative Structure

With a total population estimated at 2.2 million in 1992, Mongolia's population density is 1.5 persons per sq km, one of the lowest in the world. In recent years, population growth has slowed from 2.8 per cent per annum in 1989 to 2.1 per cent per annum in 1992, probably reflecting more difficult and uncertain economic prospects for most of the population. Infant and maternal mortality rate has been increasing from 64.4 per 1,000 births in 1989 to 69.7 per 1,000 births in 1992, and 12.5 to 22 per cent, respectively. As a result UNDP's human development index for Mongolia deteriorated from 0.74 in 1990 to 0.59 in 1994.

The rapid urbanization has increased the population in urban areas to about 57 per cent of total population compared to only 44 per cent in 1970. The capital city of Ulaanbaatar has a population of about 589,000 inhabitants (1993 estimates). The other major urban centers are Darkhan (population of about 85,000), Erdenet (56,000), and Choibalsan (37,000). All major urban centers are located in the north. The rest of the country is largely pastoral, with animal husbandry being the main economic activity. The country is divided into 21 administrative territorial units, named aimags (provinces), each with a provincial capital and a local government headed by an aimag governor. The governor is nominated by the local Khural and approved by the President. Each aimag is divided into soums (local government areas). There are 310 soums, each of which is divided into bags consisting of 50 to 350 families each. Executives at the aimag and soum levels are appointed by the Parliament.

The main ethnic group is Khalka Mongol (80 per cent). Kazhaks, who are found in the western part of the country, are the largest ethnic minority group (5 per cent). Durbet and Buryat Mongols are other significant communities. The lingua franca is Mongolian using the Cyrillic script. As part of its cultural revival process that has accompanied recent political and economic developments, the Government has decided to revert to the traditional Mongolian script. European languages, notably Russian and to a lesser extent German, are known to a sizable number of bureaucrats. English is becoming increasingly popular, but is still spoken by only few people. The practice of Lamaist Buddhism, which was dormant under the socialist regime, has also revived.

CHAPTER 4
Role of Agriculture in the Economy

4.1 AGRICULTURAL SECTOR CONTRIBUTION TO THE ECONOMY

4.1.1 Agricultural Sector and Domestic Economy

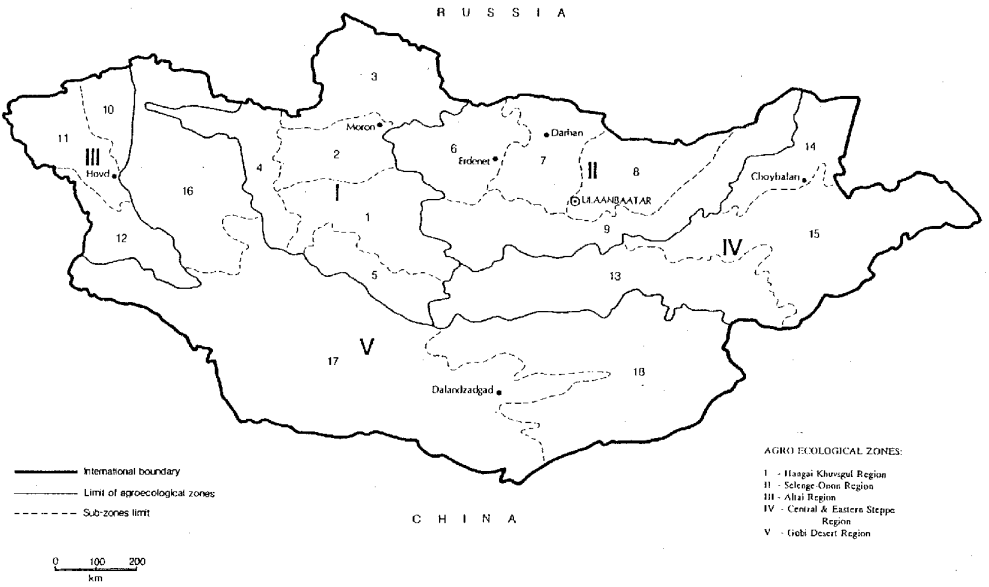
Prior to 1940, Mongolia was a simple agrarian economy in which semi-nomadic livestock raising was the main productive sector. The lack of basic industrial infrastructure meant that Mongolia had no domestic production of consumer goods. The principal exports were livestock products and raw materials while consumer goods were imported. The Government made a tentative start with crop production in the 1940's, however, it was the Virgin Lands program of 1959-60 which saw the major thrust into cereal crop production. In two years more than 500,000 ha were brought under cultivation and this area steadily increased to a peak of some 1.3 million ha by 1990. In 1994 some 400,000 ha was sown to crops, mostly wheat, and 400,000 ha bare fallow.

The process of socialization and central planning which developed in Mongolia after 1946, gradually transformed Mongolia from a rural, essentially nomadic economy, to one with a substantial sector. Industrial development accelerated after 1962 with Mongolia's official entry into the Council for Mutual Economic Assistance (CMEA) and the establishment of several joint ventures with CMEA countries. The beginning of substantial and continued dependence on Soviet aid Facilitated the build-up of Darhan and other industrial centers, the implementation of major energy and construction projects, the increased mechanization of the agricultural sector and the general development of industrial activities in Mongolia. As Mongolia's non-agricultural sectors of the economy have developed, agriculture's contribution to net material product has declined from 76 per cent in 1940 to a level of around 20 per cent from the mid-1980s onwards, along the classic lines of a developing economic system. Total agricultural output, especially crop production, however, rose during this period. During the recent reform years the agriculture sector regained importance. In 1992, total agricultural production was about $ 394 million, contributing to about 34 per cent in 1994 28 per cent.

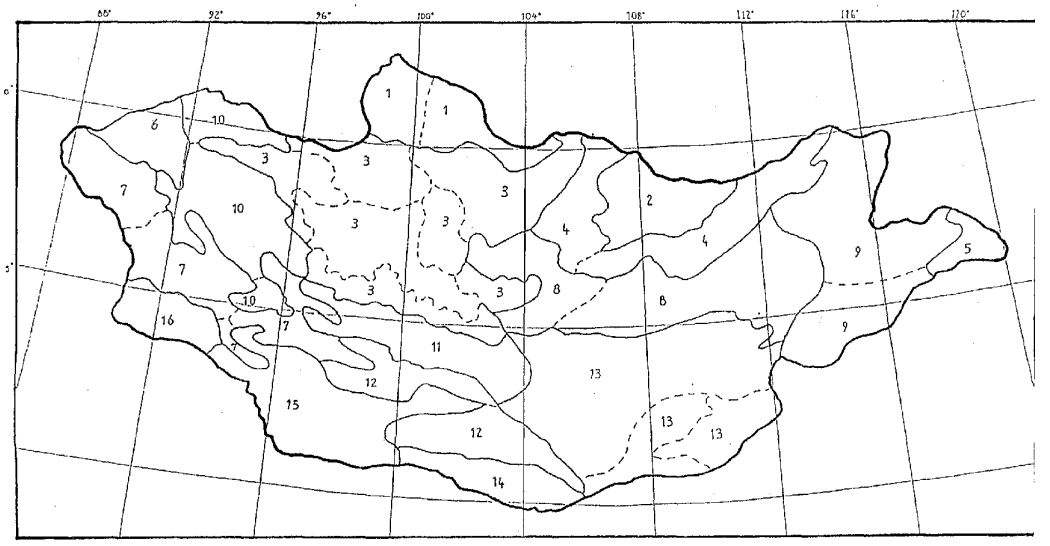
Table 1 Agro-ecological Regions: Climatic Data and Major Agricultural Activities

Zone No.Agro-Ecological Region/Zone	Average Elevation Meters Above Sea Level	Mean Annual °C	Temp. Data Jan °C	Temp. Data Jul. °C	Frost free Days	Precipitation mm	Major Agricultural Activities Livestock Subsector/Crop Subsector
Hangai-KhuvsgulRegion							
1. Central Hangai meadows and valleys	3,000	-3.75	-22	11.5	70	>400	Yaks, cattle, sheep and greenhouse Sheep, cattle and fodder production
2. Buinai forest-steppe and steppe	2,750	-6.25	-22	9.5	70	350	
3. Hovsgol mountain, taiga. forest and steppe	2,600	-6.25	-27	17.0	100	225	Yaks, cattle, reindeer & greenhouse Sheep, early-ripening cereals &
4. Western Hangai steppe and arid step areas	2,250	-1.25	-18	17.0	90	225	fodder prod.
5. Southern Hangai steppe and steppe and semi-desert area	2,150	-1.25	-18	17.0	90	225	Sheep, cattle, early-ripening grain and fodder crops
Selenge-Onon							Cattle, sheep & non-irrigated crop
6. Selenge forest and steppe	1,750	3.75	-22	17	110	350	production
7. Onon low mountain forest and steppe	1,850	1.25	-17.5	17	90	325	Non-irrigated crop production, cattle and sheep
8. Khentei mountain forest and steppe	1,850	3.75	-22	14	110	350	Cattle production and non-irrigated cropping
9. Ulz-Tuul steppe and arid steppe	1,750	3.75	-22	14	110	350	Sheep, cattle, early-ripening grain and fodder
Mongolian Altai							
10. Harhira and Turgen mountains arid steppe	4,250	1.25	-22	10.5	70	450	Sheep, goat, cattle & early-ripening vegetables
11. Central Altai meadow and steppe	1,750	1.25	-18	20.5	130	450	Sheep, goat, yak & prevailing cattle, early-ripening fodder crops
12. Southern Altai steppe	2,750	1.25	-18	17	100	450	Animal production, irrigated fruit & berry, melons & fodder
Central and Eastern Steppe							
13. Central Khalkha	1,200	1.25	-24	17.5	225	200	Sheep, goat and cattle
14. Herlen-Huh-Nuur	800	1.25	-24	20.5	130	200	Sheep, cattle and non-irrigated crop production
15. Mene-Dfar'ganga arid steppe	1,450	1.25	-24	20.5	130	200	Sheep, goat, non-irrigated crop and fodder production
Gobi Desert							
16. Great Lakes lowland semi-desert & arid steppe	1,000	1.25	-22	20.5	130	<100	Sheep, goat, camel, fruit berries and melons
17. Gobi-Altai mountain-steppe, semi-desert subregion	1,100	>2.5	>16	>23	140	<100	Goat, sheep, camel and irrigated crop production
18. Galbyn Gobi semi-desert, desert areas	850	>2.5	-18	21.5	>140	<100	Camel, sheep, goat, Irrigated vegetable and melon

FIG. 1 PRINCIPAL AGROECOLOGICAL ZONES



GEOBOTANIC REGIONS



GEOBOTANIC REGIONS

1. HOVSGOL MOUNTAIN TAIGA
2. HENTII MOUNTAIN TAIGA
3. HANGAI MOUNTAIN FOREST STEPPE
4. MONGOL DAVGIR MOUNTAIN FOREST STEPPE
5. HYANGAN MOUNTAIN MEADOW STEPPE
6. HOVD MOUNTAIN DESERT STEPPE
7. MONGOL - ALTAI MOUNTAIN STEPPE
8. MIDDLE HALH STEPPE
9. EAST MONGOLIAN STEPPE
10. DEPRESSION OF GREAT LAKES SEMI-DESERT STEPPE
11. MANY LAKES VALLEY DESERT STEPPE
12. GOBI - ALTAI MOUNTAIN DESERT STEPPE
13. EAST GOBI DESERT STEPPE
14. ALASHA GOBI (DESERT)
15. ALTAI SOUTH GOBI

Agriculture employs about 27.4 per cent of total labor resource (1991) compared to 40 per cent in the mid-1970s and 60 per cent in 1960. Rural population is put at 924,200 persons or 43 per cent of total population (1991) compared to 78 per cent in 1956. Most recently, however, there has been a small but steady migration of town people back to rural areas in order to benefit from privatization and to escape from increasing unemployment and high living costs in the cities.

CHAPTER 5
Plant Genetic Resources

5.1 FORAGE GRASS

Mongolians have a rich heritage of effectively utilising their grazing lands to produce a number of diverse livestock products for consumption and sale. Since ancient times, many of the Mongol herders have grazed five kinds of livestock in order to use rangeland more effectively. Livestock products continue to dominate the food Mongolians and the rangelands of Mongolia will continue to produce the majority of livestock feed.

Mongolia's total land area is 156.4 million hectares with the vast majority of the area considered rangeland. The primary use of the rangeland is extensive livestock production. According to the Institute of Land Policy, 82 per cent of the area is classified as capable of supporting agricultural production (rangeland or cropland), slightly less than ten per cent of the total area is classified as forest, two per cent as urban, one per cent as water surface, and five per cent is classified as natural conservation or reservation areas. Of the land capable of supporting agricultural activities, approximately 68 per cent is used as rangeland for livestock production (another 27 per cent could be utilised as grazing land if access to roads was improved or if water for livestock was available), 1.6 per cent is used for hay production, and one per cent is used as cropland (including fallow for soil fertility recharge). Over two per cent of the land previously used for crop production has been damaged and can no longer be used for productive purposes and over 50 per cent of the existing land utilised for crop production has been found to be suffering from some degree of water or wind erosion.

The knowledge of the Mongolian herdsman in management of his animals and grasslands is a source of pride to most Mongolian pasture and livestock management professionals. in addition, administrators at the national, Aimag and summon level generally praise herders for their knowledge and management of their livestock and grazing lands. Presently, Mongolia has over 25 million head of livestock and production could be increased. Improved livestock production can be introduced by using some intensive management in combination with the extensive system to produce an increase in production per animal (more efficiently utilised feed). Livestock production, for sale and consumption, could be increased while maintaining sustainability and ecological diversity.

In order maximise livestock production in a sustainable and ecologically sound manner, the best methods from traditional livestock herding methods would need to be joined with modern technical knowledge. Traditional pastoralism methods must not be ignored and should receive careful study and attention. This will briefly examine the rangelands of Mongolia, review past and present situations regarding extensive livestock systems, examine constraints and opportunities for development and redevelopment, review relevant government policies and other ongoing development activities, examine potential projects that will improve livestock production, and examine how factors have affected and will potentially affect sustainability of extensive livestock systems.

Mongolia is known for its grasslands and production of animals in an extensive system. Livestock production is practiced throughout the country and within most natural vegetation types. Mongolia has been divided into various geographical-climatic zones (Table), botanical-geographical zones (Table), and vegetation zones (Table). The Atlas of the Climate and Ground Water Resources in the Mongolian Peoples Republic, 1985 also has maps andinformation on physiography, soils, vegetation cover, climate and agricultural and zooclimatic regionalisation, surface waters, water resources. the country can be divided into six belts and vegetation zones (Table) as summarised below: a review of these zones/belts follows. Plant life-forms by ecological zones (Table), distribution of family, genera, and species within higher plant groups (Table), larger families (Table) and genera by number of species (Table) are also well documented in Mongolia.

5.1.1 The High Mountain Belt

The high mountain belt stretches over the main ridges of the Hangai, Hentii, Mongolian Altai and Hovsgol regions. In the Govi'altai, the belt is pronounced only in the highest ridges. This zone is characterised by low growing alpine plants with some minor areas of wet meadow, tundra, and low shrub formations. The dominants *Kobresia sibirica* and *K.mysouroides* and other alpinesedge species are utilised by grazing animals, especially yak.

5.1.2 The Mountain-Taiga Belt

The mountain-taiga belt covers limited areas of the Hentii and Hovsgol sub-region mountain systems. The belt reduces markedly further south in the Hangai mountain region (Mongolia Academy of Sciences, 19). The principal forest species are *Pinus sibirica, Larix sibirica. Larix dahurica, Picea ovobata* and *Abies sibirica*. Typical taiga vegetation provides only minimal forage for livestock. In come areas of under-stocked and cleared larch or pine forests

there may be some minimal livestock grazing use, but these areas are not presently important for livestock production.

5.1.3 The Mountain Forest-Steppe Belt

The mountain forest-steppe provides abundant forage for livestock. The change of vegetation from forests and steppe is associated with changes in elevation, topography, and aspect; moister areas tending to support forest and drier areas tending to support steppe. The mountain steppe includes forest of larch, pine-birch, and birch forests. often, the forests have a rich herbaceous understorey. Species from the genera *Poa, Festuca* and *Koeleria* are common in the forest steppe. The forest-steppe belt provides some unique landscapes that are valuable for their scientific beauty, wildlife habitat and as livestock production areas.

5.1.4 The Steppe Zone.

The steppe zone is most pronounced in the plains of eastern Mongolia, but parts of it can be found far into western Mongolia. The zone, passing the Hangai to its south, abruptly tapers towards the west and is found in the Depression of the Great Lakes in far western Mongolia. Separate parts of the steppe penetrate deep into the Hangai mountains through the broad intermundane valleys.

The major dominants are *Stipa baicalensis, S.krylovii, S.grandis, Cleisto genessquarrosa, Agropyron cristatum, Leymus chinensis, Poa attenuata, Festuca ovina, Koeleria gracilis, Artemisa frigida* etc. Shrub dominants are *Caragana microphylla, C. buriatica, C. stenophylia, C. bungei*, and *C. leucophloea*. The steppe zone provides abundant livestock forage and many areas of the eastern steppe are underutilised.

5.1.5 The Desert-Steppe Zone

The desert-steppe zone stretches through the south-east, from where it goes northwest to the Depression of the Great Lakes, through the "vast hollow" between the Hangai and the Mongolian Altai mountains. The major segment of the Gov'altai region is desert steppe. The main plant forms in the desert-steppe zone are low caespitose grasses (*Stipa gobica, S.glareosa, Cleistogenes soogarica*) with a considerable (but not predominant) share of semi-shrubs (*Salsola, Eurotia, Kochia*). Productivity is relatively low in this zone and drought is frequent. The desert steppe zone supplies forage for all five types of livestock, but flexibility in management is a critical need for this zone.

5.1.6 The Desert Zone

The desert zone is found in the southern border area of Mongolia in the Gobi desert proper (Alshaan, Trans-Altai, and Zuungar deserts). Rockly deserts (hammada) are characteristic of the desert in Mongolia. Sandy deserts occupy a relatively small area. The principal plant groups of Mongolia's deserts are shrubs and semi-shrubs of the Chenopodiaceae family. Important species of the desert zone are *Salsola passerina, Anabasis brevifolia*, saxacel (*Haloxylon ammodendron*), *ephedra przewalskii*, and nitre (*Nitraria sphaerocardpa*).

Table 2 Distribution of family, genera, and species within higher plant groups

Plant group (Division)	Families	Genera	Species number	Species %
Lycopsida	3	4	7	0.26
Equiscetaceae	1	1	9	0.33
Pteridophyta	2	16	26	0.96
Gymnospermae	3	6	21	0.78
Anglospermae	104	614	2647	97.67
Monocots	(19)	(121)	(535)	(19.7)
Dicots	(85)	(493)	(2,112)	(77.9)
TOTAL	**122**	**641**	**2,710**	**100%**

Table 4 Classification of plant life forms for ecological zones in Mongolia

Life forms	Total Species No.	Total Species %	Alpine	Taiga	Mountain forest steppe	Steppe	Semi - desert	Desert
WOODY PLANTS	364	13.4	60	134	219	76	93	108
Large Tree	17	0.6	0	12	14	4	3	2
Small Tree/Large Shrub	40	1.5	3	22	22	7	9	10
Shrub	156	5.8	31	60	98	29	40	45
Shrubby	48	1.8	17	15	24	7	10	14
Semi-shrub	97	3.6	9	23	56	26	30	37
Vine	6	0.2	0	2	5	3	1	0
HERBACEOUS PLANTS	2,346	86.6	419	854	1,498	661	612	389
Perennial	2,015	74.6	392	755	1,292	500	507	282
Annual and Biennial	331	12.2	27	99	206	122	105	107

Table 3 Botanical-Geographic regions of Mongolia with number of plant species per region

Botanical-geographic region	Percent of total area	Number of species	Relative richness	Area of species per km^2
Khubsugul	4.96	886	5	87.47
Khenti	3.05	977	3	48.72
Khangai	17.59	1,214	11	226.46
Mongol-Daurian	6.62	946	7	109.29
Great Khingan	1.98	657	2	47.03
Khobodo	7.02	1,020	6	107.58
Mongolian Altai	0.08	461	1	29.35
Middle Khalkha	11.54	509	14	354.39
East Mongolia	3.94	539	12	259.06
Depression of Great Lakes	6.11	666	10	143.45
Valley of Lakes	3.18	346	9	143.37
East Gobi	5.02	710	8	110.57
Gobi-Altai	9.35	329	15	446.93
Dzungarian Gobi	6.43	183	16	549.45
Transaltai Gobi	5.72	326	13	274.10
Alashan Gobi	1.62	483	4	52.61
TOTALS	**100.00**	**2,443**	*	**642.82**

Table 5 Ranking of genera based on the number of species found in Mongolia

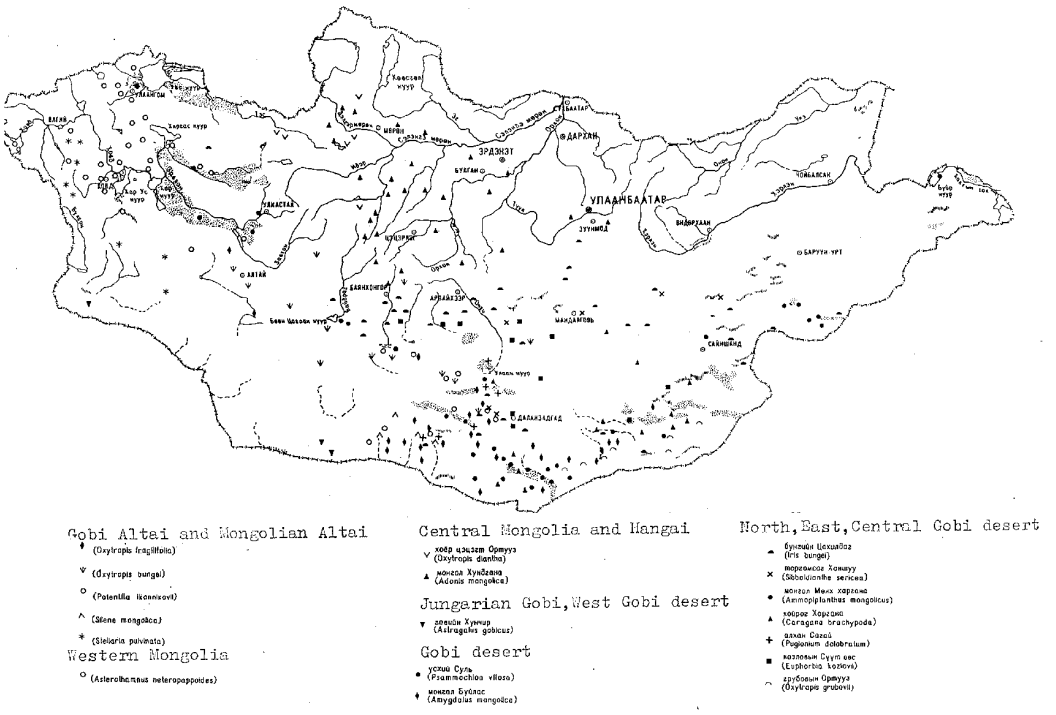
Genera	Number of species
Astragalus	110
Artemisia	99
Oxytropis	92
Carex	89
Potentilla	62
Saussurea	47
Salix	42
Allium	42
Taraxacum	34
Pedicularis	30
Polygonum	27
Poa	25
Veronica	23
Senecio	23
Gentiana	20
Elymus	19
Stipa	19
Ranunculus	19
Vicia	19
Hedysarum	19
Saxifraga	19
Dracocephalum	18
Festuca	17
Chenopodium	17
Stellaria	17
Aconitum	17
Viola	16
Juncus	16
Caragana	16
Limonium	16
Potamogeton	16
Betula	15
Calamagrostis	15

Genera	Number of species
Draba	15
Iris	15
Salsola	14
Rumex	14
Ribes	13
Zygophyllum	1
Rosa	12
Androsace	11
Euphorbia	11
Crepis	11
Scorzonera	11
Lappula	11
Puccinella	11
Silene	11
Delphinium	11
Erigeron	10
Thymus	10
Adenophora	10
TOTAL	***1,310****

Table 6 Top 20 angiosperm families (based on number of species) found in Mongolia

Rank	Family	Genera number	Genera %	Species number	Species %
1	*Asteraceae*	70	10.9	399	14.7
2	*Fabaccae*	25	3.9	311	11.5
3	*Poaceae*	63	9.8	236	8.7
4	*Rosaceae*	28	4.4	133	4.9
5	*Cyperaceae*	11	1.7	129	4.8
6	*Brassicaceae*	55	8.6	128	4.7
7	*Ranunculaceae*	22	3.4	114	4.2
8	*Chenopodiaceae*	25	3.9	91	3.4
9	*Caryophyllaceae*	21	3.3	82	3.0
10	*Scrophulariaceae*	13	2.0	80	2.9
11	*Lamiaceae*	23	3.6	78	2.9
12	*Apiaceae*	31	4.8	65	2.4
13	*Polygonaceae*	8	1.2	63	2.3
14	*Salicaceae*	2	0.3	47	1.7
15	*Boraginaceae*	22	3.4	46	1.7
17	*Allicaceae*	1	0.2	42	1.5
17	*Gentianaceae*	6	0.9	32	1.2
15	*Liliaceae*	13	2.0	26	1.0
19	*Saxifragaceae*	4	0.6	25	0.9
20	*Primulaceae*	7	1.1	24	0.9
	TOTALS	**150**	**70.2**	**2,151**	**79.4**

FIG. 3 MONGOLIAN ENDEMIC PLANTS



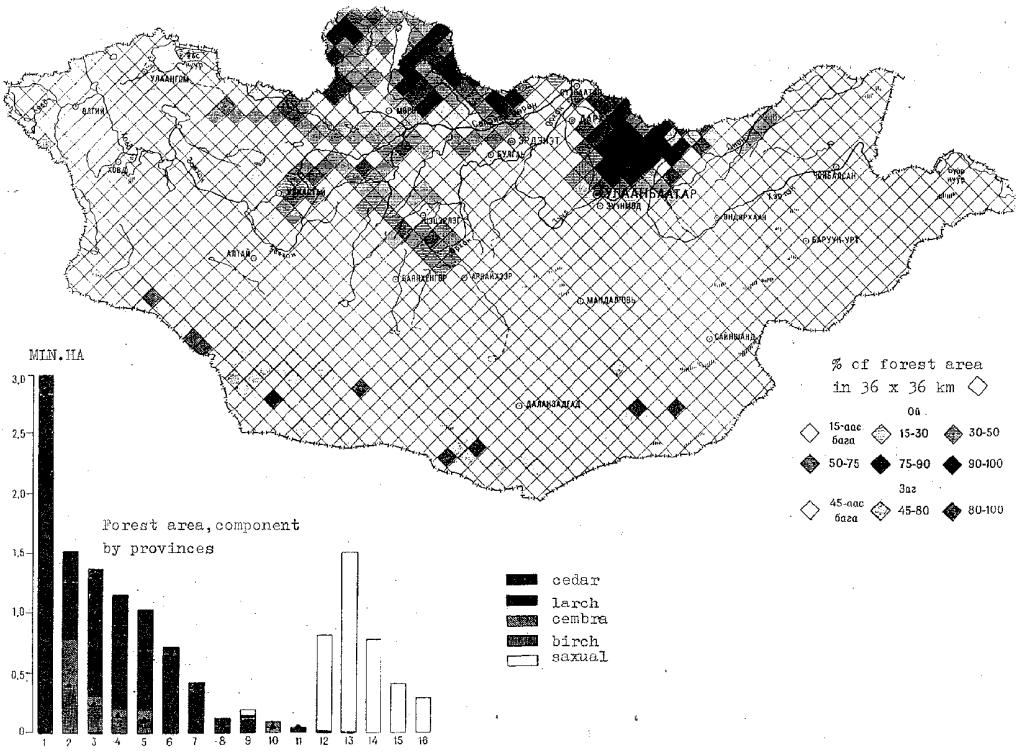
5.2 FOREST RESOURCES

Estimates for Mongolia's total standing forest area are conflicting and range from 10 million to 15.2 million ha, since no exact inventory data are available. In 1976, the Mongolian Forest Expedition estimated that there were 15.2 million ha of forest in Mongolia. In 1987, the forest area was estimated at 13.6 million ha, and in November 1990, the State Committee for Environmental Control estimated Mongolia's forest area at 10 million hectares, about 9 per cent of total land area, which apparently identified commercial forests. Although these data were developed by using different methods, they suggest a rapid rate of forest loss. The average forest loss rate for the period 1978-1990 is estimated at about 268,000 ha per *annum*.

Forest most suitable for timber production occur in portions of nine north central aimags and comprise about two-thirds (9.8 million ha) of total forest area. The forests species composition in these aimags is 73.6 per cent larch, 13 per cent cedar, 8 per cent pine, 5 per cent birch, and 0,4 per cent other species (fir, aspen, etc.). Arid forests covering about 4 million ha (1987 estimate) are found mainly in the seven southern aimags. The forests, or more correctly shrubs, are dominated up to 90 per cent by saxual (*haloxylum ammodendron*) and 10 per cent by *Tamarix*. Less important woody species are *Populous tremula, Populous diversifolia, Ulmus, Caragana, Nitaria, Eleaganus, Cynomorium, Salsola* and *Artemisia*. Saxual is the most important species not only due to its coverage, but also since it is the main source of animal fodder in winter or after droughts. Its timber vaue, however, small.

The most recent estimate in 1987 of the average standing density of wood in the northern, commercially important forest, is 133 cu m per hectare with a mean annual increment of 1 cu m/ha/annum. The estimated sustainable yield from these forest resources is 9.9 million cu m per year. It is important to note, however, that about 55 per cent of the commercially important forests are considered to be not accessible, i.e. are located on slopes above 22 degrees of inclination or are located at great distances from potential markets without being connected to these markets by roads or transportation systems. In addition, Mongolian environmental experts consider much of even accessible forests to be critical for watershed protection, and suggest that such forest areas should not be exploited. Because of the climatic conditions, forest regeneration is a very slow process in Mongolia, a fact which has important implications for the level of the sustainable yield, and for the impacts of deforestation on watersheds, wildlife habitat, and other resources.

FIG. 4 FORESTRY



5.2.1 Utilization of Forestry Products

There are three major types of forest utilization in Mongolia: (i) logging operations, saw milling and wood processing; (ii) fuel wood harvesting; and (iii) wildlife utilization. Timber harvesting declined during the last decade from 2.8 million cu m in 1980 to 1.4 million cu m in 1990 MNE projects 0.973 million cu m timber to be harvested in 1993. The decline is probably due to constraints in supply of machinery and spare parts, and possibly also the result of more restrictive policies by MNE. Thus, production is clearly below sustainable yield, however, at the current extremely high rate of forest destruction by fire and insects (see below) and very low rates of reforestation of harvested areas, the sustainability of the current rates of timber harvest, and of the timber industry may be questionable. Timber harvest is most intensive in the north central forest area. Since poor transport infrastructure inhibits the harvesting of timber at extended distances from markets, intensification of timber harvest and increased pressure on forest resources near population centers occurs.

Timber harvest supports a woodprocessing industry producing a variety of products (e.g. particle board, furniture, ger frames). The value of timber harvested in 1990 amounted to Tug 24 million, about $ 1.2 million. Data for 1992 indicate that saw timber production was about 125,000 cu m and production of construction wood about 42,000 cu m. Oi Mod, a former Government corporation which is now owned by about 70,000 sharenholders, dominates timber harvesting and wood processing and accounts for nearly 100 per cent of timber harvested. Oi Mod comprises 16 factories and enterprises. It acts as supplier of inputs, machinery and logging licenses for its subcontractors and processes or trades nearly all of timber harvested. About 75 per cent of timber harvested is traded as logs, while theremaining 25 per cent are processed. Roughly 5,000 cu m of plywood and 16,000-17,000 cu m of particle board are produced annually. Whilst wood remains a primary fuel source in rural areas, no data are available on the volume and geographic distribution of fuelwood harvesting. traditionally, most fuelwood harvesting has been done as a by-product of logging and fence post making operations.

Apart from timber and fuelwood production, forest utilization is related to wildlife, national parks and national reserves management, all under the supervision of MNE. About two per cent of forest land are national reserves, in which all commercial activities are forbidden. in national parks, which cover also about two per cent of forest land, commercial logging is banned, while other activities, such as hunting is allowed. Commercial exploitation of wildlife is under the responsibility of Oi An, a former Government agency under MNE that is now apparently privatized. Oi An is also responsible for forest nurseries and afforestation, environmental control, tourism and wildlife

management on forest land. Mammals such as marmots, squirrels and foxes as well as birds are exploited. Commercial utilization of wildlife includes not only hunting but potentially also ecological tourism. The Government's policies aimed at nature and biodiversity conservation have increasingly emphasized creation of additional national parks and reserves. MNE indicates desired targets of 20 to 30 per cent of forest land to be protected.

5.3 FRUITS AND BERRIES RESOURCES

Mongolians have a vast tradition of the wild fruit utilization. Mongolians used up a wild berries for a medicines, drinks (a tea, juice, and a wine) and for a decorations too except for a food. Mongolia is extremely rich with a wild berry species, especially with a *Hippaphae rhamnoides. Grossularis, Vaccinium L., Malus baccata, Amygdalus mongolica* which aren't very popular on the World. We have about 60 species of wild berries, a numbers of them also exist. These may have a big potential for development as a colorants, a different vitamins or for pharmaceutical purposes, but a little is known about them. Berry yields have been extremely variable over the years and between an areas, ranging from 50-2,600 kg per ha. During the investigation of the wild berries germplasm, we found more than 30 species but only 50 percent of them we have conserved to evaluate.

Many types of wild berries were found in Khentijmountains region (1,100 ha, 250 tonn fruit production) about 10,000 ha growing area of seabukhthorn (Hippophae rhamnoides) had been estimated in Western and Central region of Mongolia. Since the 1954, Shaamar fruit research station, Eastern station of Agriculture, Plant Science and Agricultural research Institute (PSARI) in Darhan, Ulaangom's research station, Bulgan research station have done much work in introduction of main cultivated fruits such as an apple, a blackcurrant, a seabucktorn and a raspberry. Berries, mainly blackcurrant and seabuckthorn are grown on about 500-1,000 ha in Mongolia, but are largely confined to the higher rainfall areas. Yields are low and variable, a total production isn't yet sufficient to support a significant processing industry for berries, although there is some professional research interest in the products. During the 40 years a research objectives were:

- evaluation of germplasms (local and exotic),
- improvement in cropping technologies and cultural practices of fruits,
- development and introduction of a high yielding and a resistant to cold cultivars.

During 1986-1989 PSARI in Darkhan had released two new cultivars of a blackcurrant (Darkhan and Shaamar) and the Ulaangom's research station developed three new cultivars of seabuckthorn: Ulaangom, Chandmani and Tes by using local wild samples seabuckthorn. the Fruit and an Ornamental section, where we work, is a biggest center of the fruit's research organizations in Mongolia. We have 15 ha experimental field, one supervisor, four researchers and one assistant worker. We are working with 24 species of fruits and ornamental plants in which are 17 varieties of apple, 18 varieties of currents (red, black and white), 14 of seabuckthorn, 4 of raspberry, 6 of plum and 1 of cherry. Most of these varieties of from the Sibirian region.

WILD BERRY SPECIES IN MONGOLIA

Genus	Species	Ares area distributed
1. Malus	*Pallassian*	Hentii, Hangai, Selenge, Bulgan
2. Sorbus	*sibiricus*	Hentii, Selenge
3. Crataegos	*sanguinea*	Altai, Hovsgol, Hentii, Hangai
	dahurica	Hentii, Dornod, Tov
	pinnatifida	Hentii, Dornod, Tov
4. Cotoneaster	*uniflora*	Gobi-Altai, Hangai
5. Padus	*asiatica*	Hentii, hangai, hiangan
6. Armeniaca	*sibirica*	Hangai, Hentii
	mongolica	Altai
7. Rubus	*ideabatus*	Hovsgo, Hentii,Hangai
	sachalinensis	"
	arcticus	"
	saxailes	"
	humifolins	"
8. Rosa	*Rugosa*	Hentii, Hovsgol, hangai
	oxyacanta	Hangai, Hovd, Altai
	aibartii	
	dahurica	
	laxa	
	beggeriana	
	spinosissima	
	plattyacantha	
	kokanica	
9. Fragaria	*orientalis*	Hentii, hangai, Altai, Hiangan
10. Grossularia	*acicularis*	Hangai, Hentii
11. Sorbaria	*sorbifolia*	Hiangan
12. Viburnum	*sargenti*	Hiangan
13. Elaegnaceol	*moorcrofti*	Gobi
14. Hippophae	*rhamnoides*	hangai, Hentii, Altai, Selenge, Orhon, Tes, Bulgan, Zavhan
15. Beriberidaceae	*sibirica*	Hovsgol, Hentii, Hangai, Altai

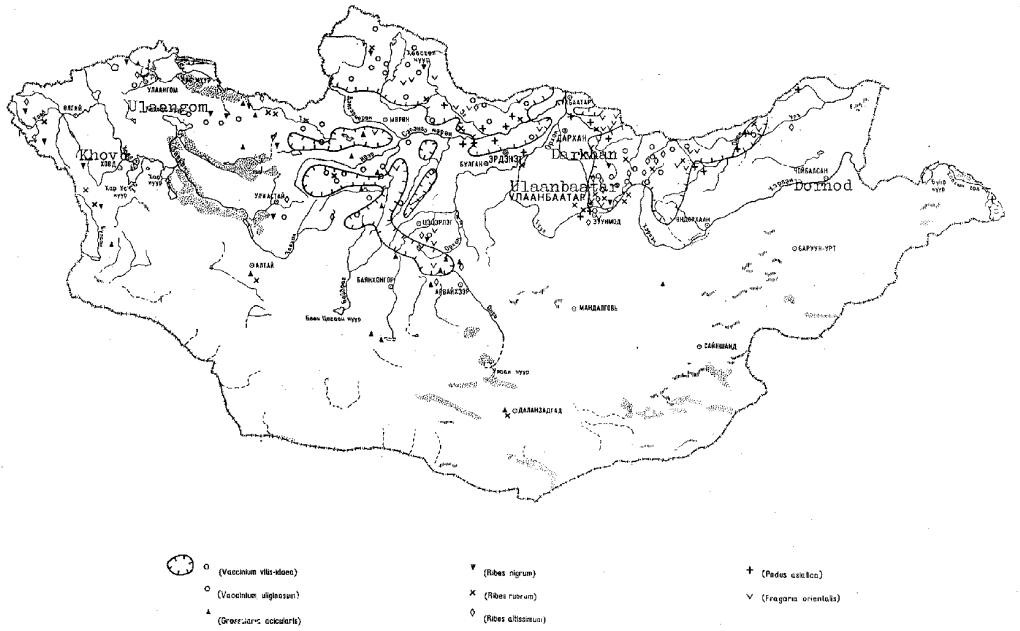
Genus	Species	Ares area distributed
16. Yacciniaceae	*utignosum*	Hovsgo, Hentii,Hangai
17. Rnodococcut	*vitis ideae*	Hangai, Hentii, Hovsgol,
18. Oxycoccus	*microcarpus*	Hentii
19. Lonicera	*altaica*	Altai, Hovsgol, Hentii
	microphilla	Hangai, Hovd, Altai
	hispida	Hangai, Altai
	tatarica	Shaamar
20. Ribes	*rubrum*	Hentii, hangai, Hovd, Altai
	hispidulum	Hovsgol
	altissimum	
	nigrum	
	atropurpureum	
	pauciflorum	
	procumbens	
	fragrans	
	graveolens	
	Heterotrichum	
	pulchellum	

The fruit varieties which we are working with:

No.	The fruits and a berries	Names of the varieties
1.	An apple	Altaiskaja dessertnaja
		Belaja nallva
		Gornoaltaiskoje
		Jermolajevo-23
		Komsomolec Buriatij
		Malinka
		Mechta
		Osennjja radostj
		Osennjja Kravchenko
		Pervenec Burlatij
		Slava
		Slava Buriatij
		Sejanec Kravchenko
		Sejanec Pudovshinij
		Ulan-Udinskoje
		Sibirskoje zoloto
		Pheniks Altaja
2.	A. Black currant	Primorskij champion
		Golubka
		Sejanec golubki
		Darkhan
		Shaamar
		Chernoje Lisavenko
		Dikovenka
		Gorhon
		Veljur
		Sofia
		Slavianka
		Primorskij vellkan
		Ljubimica Altaja
	B. Red currant	Altajskij rubin
		Volshebnaja
		Cheljabinskij velikan

No.	The fruits and a berries	Names of the varieties
	C. White currant	Pozdnespelaja
		Beloje Potapenko
3.	Seabuckthorn	Oblljnaja
		Oranzsevaja
		Vitaminnaja
		Tshulskaja
		Novostj Altaja
		Masllchnaja
		Dar Katunl
		Zolotoj pochjotok
		Obskaja
		B-32
		Ajaganga
		Solnechnaja
		Bajangol
		Prevoshodnaja
4.	Plum	Ojuna
		Amtataj
		Vaulinskaja
		Piramldalnaja
		Buriatskaja jubilejnaja
		Neznakomka
5.	Raspberry	Zorenjka Altaja

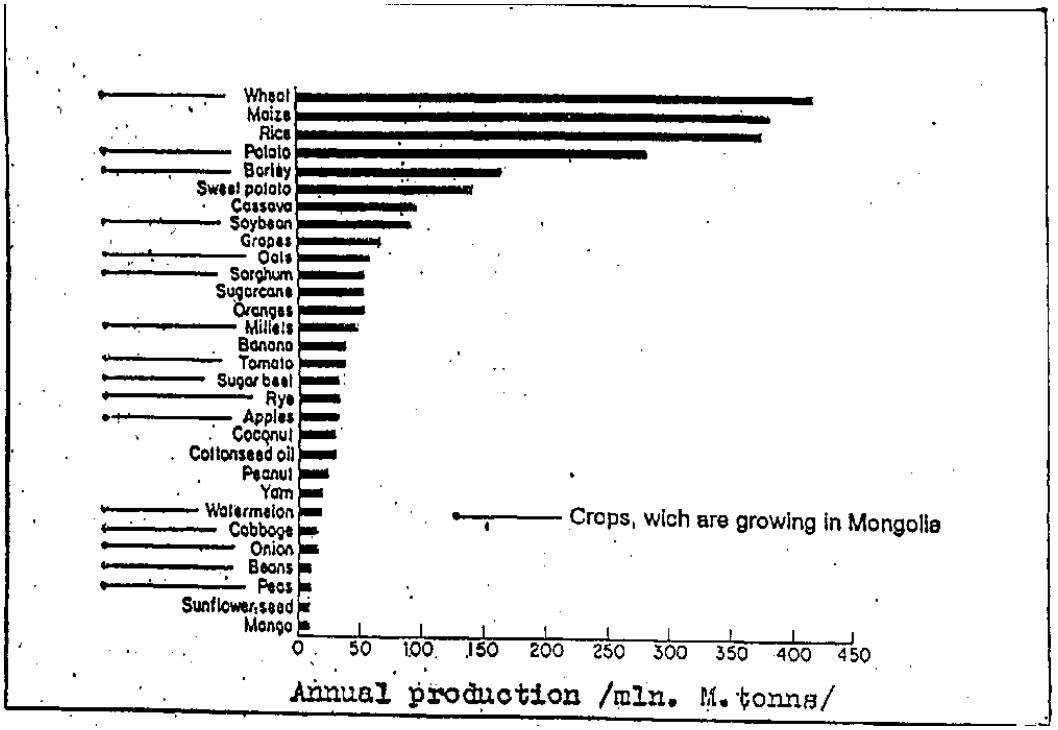
FIG. 5 WILD BERRIES RESOURCES



CHAPTER 6
Crop Genetic Resources

The appearance of agriculture some 10,000 years ago in various parts of the globe disrupted the ecological balance of a number of systems. Fortunately, however, plants were domesticated slowly enough to permit a new and stable equilibrium to emerge. Throughout this slow and lengthy evolution, man is estimated to have utilized more than 100,000 edible planate species. Barely more than 150 species, are now under cultivation. According to Mangeldorf, the great majority of manning is now living off no more than 12 plant species.

THE WORLD'S TOP 30 CROPS (EXCLUDING GRASS)



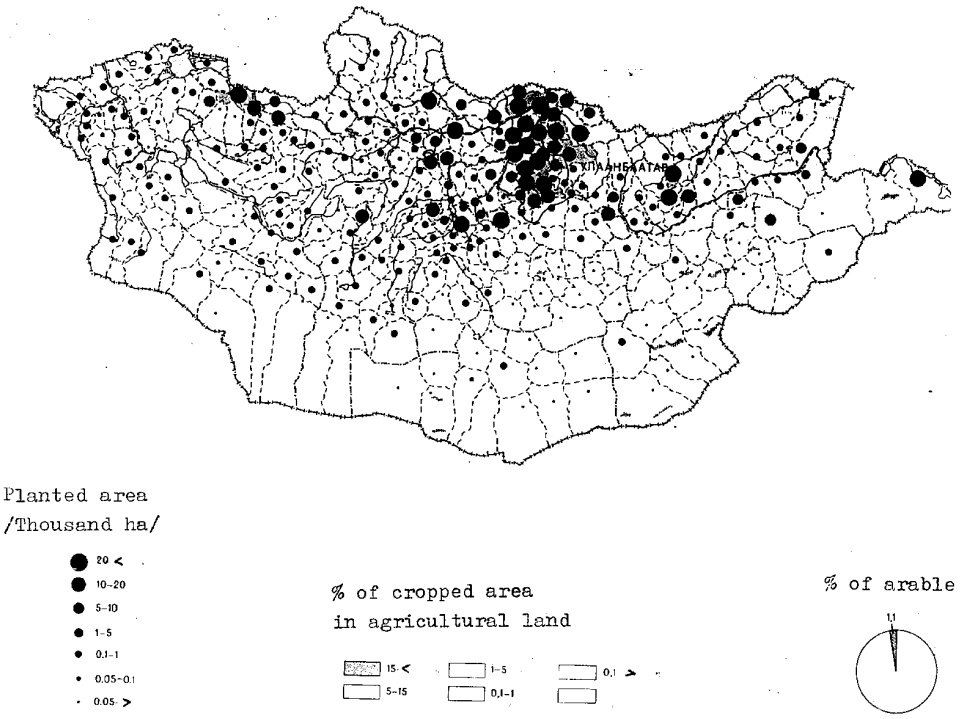
According to the same source, during the period since 1940's Mongolian researchers are estimated to have utilized more than 150 crops in Mongolia and from these 18 crops are used for various purpose including a few minor crops. It is well known that just 5 crops from top 15 grown widely in Mongolia.

Table 7 Average yields of 5 important crops

Crops	Varieties	Yieldt/ha
Wheat	Albidum 43	1.84
	Skala, Orkhon	2.49-2.41
	Sar 29, Buriatskaha 34	3.07-3.20
Barley	Viner	2.0
Oats	Altanboroo	1.85
Millet	Omskoe	1.49
Potato	Priekulsky	21.70

One striking feature of this new stage from 1950s is the eduction of genetic diversity. During the last 40 years the development of communication systems has greatly boosted the phenomenon of cultural integration, including the imposition of the eating habits of the dominant culture. Most important crops were very rapidly replaced by the new varieties from Soviet Union. Many local varieties of cereals, vegetables were ignored for many years. because of its many negative agricultural characteristics such as high yield it has only recently been discovered that local varieties carried genes resistant to drought, diseases, with high protein, early maturity.

FIG. 6 ARABLE LAND RESOURCES



Now, more efforts are being given to the collection and preservation plant genetic resources including local varieties. At same time, the utilization efficiency of plant genetic resources is being included through extensive evolution for the resources preserved and computerization of detailed information obtained.

With the establishment of Plant Genetic Resources section/PGR at the PSARI in l979, comprehensive conservation and exploration of plant genetic resources have been started on a regular basis. Present PGR section has a responsibility for a safe conservation, collection of germplasms including landraces and introduced accessions, their wild relatives and regeneration primary evaluation. Also makes study on new or traditional plants to develop new adopted varieties in different ecological conditions Mongolia. PSARI is the leader institute in Agricultural science, and has a biggest plant germplasm collection in Mongolia. Totally 20,713 beed accessions including 1,200 landraces are conserved at the PSARI.

There are 6 affiliated research institutions and experimental stations which have undirect connection with PSARI. As shown on figure 1, PSARI plays key role in research related to plant genetic recourses. In consultation with the National board of Plant Genetic Resources/NBPGR/PSAGR sets up a basic workplan for related research on plant genetic resources and carries out basic research on it.

Table 8 a Crop Area Production

				Area (1,000 ha)		
Year	Grain	Wheat	Potato	Veg.	Fodder	Silage
1955	59.0	20.0	1.1	0.7	1.9	47.0
1960	246.7		2.2	0.8	15.8	227.4
1961	334.0	266.7	2.3	1.0	33.4	8.2
1962	380.1	321.1	2.1	13	41.9	9.8
1963	402.15	347.8	2.7	1.4	37.8	10.1
1964	409.0	356.4	2.7	1.5	31.4	8.7
1965	419.9	302.2	2.7	1.3	50.6	5.4
1966	405.5	342.6	2.9	1.3	62.8	4.3
1967	415.9	346.0	3.2	1.4	71.4	4.4
1968	413.2	346.3	3.1	1.4	65.4	2.5
1969	417.7	347.1	2.7	1.5	28.0	1.8
1970	419.8	348.0	2.9	1.4	37.1	2.4
1971	418.8	332.7	3.3	1.5	37.1	4.2
1972	420.3	314.4	2.8	1.6	46.5	1.9
1973	428.2	307.2	3.4	1.7	46.3	8.0
1974	429.4	305.2	4.0	1.9	48.5	9.3
1975	437.1	315.6	4.3	2.0	53.1	10.1
1978	450.1	324.3	4.7	2.0	62.2	11.1
1977	487.6	351.3	5.7	2.0	79.1	13.7
1978	569.9	414.9	6.5	2.3	83.9	13.5
1979	585.5	422.5	7.3	2.4	89.6	10.4
1980	575.8	423.9	7.5	2.4	108.5	10.2
1981	542.4	409.7	4.7	2.5	119.8	14.0
1982	529.1	430.9	7.1	2.8	68.4	14.1
1983	586.5	444.2	9.5	2.8	107.2	14.8
1984	619.0	400.7	9.7	2.9	124.7	14.5
1985	634.8	460.7	9.0	3.0	115.2	18.2
1986	631.5	466.2	9.8	3.5	133.5	21.3
1987	523.0	467.8	11.1	3.6	127.4	27.3
1988	641.0	491.0	11.8	3.6	134.0	27.6
1989	673.9	530.2	11.5	3.7	109.8	28.5
1990	653.9	532.0	11.8	3.3	81.9	26.5
1991	617.5	534.2	9.3	2.3	65.0	15.0
1992	592.8	525.0	8.2	1.9	44.4	14.0
1993	504.2	468,8	8.5	2.9		480.1
1994	390.9	377.7	7.4	2.5		330.8

Table 8 b Crop Area Yield Production (1,000 tons)

				Production (1,000 tons)		
	Grain	Wheat	Potato	Veg.	Fodder	Silage
1955	47.0	14.0	7.1	2.9	12.8	
1960	227.4	195.4	18.5	6.8	37.4	
1961	120.6	93.3	16.0	9.2	82.3	18.0
1962	315.7	288.4	122.3	10.0	109.5	25.0
1963	305.1	290.9	19.7	12.9	88.8	3.0
1964	366.6	335.2	24.0	15.7	58.1	39.6
1965	322.0	291.2	24,4	10.8	44.8	12.8
1966	260.5	252.9	20.1	10.4	87.5	8.8
1967	331.3	289.2	19.8	11.2	61.9	9.0
1968	215.7	188.0	25.4	11.3	48.0	9.9
1969	132.1	114.2	14.5	11.2	80.8	5.8
1970	184.8	250.2	20.8	11.7	27.8	8.6
1971	372.9	316.4	18.6	14.2	57.2	17.3
1972	205.0	169.7	10.2	10.9	40.9	10.0
1973	455.4	339.6	35.3	22.4	58.9	56.5
1974	315.8	250.2	22.8	21.2	55.3	80.8
1975	482.5	385.7	40.7	21.2	70.2	95.8
1978	370.3	280.3	36.0	25.1	105.1	70.2
1977	414.4	318.0	44.6	10.8	113.9	43.1
1978	354.9	279.3	48.5	24.6	79.2	49.8
1979	330.7	239.7	72.4	23.5	119.2	67.2
1980	259.1	207.2	37.9	26.3	65.5	39.6
1981	343.8	295.5	40.4	29.1	136.2	114.9
1982	551.3	439.8	75.1	38.1	160.8	148.1
1983	812.8	547.8	97.5	34.3	351.2	354.4
1984	586.2	448.0	112.0	34.2	159.1	195.6
1985	890.2	692.3	106.3	36.7	278.5	313.1
1986	869.6	663.8	123.9	43.8	294.2	246.1
1987	689.7	543.8	138.0	45.7	318.3	276.1
1988	814.4	672.0	97.9	51.2	220.7	290.81
1989	839.0	666.7	148.0	54.9	225.5	288.1
1990	721.5	598.9	129.2	35.4	223.9	273.9
1991	596.2	539.1	95.1	22.4	83.0	116.0
1992	493.8	450.9	76.9	14.8	107.1	84.6
1993	448.7	58.4	23.0			
1994	321.8	55.0	23.0			

Table 9 Vegetation types (%) in Mongolia and their distribution in different formations

Vegetation Type	Percent in Mongolia	Alpine	Taiga	Mountain Forest Steppe	Steppe	Semi-Desert	Desert
1. Dry Steppe	10.7	0	4.7	10.0	21.8	21.4	19.7
2. Steppe Meadow	9.2	0	10.9	10.9	15.6	10.6	6.8
3. Forest and River Meadow	16.1	4.2	22.8	20.5	13.7	4.9	5.0
4. Wet Meadow	5.5	1.7	9.9	5.8	3.0	1.1	1.0
5. Swamp	5.0	2.5	9.0	5.9	5.2	4.3	5.4
6. Bog	0.4	0	0.9	0.1	0	0	0
7. Dry swamp	1.1	0	0.7	1.0	0.8	2.3	.3.0
8. Submergents and Emergent	2.4	0	3.1	2.5	3.7	2.8	3.2
9. Cold Tolerant Plants	4.8	20.0	3.4	2.7	0.5	0	0
10. Mountain Meadow	6.2	23.2	9.2	0	0	0	0
11. Mountain Wet Meadow	3.9	16.9	6.1	3.1	0	0	0
12. Rock and Stone*	13.5	3.8	7.6	14.1	17.1	21.3	21.3
13. Rocky Wet Meadow*	2.6	1.0	4.1	3.5	2.7	3.1	1.0
14. Rocky High Mountain*	6.4	26.7	3.0	3.4	0	0	0
15. Halophytes	1.6	0	0	1.2	1.5	4.1	5.0
16. Wet/Alkaline	6.0	0	3.7	5.4	8.1	15.5	17.5
17. Dry/Alkaline	0.9	0	0	0.4	0.7	1.1	2.4
18. Alkaline/Sandy	0.4	0	0	0.3	0.4	1.4	2.2
19. Sands	3.0	0	0.8	1.9	5.2	6.5	6.2

6.1 COLLECTION

Mongolia is located near Chinese and Central Asiatic centres of form origination of the principal cultivated plants and it is well known that Mongolia has remained a specific agricultural society for several hundreds of year, collection of crop germplasm resources in Mongolia have been carried out from 1921-1922 by the Vavilov's collection mission under the leadership V.E.Pisarev. According to the collection many endemic land races were found: 21 of barley, 18 of wheat, 7 of oats, 8 of millet, 4 of peas.

Table 10 The most important land races of crop collected in 1921-1922

Crop	Scientific name	varieties
Wheat	*Triticum*	*aestivum*
		durum
		turgidum
Millet	*Panicum Patantissimum*	*mongolicum Submongolicum*
Barley	*Hordeum Vulgare*	*Hangaicum*
		Uliastaicum
	Hordeum intermedium	*Mongolicum*
		Gobicum
		Kobdicum
		Urgaicum
		Haliunicum
Oat	*Avena Sativa*	*mongolica*

A major collecting trips were undertaken in 1930-1932, 1958, 1972 with the Vavilov research institute of Plant Industry, Saint-Peterbourg.

Most of the plant genetic resources collected up to 1960s and presently more than 1,200 land races of cultivated plant germplasms are conserved in ambient condition at the PSARI Darkhan. Two collecting trips were carried out recently in 1990 with Vavilov's Institute and Czechoslovakian Research Institute. Praha-Ruzyne, in 1994 with Grassland Research institute. China, sponsored by IBPGR. About 420 land races including food crops, fodder grasses were collected by researchers.

CHAPTER 7
Evaluation Regeneration and Utilisation

This activity is one of the most important functions of the PSARI PGR sections and carries out in coordination with PSARI related institutions.

Presently most of this activity carried out at the PSARI and plants with long vegetation period or which has high requirements to the temperature, carried out at affiliated institutions. According to the results of the seed viability test, accessions which the germination rate shows less than 85%, should be regenerated.

Systematic crop breeding started in Mongolia about 40 years ago, by using indigenous varieties and several excellent cultivars released as a result of the initial phase of crop breeding. However, additional improvement by breeding became increasingly difficult to attain mainly due to common genes among its parental varieties. To overcome this difficulty, exotic breeding materials from other countries were used as gene sources to introduce new superior genes into plants. They played important roles in the breeding and seed production of new cultivars.

Since 1964 officially released 58 cultivars of 25 crops, including:

wheat	12
durum wheat	3
barley	3
oats	1
rye	1
millet	2
potato	5
cabbage	3
carrot	2
turnip	1
tomato	3
cucumber	1
garlic	1

Also, PSARI is to assess the plant germplasms whose accessions are not still evaluated and send it to the related institutions or researchers who has responsibility on that plant. Some of the collected resources have been utilized effectively in plant breeding in recent y ears. Utilization of exotic genetic resources in plant breeding has become still more active recently.

Table 11 Developed varieties in Mongolia

Crops	Varieties	Remarks(yield)
l. Wheat	Orhkon	1.7-2.8 t/ha
2. Barley	Aiag-erdene	1.05-2.1 t/ha
3. Potato	Zavhan-35	25-26 t/ha
4. Cabbage	Hurgalag	45-55 t/ha
5. Garlic	Uliastai	19, 8 t/ha
6. Elymis	Haraa	5.2-17.8 t/ha
7. Hippophae	Ulaan-gom	5,5 t/ha, oil 8,5%
	Tes	6,0 t/ha, 8%
	Chandman	6,2 t/ha, 8,4%
8. Carrix	Shimt	2,7 t/ha (grasses)
9. Lucern	Burgaltai	9-31 t/ha -"-
10. Blackberry	Darhan	2,5-3 t/ha
	Shaamar	
11. Flower (Gladiolus)	Muroodol	

CHAPTER 8
Plant Germplasm Conservation

PSARI has held 21,000 plant germplasm of seeds and fruit trees and perennial flowers etc. which has been conserved under the ambient conditions.

PSARI has a latest facilities for working collection with the holding capacities 25,000 accessions respectively. So far, seed germplasms at the PSARI consists of 8,448 of wheat, 4,423 of barley, 1,152 of oat. 2,020 of different vegetables and others are grain legumes, industrial crops, ornamental plants (trees, flowers, herb etc.).

On the other hand conservation of different plant germplasmes have been done at the related, institutions and exp. stations, depending on their biological characters and field of use. Seeds stored under ambient condition, too. For example: PSARI has a collection of all kind of plants, ERARI has held basically industrial plants and oil plants. As mentioned above all plant germplasms stored in a paper bags, under ambient condition and in order to maintain their seed longevity, the regenerating process has to be done annually or in 3-5 years at the field plots. It causes difficulties of the PGR activity, even whether the original seeds would be dead or changed.

Therefore new seed storage facilities for short and long term store with the holding capacity 30,000, and laboratory equipments for controlling of storing condition, seed viability etc, and for other purpose, would be necessary
at the PSARI.

Table 12 Conservation of plant germplasms at affiliated institutions

Field of use	No. of accessions	Institutions stored	Remarks
1. Cereals, food legumes, industrial crops, vegetables, ornamental plants	21,000	PSARI	Collection, evaluation, regeneration and conservation in ambient condition
2. Industrial crops, oil,fibre crops, some vegetables	210	ERARI	Conservation, evaluation, regeneration
3. Vegetables, some oil plants	252	ARARI	Conservation, evaluation
4. Fodder plants perennial, annual fodder grasses, other	2,000	RIAH	Collection, evaluation, conservation
5. Cereals, potato, some vegetables	513	ARSU	Conservation, evaluation

8.1 CHARACTERIZATION AND DOCUMENTATION

In the past 2 years more than 4,000 accessions of cereals, vegetables, fruits and industrial crops have been evaluated and multiplied for agronomic characters, quality, disease and drought resistance. More than 100 accessions have been provided to the breeding programmes and used effectively in production.

Table 13 Germplasm samples, characterized and evaluated 1992-1993

Crop	No. of samples			
	1993	1992	1993	1994
Wheat	446	412	300	300
Oats	510	630	40	43
Millet	105	-	-	-
Barley	-	36	100	120
Potato	190	196	170	170
Legumes	12	12	16	16
Vegetables	73	71	88	102
Root/tuber	127	136	102	100
Industrial crops	79	235	215	208
Forages	20	39	46	68
Fruit tree	50	50	40	40
Flowers	21	25	37	43
Total				

Some of accessions of the Plant Genetic Resources evaluated for their utilization in breeding and related research Evaluation of the Plant Genetic resources is different between each crops. Most important evaluation characters related to yield and quality of outs, flax, pea, bean.

The value of foreign varieties still high. But, respects of crops for the Mongolian condition generally differ.

1. They are hardy or frost tolerant.

2. More attention must be paid to irrigation.

3. Resistance to drought.

4. Resistance to major pests and diseases.

5. Good storability.

6. High yielding.

7. Attractive appearance.

8. High protein and strach content.

9. Seeds germinate at cooler soil temperatures etc.

According to the above respects, to the consumption of crops amongst NBPGR's major tasks are the promotion, collection, conservation and evaluation of crop genetic resources of species of major economic importance. It has defined over 25-30. National priority crops needing urgent action for breeding and seed production. From these 11 global priority crops.

Priority crops needing urgent action

1. Wheat.
2. Barley.
3. Oats.
4. Rye.
5. Millet.
6. Potato.
7. Cabbage.
8. Turnip.
9. Garlic.
10. Leek.
11. Welsh.
12. Shallot.
13. Onion.
14. Tomato.
15. Cucumber.
16. Spinach.
17. Rhubarb.
18. Carrot.
19. Radish.
20. Pea.
2l. Siberian kale.
22. Sugar beet.
23. Soyabean.
24. Kanola.
25. Watermelon.
26. Common bean.
27. Buckwheat.
28. Pepper.

8.2 ORGANIZATION

Integrated and systematic conservation of crop genetic resources was started in 1979 when the Plant Genetic Resources section at the PSARI was established and Mongolia has been joint to the International COMECON Board of Plant Genetic Resources. But the organization and the operation of the Seed

conservation Facilities are still in their infancy in respect of modern management and equipments.

In Mongolia recently, the research works of Plant Genetic Resources are mainly carried out by the National Research Project (Programme) on Plant Genetic Resources at the Plant Science and Agricultural research Institute (PSARI), East Regional Agricultural research Institute (ERARI), Altain regional Agricultural Research Institute (ARARI), West Regional Agricultural Research-Station (WRARS), Research Institute of Animal Husbandry (RIAH). Mongolian National Agricultural University is in charge of united coordination of nationwide crop germplasm research programmes. The Institute of Botany of Academy of Sciences (IBAS) bear the responsibility for performing national research Project for wild species of grasses, berries mainly. The main tasks of each research institute are as below:

8.2.1 Plant Science and Agricultural research institute of MNA University

- Organization and performance of nationwide key research projects.
- Exchange of crop germplasm resources with other countries.
- Conservation of crop germplasm for the whole country.
- Collection, identification and evaluation of crop germplasm.
- Identification of donors for plant breeding programmes.
- Plant breeding for grain, vegetables, fruits.
- Introduction and field testing of new cultivars, varieties, plants.

8.2.2 East Regional institute of MNA University (ERARI)

- Evaluation of oil crops,
- ecological test of new varieties, plants,
- plant breeding of wheat,
- seed conservation of oil crops (active short-term conservation).

8.2.3 Altain Regional institute of MNA University (ARARI)

- Short term seed conservation of vegetables,
- evaluation of vegetables.

8.2.4 West Regional research Station of MNA University (WRAR)

- Evaluation of barley genetic resources,
- ecological test of new varieties of grain, vegetables,
- evaluation and conservation of fruits,
- plant breeding of barley.

8.2.5 Research Institute of Animal Husbandry of MNA University (RIAH)

- Collection, identification and evaluation of forage grasses,
- short-term seed conservation of forage grasses,
- plant breeding of forage grasses.

8.2.6 Institute of Botany Mongolian Academy of Science

- Collection, identification and evaluation of wild relatives.

8.3 INTERNATIONAL COOPERATION

The earliest international activities on Plant Genetic resources date back to 1921 when the Vavilov's Institute (VIR) sent an expedition collection mission team to Mongolia. Since 1972 Mongolia has been linked with International COMECON Plant Genetic Resources Board and carried out research Cooperative Programme with USSR, Czechoslovakia, Bulgaria, Hungary, Poland, GDR, Romania. In 1980 started germplasm exchange activities with USA, India, CIMMIT. International cooperation on plant genetic resources including the introduction and distribution of crop seeds gradually coming from 1979 when was established Plant Genetic Section at the PSARI. Now PSARI holds more than 20 thousands accessions from 43 countries of the World.

From 1990 Mongolia is actively cooperating with IPGRI for increasing plant genetic activities, establishing storage facilities and training personal of Plant Genetic National Programme. In 1993, 1994 have been organized international collection mission supported by IBPGR, Mongolia scientists have been participated to 3 international training courses on genetic resources sponsored by IBPGI, JICA. In the future international cooperation guided by IPGRI will be most important solution on developing research and extension activities on plant genetic resources in Mongolia.

8.4 FUTURE PERSPECTIVES AND NEEDS

1. According to the needs of the development of the international, regional activities on plant genetic resources Mongolia lays more emphasis on the preservation, evaluation, and characterization of seed propagated crops and exploration of the wild relatives on country.

2. We are trying to enlarge the range of our plant species even to include vegetables, technical crops, legumes to establish more sustained base for food security of country by the regional cooperation on plant genetic resources.

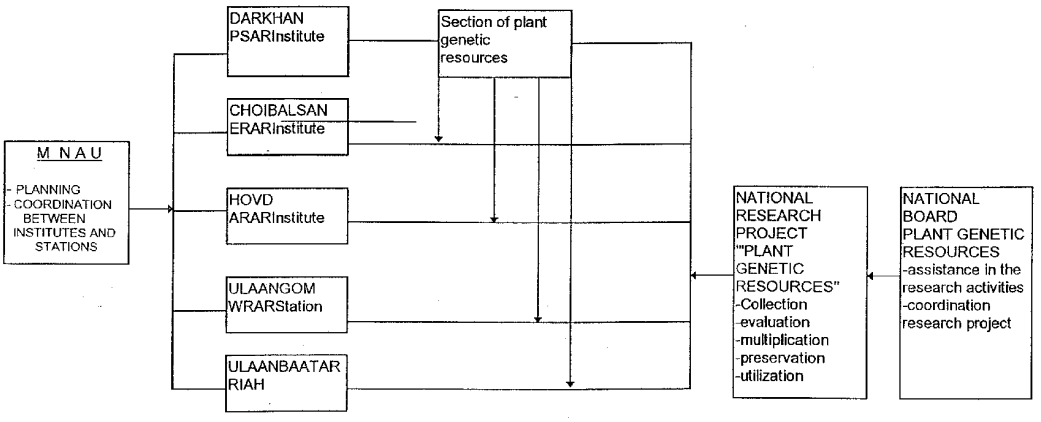
3. We plan to centralize the preservation of crop genetic resources which are now maintained in institutions this will be done if we will make normal seed storage with the total area 300-500 sq-m.

4. We plan to increase our field activities through project-type technical cooperation with regional countries on plant genetic collection, evaluation and utilization. As possible, we invite collecting further diversity of resources at regional level by the establishing mobile international Plant Genetic resources research station in specific Mongolian condition for collection test, characterization and evaluation new varieties.

5. Better systematization and utilization of the information obtained on plant genetic resources is also one of the most important tasks in regional and national level. We plan to make information electronic system of plant Genetic Resources Date base. We need to be well prepared technical staff and facilities for this computerized system.

6. The most urgent need for us is to have personnel professionally trained on plant genetic Resources. We will give first priority to training of research personnel for the better management and handling of plant genetic germplasm in the future.

FIG. 7 MONGOLIAN CROP GENETIC RESOURCES PROGRAMME



ANNEX 1
Environmental Package Laws of Mongolia

1. Law on protection of Nature & Environment.

2. Land Law.

3. Protected areas Law.

4. Forest Law.

5. Water Law.

6. Hunting Law.

7. Natural Plant Law.

8. Air Pollution Law.

9. Chemical toxic substance Law.

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