



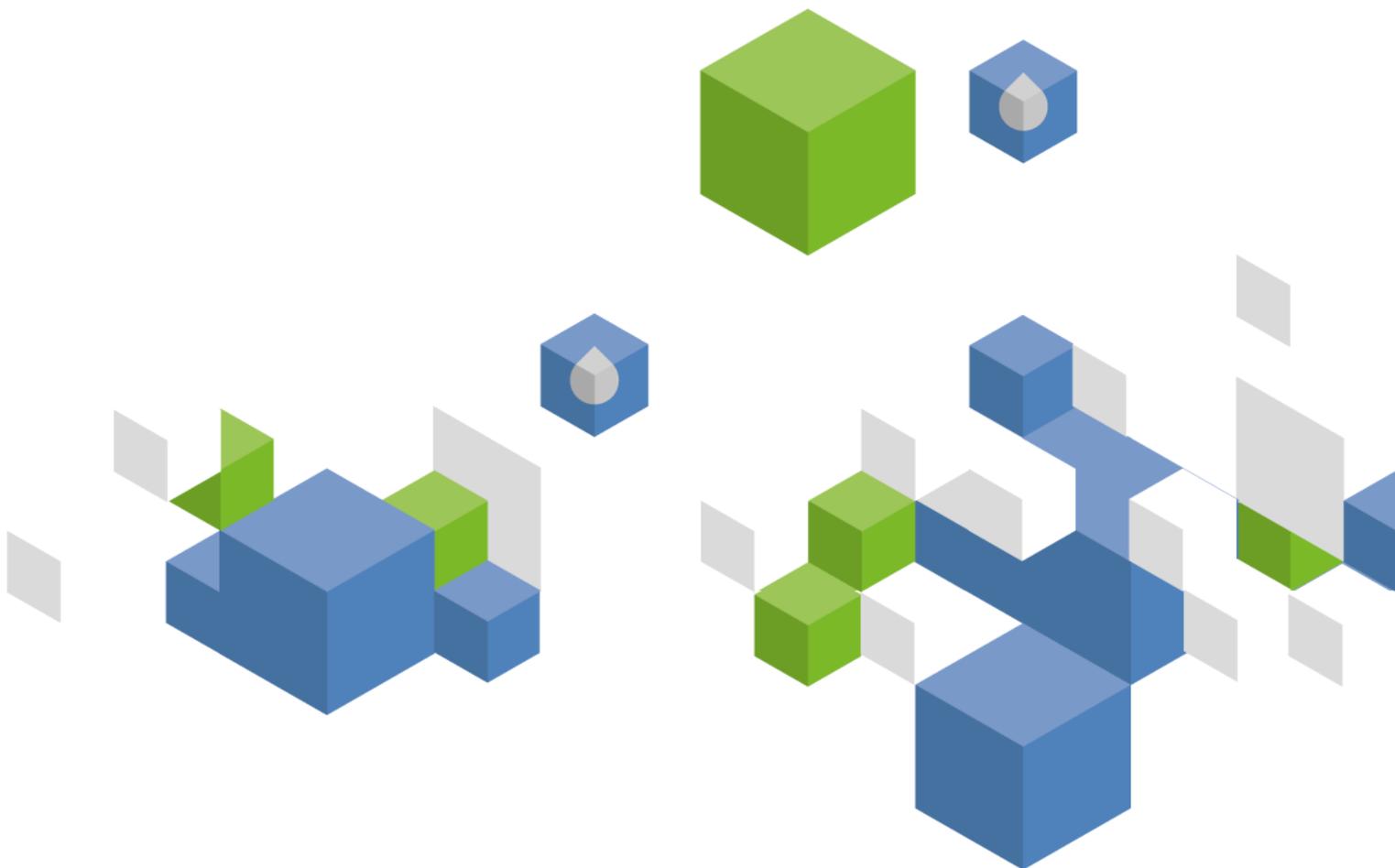
Food and Agriculture Organization  
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Reports

# Country profile – Mongolia

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# Mongolia

## GEOGRAPHY, CLIMATE AND POPULATION

### Geography

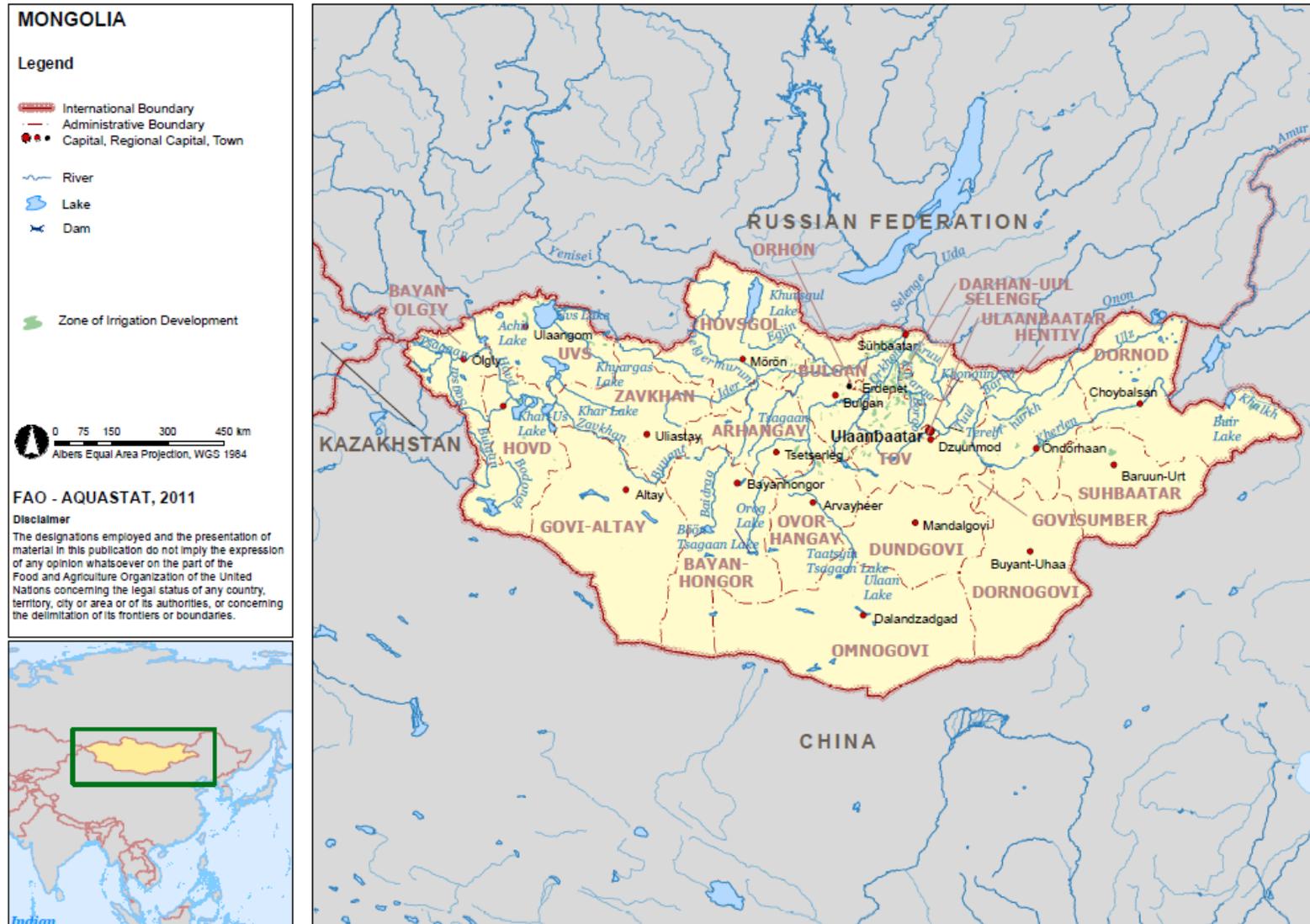
Mongolia is located in the north of the central Asian plateau and has an area of about 1.56 million km<sup>2</sup> (Table 1). It is a landlocked country bordered in the north by the Siberian Russian Federation, and in the east, south and west by China. Administratively the country is divided into 21 provinces (aimags), each with a provincial capital and a local government headed by an aimag governor, and the capital city Ulaanbaatar.

TABLE 1  
Basic statistics and population

Physical areas			
Area of the country	2009	156 412 000	ha
Cultivated area (arable land and area under permanent crops)	2009	962 000	ha
• as % of the total area of the country	2009	0.6	%
• arable land (annual crops + temp fallow + temp meadows)	2009	960 000	ha
• area under permanent crops	2009	2 000	ha
Population			
Total population	2009	2 712 000	inhabitants
• of which rural	2009	39	%
Population density	2009	2	inhabitants/km <sup>2</sup>
Economically active population	2009	1 200 000	inhabitants
• as % of total population	2009	44	%
• female	2009	50	%
• male	2009	50	%
Population economically active in agriculture	2009	221 000	inhabitants
• as % of total economically active population	2009	18	%
• female	2009	52	%
• male	2009	48	%
Economy and development			
Gross Domestic Product (GDP) (current US\$)	2009	4 202	million US\$/yr
• value added in agriculture (% of GDP)	2009	24	%
• GDP per capita	2009	1 550	US\$/yr
Human Development Index (highest = 1)	2010	0.622	
Access to improved drinking water sources			
Total population	2008	76	%
Urban population	2008	97	%
Rural population	2008	49	%

The country consists principally of inter-mountain plateaux. About 80 percent of the territory lies above 1 000 m above sea level. The main mountain ranges are the Mongolian Altai in the west and the Khangai and Khentii mountains in the north and centre, with the large depression of the Great Lakes located between the two ranges, while to the east there are elevated plains. Geographically, Mongolia can be divided into four regions: Khangai forest region, the eastern steppe region, Gobi (Govi in Mongolian) desert region and the semi-desert region.

FIGURE 1  
Map of Mongolia



The total cultivable area is an estimated 1.8 million ha, which is about 1 percent of the total area. Some 80 percent of the total land area can be used for pastoral activities. The main crop growing areas are in the central-northern part of the country and include portions of Selenge, Tov and Bulgan provinces, which contain about 67 percent of all cultivated land. These areas comprise a broad basin draining to the north. Only valley bottom land and the lower slopes of hills with sufficiently deep soils are cultivated. In 2009, the total cultivated area was estimated at 962 000 ha, of which 960 000 ha was arable land and 2 000 ha permanent crops. Only 10 percent of the country is forested (FAO, 2003).

### Climate

The country has severe climatic conditions with long cold winters. The average annual precipitation is 241 mm, ranging from 400 mm in the north to less than 100 mm in the southern Gobi region. The mean monthly temperature is below 0 °C throughout the country between November and March. Late spring and early autumn (even late summer) frosts reduce the vegetation period to 80-100 days in the north and 120-140 days in the south. Summer precipitation occurs between June and August, representing 80-90 percent of the total annual rainfall. Other climatic factors affecting agricultural production include low soil moisture and air humidity in spring and early summer, and strong winds in spring, resulting in high evaporation and soil erosion.

### Population

The total population in 2009 was 2.7 million, of which around 39 percent lived in rural areas (Table 1). Mongolia is sparsely populated with the lowest average population density in the world, 2 inhabitants/km<sup>2</sup>, but there are 180 inhabitants/km<sup>2</sup> in the capital city Ulaanbaatar. The annual population growth rate during the period 1999-2009 was 1.3 percent.

In 2008, access to improved drinking water sources reached 76 percent (97 and 49 percent for the urban and rural population respectively). Sanitation coverage accounts for 50 percent (64 and 32 percent for the urban and rural population respectively).

### ECONOMY, AGRICULTURE AND FOOD SECURITY

In 2009, the total population economically active in agriculture was an estimated 221 000, amounting to 18 percent of the economically active population. About 52 percent of the population economically active in agriculture are women. In 2009, the gross domestic product (GDP) was US\$ 4 202 million of which agriculture accounted for 24 percent.

The Mongolian agriculture sector is divided into four subsectors:

- extensive livestock, which is the traditional semi-nomadic pastoral system, where camels, horses, cattle, sheep and goats are grazed together;
- mechanized large-area crop production of cereals and fodder crops;
- intensive farming, producing potatoes and other vegetables, with both mechanized and simple production methods; and
- intensive livestock, with housed dairy cattle, pigs and poultry.

The livestock sector dominates, contributing almost 85 percent of total agricultural production (FAO, 2001).

The country adopted a free-market economy in 1990. The privatization of crop production has partly failed and is still incomplete. Under liberalization policies, the original, very large production units were to be privatised, reduced in size and organized into various types of companies. In the beginning the number of these companies increased rapidly, then many disappeared during the break up of the Union of Soviet Socialist Republics (USSR), because of inadequate access to credit, inflation and

mismanagement in the new free market conditions. By 1997, only 300 large wheat farms (between 1 000 and 30 000 ha each) remained operational (FAO, 2001).

In 1992, cereals occupied nearly 90 percent of the total cropped area, but declined as a result of the reduced availability and increased cost of production inputs and lack of working capital. About 8 percent of the total arable area was devoted to fodder crops. Potatoes and vegetables together accounted for 1.5 percent of the area planted, while fruit trees covered 0.5 percent of the total area.

## WATER RESOURCES

Mongolia is situated on three international river basins (Mongolian River Resources, 2010):

- The Arctic Ocean Basin in northern and central Mongolia, also known as the Yenisei river basin, drains in a northerly direction through the Russian Federation into the Arctic Ocean and covers 20 percent of the country. The many lakes and rivers are fed by water from the northern Khangai mountains and the western slopes of the Khentii mountains. The total length of the rivers in the basin is 35 000 km, which is about 50 percent of the total length of all Mongolia's rivers. The basin's flow accounts for 51.4 percent of the country's total annual runoff. Major rivers in the basin are the Selenge and its tributary the Orkhon, the Ider and the Delgermurun.
- The Pacific Ocean Basin in eastern Mongolia, also known as the Amur River Basin, drains in an easterly direction through China, the Russian Federation and the Democratic People's Republic of Korea into the Pacific Ocean and covers 12 percent of the country. This Basin encompasses rivers in the eastern part of Mongolia, which originate in the Khentii and Khyangan mountains. The basin's flow accounts for about 15 percent of the country's total annual runoff. Major rivers in this basin are the Onon, Ulz, Khalkh and Kherlen.
- The Central Asian Internal Drainage Basin in southern and western Mongolia covers 68 percent of the country, does not drain into an ocean, occupies much of the arid Gobi Desert and hence has few rivers (Hovd, Zavkhan, Bulgan, Uyenich, Bodonch and Buyant) and limited groundwater resources. It has a series of internal drainage systems: the Khar-Uus Nuur, the Uvs Nuur, and the Pu-Lun-To. It is home to 78 percent of Mongolia's wetlands.

Located within these international basins are eight major regional basins, determined by their economic and environmental significance (Mongolian River Resources, 2010):

- Arctic Ocean Basin:
  - the Selenge river basin, located in semi-arid northern Mongolia, is the country's largest basin. It is composed of two main rivers, Selenge and its tributary Orkhon. Its major sub-basins are the Egiin, Ider, Orkhon and Tuul river basins;
  - the Tuul river basin covers almost 3.2 percent of the country and is home to more than half of Mongolia's population. It has a catchment area of 49 840 km<sup>2</sup>.
  - the Khuvsgul lake basin in northern Mongolia is the location of the second biggest freshwater lake in the world.
- Pacific Ocean Basin:
  - the Kherlen river basin covers 116 455 km<sup>2</sup> in semi-arid eastern Mongolia;
  - the rivers of the Onon, Ulz, and Khalkh basins are among the largest in eastern Mongolia and originate in the upper reaches of the Khentii and Khyangan mountains; They account for about 11 percent of the country's total surface water runoff.
- Central Asia Internal Drainage Basin:
  - the Great Lakes basin in western Mongolia contains Central Asia's most important wetlands. The basin is divided into four parts: the Uvs, Khyargas, Khar-Uus and Sharga depressions. It features a series of large lakes: the Uvs, Khyargas, Khar-Uus, Khar, Airag and Shargiin Tsagaan;
  - the Northern Gobi river basins; and
  - the Southern Gobi river basins.

There are about 4 113 rivers in Mongolia, with a total length of 67 000 km. Large rivers originate in the mountainous areas in the north and west of the country – primarily in the Mongol Altai, Khangai-Khuvsgul and Khentii mountain ranges – where small rivers and mountain streams merge to create well-developed water networks. In contrast, the southern, central and southeastern parts of the country have few rivers or other water resources. In the interior drainage basins, in the western and southern areas of Mongolia, seasonal or intermittent streams end in salt lakes or disappear into the desert. The rivers' main water sources are rainfall, groundwater, snow and glaciers, with melting snow accounting for 15-20 percent of the annual runoff. From November to May, the rivers in the north are frozen. Waterways in the Gobi Desert are fed almost exclusively by groundwater. Sixty percent of Mongolia's river runoff drains into the Russian Federation and China, while the remaining 40 percent flows into the lakes of the Gobi Desert. The longest rivers within the Mongolian territory are (Mongolian River Resources, 2010):

- The Orkhon river (1 124 km) originates in the Khangai mountains. It initially flows eastward, before heading north and joining the Selenge river as its major tributary, which then continues northwards into the Russian Federation and Lake Baikal, by volume this is the world's largest freshwater lake. It has a drainage area of 132 855 km<sup>2</sup> and occupies 47 percent of the Selenge river basin. The Tuul and Kharaa rivers drain into the Orkhon river.
- The Selenge river (1 024 km) is Mongolia's principal waterway, accepting 30.6 percent of the flow of all the rivers in Mongolia. It is formed by the confluence of the Delgermurun and Ider rivers. It flows north into the Russian Federation, eventually draining into Lake Baikal, of which it is the most substantial source of water. Its main tributaries are the Egiin, Orkhon and Uda rivers. It is also the headwater of the Yenisei-Angara river.
- The source of the Kherlen river (1 090 km) is in the Khentii mountains. It flows to China, where it subsequently empties into Lake Hulun. Its main tributaries are the Iluur, Burkh, Baidrag, Terelj and Tenuun rivers.
- The Zavkhan river (808 km) starts at the confluence of the Buyant and Shar Us rivers in the Khangai mountains. It empties into Lake Airag in the Great Lakes basin, which then connects with Lake Khyargas. The river provides most of Lake Khyargas' tributary flow.
- The Tuul river (704 km) originates at the confluence of the Namiya and Nergui streams. It flows in a southwesterly direction, passing through the southern part of the Mongolian capital, Ulaanbaatar, before joining the Orkhon river.
- The source of the Hovd river (593 km), is on the northern side of the Mongol Altai mountains, rises from the permanent snows of Tavan Bogd mountain. It flows into Lake Khar-Us in Hovd province in western Mongolia. Its main tributaries are the Tsagaan and Sagsai rivers.
- The Eruu river (323 km) starts in the Khentii mountains at the confluence of the Khongiin and Sharluun rivers. It flows into the Orkhon river and has a drainage area of 11 860 km<sup>2</sup>.
- The Onon river (298 km) originates in the Khentii mountains, from where it flows in a northeasterly direction, eventually converging with the Ingoda river in the Russian Federation to produce the Shilka river. At the border with China, the Shilka joins the Argun river to form the Amur river, which eventually drains into the Pacific Ocean. The Onon river has a drainage area of 94 010 km<sup>2</sup>. Its main tributaries are the Barkh, Balzh and Khurkh rivers.
- The Kharaa river (291 km) originates in the mountains north of Ulaanbaatar and passes through Selenge and Darkhan-Uul provinces before flowing into the Orkhon river.

Mongolia's long-term average annual renewable water resources include 32.7 km<sup>3</sup> of surface water and 6.1 km<sup>3</sup> of groundwater. Part of the groundwater flow, estimated at 4 km<sup>3</sup>/year, returns to the river system as base flow and is called overlap (Table 2). This gives a total of 34.8 km<sup>3</sup>/year (32.7+6.1-4.0) for internal renewable water resources (IRWR). It is estimated that no water enters the country from neighbouring countries, but that 25 km<sup>3</sup>/year flows into the Russian Federation and 1.401 km<sup>3</sup>/year into China.

TABLE 2  
Water resources

Renewable freshwater resources			
Precipitation (long-term average)	-	241	mm/yr
	-	377 000	million m <sup>3</sup> /yr
Internal renewable water resources (long-term average)	-	34 800	million m <sup>3</sup> /yr
Total actual renewable water resources	-	34 800	million m <sup>3</sup> /yr
Dependency ratio	-	0	%
Total actual renewable water resources per inhabitant	2009	12 832	m <sup>3</sup> /yr
Total dam capacity		-	million m <sup>3</sup>

There are some 3 060 natural lakes with surface area larger than 100 ha or 0.1 km<sup>2</sup>. The lake with the largest surface area is Lake Uvs (3 518 km<sup>2</sup>), which is a saline lake without an outlet (Table 3). Lake Khuvsgul has the greatest volume (384 km<sup>3</sup>) and depth (139 m). It contains 74 percent of the total freshwater resources of Mongolia, and is fed by 46 rivers and other large lakes. In the higher mountainous regions the potential evaporation is lower than the annual precipitation and, therefore, the lakes never dry up and persist against periods of drought. In areas such as the Valley of Lakes, however, it is the opposite and therefore the lakes there can become quite shallow in very dry areas. Most of the medium lakes such as Orog, Taatsyin Tsagaan, Adgiin Tsagaan and Ulaan in the Valley of Lakes dry up once or twice every 11-12 years, which can lead to an ecological crisis when millions of fish, aquatic plants and animals die in isolated spots of concentrated saline mud left by the drying lake (Davaa et al., 2007).

TABLE 3  
Characteristics of some natural lakes (Source: Davaa, Oyunbaatar and Sugita, 2007)

Lake	Water level (m)	Surface area (km <sup>2</sup> )	Volume (km <sup>3</sup> )	Average depth (m)	Area/depth (km <sup>2</sup> /m)	Location
Khuvsgul	1 647.6	2 770.0	383.7	138.5	20.0	Khuvsgul
Uvs	760.0	3 518.3	35.7	10.1	98.6	Great Lakes' Hollow
Khyargas	1 035.3	1 481.1	75.2	50.7	19.7	Great Lakes' Hollow
Khar-Uus	1 160.1	1 495.6	3.1	2.1	479.4	Great Lakes' Hollow
Khar	1 134.1	565.2	2.3	4.1	137.8	Great Lakes' Hollow
Terkhiin Tsagaan	2 059.2	54.9	0.3	6.1	9.0	Khangai Mountain
Buir	583.0	615.0	3.8	6.1	100.8	Eastern Mongolian Plain Land
Boon Tsagaan	1 312.0	252.0	2.4	10.0	25.2	Valley of Lakes
Adgiin Tsagaan	1 285.0	11.5	0.01	0.8	14.4	Valley of Lakes
Orog	1 217.0	140.0	0.4	3.0	46.7	Valley of Lakes
Ulaan	1 008.0	175.0	Dried up	-	-	Valley of Lakes

In 1999, about 27 earth dams were constructed to store water for sprinkler irrigation systems. A small part (55 km<sup>2</sup>) of the catchment drained by the Boroo river is intercepted by the Shariin Am dam and storage reservoir facility. The Shariin river is a narrow and shallow river with a small dam about 4 m high, capable of impounding a small storage reservoir with a regulating capacity of about 250 000 m<sup>3</sup>.

The theoretical hydropower potential in 1999 was an estimated 5 500-6 000 MW. There is a 528 kW mini-hydroplant in operation (the Kharakhoum scheme) on an irrigation canal that diverts water from the Orkhon river.

## INTERNATIONAL WATER ISSUES

There are about 210 rivers flowing through Mongolia into the Russian Federation and China. The first international agreement on transboundary water resources was between the governments of Mongolia and the USSR in 1974. This stipulated the use of water and protection of the Selenge river basin, which plays an important role in the economic and industrial development of both countries. The agreement made between the governments of Mongolia and the Russian Federation in 1995 on the protection of transboundary water resources focuses on over 100 small rivers and streams located in the western part of the country.

The drainage basins of the transboundary rivers between Mongolia and the Russian Federation cover almost one-third of Mongolia's territory. In 1994, an agreement was signed between China and Mongolia on the protection of transboundary water resources concerning Lake Buir, the Kherlen, Bulgan, Khalkh rivers, and 87 small lakes and rivers located near the border. Transboundary water resources shared with China include surface water bodies in Dornod, Hovd, and Bayan-Olgii provinces and groundwater resources in Govi-Altay, Omnogovi, Bayanhongor, Suhbaatar and Dornogovi provinces (UN, 2006b).

## WATER USE

In 1996, total water withdrawal from groundwater (80 percent) and surface water (20 percent) was equal to 400 million m<sup>3</sup>, of which 138 million m<sup>3</sup> (34.6 percent) for livestock, including irrigated fodder production, 32 million m<sup>3</sup> (7.9 percent) for irrigation of other crops, 101 million m<sup>3</sup> (25.2 percent) for municipalities, 103 million m<sup>3</sup> (25.8 percent) for industry and 26 million m<sup>3</sup> (6.5 percent) for other needs (Myagmarjav and Davaa, 1999).

In 2005, total water withdrawal was about 511 million m<sup>3</sup>, of which around 227 million m<sup>3</sup> (44 percent) for agriculture, 122 million m<sup>3</sup> (24 percent) for municipalities and 162 million m<sup>3</sup> (32 percent) for industries (Table 4 and Figure 2). About 82 percent, or 419 million m<sup>3</sup>, was contributed by groundwater resources (Figure 3).

TABLE 4  
Water use

Water withdrawal			
Total water withdrawal	2005	511.2	million m <sup>3</sup> /yr
- irrigation + livestock	2005	227	million m <sup>3</sup> /yr
- municipalities	2005	121.8	million m <sup>3</sup> /yr
- industry	2005	162.4	million m <sup>3</sup> /yr
• per inhabitant	2005	201	m <sup>3</sup> /yr
Surface water and groundwater withdrawal	2005	511.2	million m <sup>3</sup> /yr
• as % of total actual renewable water resources	2005	1.47	%
Non-conventional sources of water			
Produced wastewater		-	million m <sup>3</sup> /yr
Treated wastewater		-	million m <sup>3</sup> /yr
Reused treated wastewater		-	million m <sup>3</sup> /yr
Desalinated water produced		-	million m <sup>3</sup> /yr
Reused agricultural drainage water		-	million m <sup>3</sup> /yr

FIGURE 2  
Water withdrawal by sector  
Total 0.5112 km<sup>3</sup> in 2005

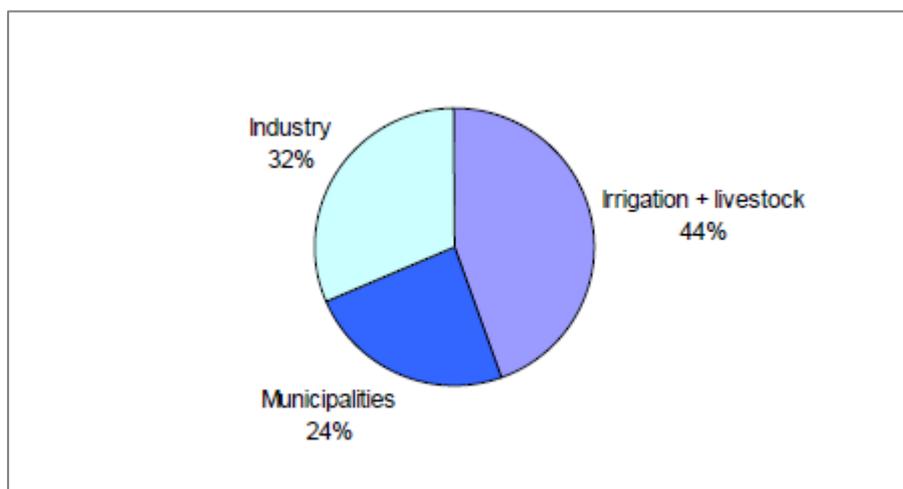
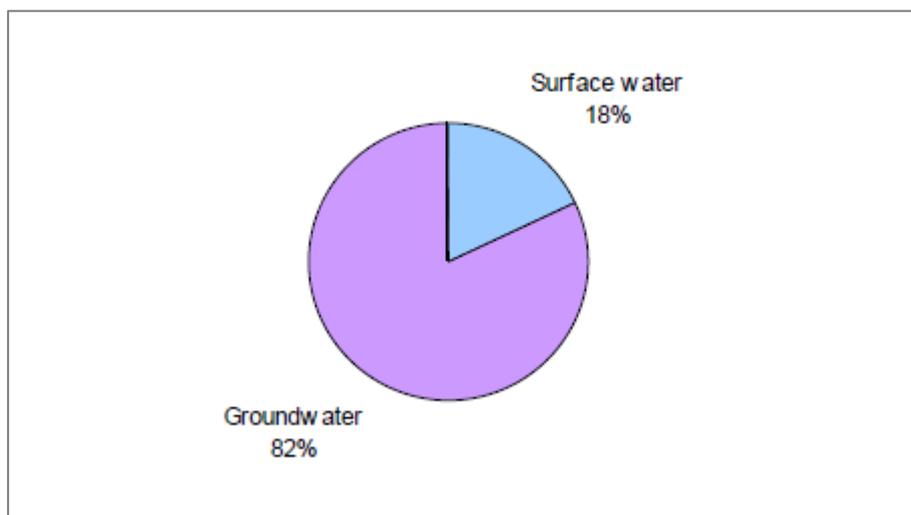


FIGURE 3  
**Water withdrawal by source**  
 Total 0.5112 km<sup>3</sup> in 2005



## IRRIGATION AND DRAINAGE

### Evolution of irrigation development

Irrigation in Mongolia was probably developed under the Huns in the first century. Irrigation development appears to have peaked at about 140 000 ha during the seventeenth and eighteenth century.

Traditional irrigation methods had been largely abandoned by the end of the nineteenth century. Chinese 'migrants' developed comparatively small-scale schemes on the larger rivers. 'Modern' irrigation development started in the 1950s, and the first modern irrigation scheme was designed in 1955.

About 518 000 ha with irrigation potential were identified at reconnaissance level in the early 1970s, of which 117 000 ha have been studied in more detail for potential development. Starting in 1971, some small irrigation schemes were built in the western aimags. A government campaign began in 1975 to produce irrigated fodder in the western and Gobi regions. The construction of further irrigation schemes, large and small, continued until 1988.

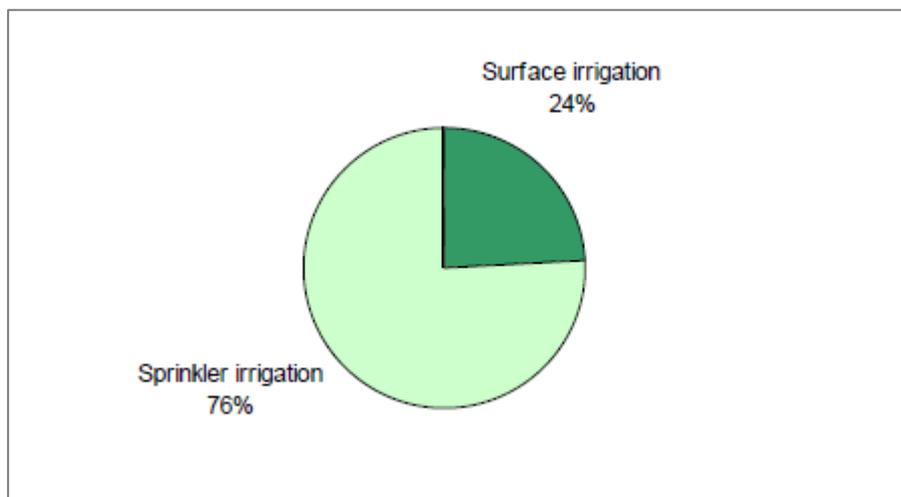
In the 1980s, irrigation schemes were characterized by sprinkler systems, generally serving from 400 to 500 ha or more, primarily for fodder and cereal production and, to a lesser extent, for vegetables and potato production.

In 1993, the total area equipped for irrigation was an estimated 84 300 ha. The total area equipped for full control irrigation amounted to 57 300 ha, of which 43 400 ha under sprinkler systems (registered schemes) and 13 900 ha of systems using surface irrigation methods (unregistered schemes) (Table 5 and Figure 4). In addition, an estimated 27 000 ha of pasture benefited from traditional floodwater diversion (spate irrigation). The area equipped for full control irrigation that is actually irrigated was estimated as 35 000 ha (61 percent), while 62 900 ha (75 percent) of the total area equipped for irrigation was actually irrigated.

TABLE 5  
Irrigation and drainage

<b>Irrigation potential</b>		518 000	ha
<b>Irrigation</b>			
1. Full control irrigation: equipped area	1993	57 300	ha
- surface irrigation	1993	13 900	ha
- sprinkler irrigation	1993	43 400	ha
- localized irrigation	1993	0	ha
• % of area irrigated from surface water	1993	37	%
• % of area irrigated from groundwater	1993	63	%
• % of area irrigated from mixed surface water and groundwater		-	%
• % of area irrigated from mixed non-conventional sources of water		-	%
• area equipped for full control irrigation actually irrigated	1993	35 000	ha
- as % of full control area equipped	1993	61.1	%
2. Equipped lowlands (wetland, ivb, flood plains, mangroves)		-	ha
3. Spate irrigation	1993	27 000	ha
<b>Total area equipped for irrigation (1+2+3)</b>	<b>1993</b>	<b>84 300</b>	<b>ha</b>
• as % of cultivated area	1993	6.2	%
• % of total area equipped for irrigation actually irrigated	1993	74.6	%
• average increase per year over the last -- years		-	%
• power irrigated area as % of total area equipped		-	%
4. Non-equipped cultivated wetlands and inland valley bottoms		-	ha
5. Non-equipped flood recession cropping area		-	ha
<b>Total water-managed area (1+2+3+4+5)</b>	<b>1993</b>	<b>84 300</b>	<b>ha</b>
• as % of cultivated area	1993	6.2	%
<b>Full control irrigation schemes</b>			
<b>Criteria</b>			
Small-scale schemes	< ha	-	ha
Medium-scale schemes		-	ha
large-scale schemes	> ha	-	ha
Total number of households in irrigation		-	
<b>Irrigated crops in full control irrigation schemes</b>			
Total irrigated grain production		-	metric tons
• as % of total grain production		-	%
<b>Harvested crops</b>			
Total harvested irrigated cropped area		-	ha
• Annual crops: total		-	ha
• Permanent crops: total		-	ha
Irrigated cropping intensity (on full control equipped actually irrigated area)		-	%
<b>Drainage - Environment</b>			
Total drained area		-	ha
- part of the area equipped for irrigation drained		-	ha
- other drained area (non-irrigated)		-	ha
• drained area as % of cultivated area		-	%
Flood-protected areas		-	ha
Area salinized by irrigation		-	ha
Population affected by water-related diseases		-	inhabitants

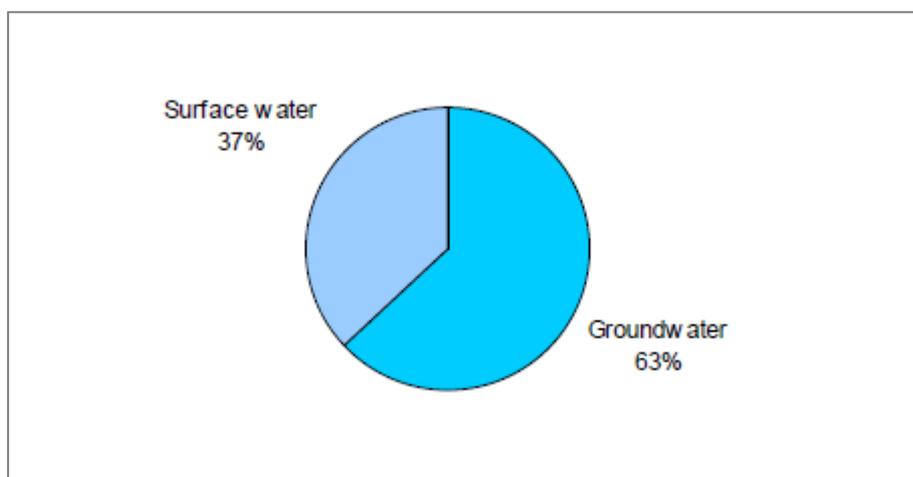
FIGURE 4  
**Irrigation techniques on area equipped for full control irrigation**  
 Total 57 300 ha in 1993



An inventory of 156 registered schemes exists, covering a total of 43 400 ha and varying in size between 5 and 3 300 ha, two-thirds of them being smaller than 50 ha. Most schemes have been developed in the north (48 percent) and west (47 percent). Unregistered schemes, an estimated 80 percent, are concentrated in the west of the country, are smaller (1-100 ha) and are the result of spontaneous efforts by local people, or are state schemes taken over by companies and private individuals after being abandoned.

Of the sprinkler irrigated area, side-roll systems account for 43 percent, tractor-mounted water guns or sprinkler booms for 28 percent, centre pivots for 25 percent and movable laterals for 4 percent. About 46 percent of the total irrigated area is served by gravity canals and the remaining 54 percent by buried steel pipes. In 1993, 36 099 ha or 37 percent of the total area equipped for full control irrigation was irrigated by surface water and 21 201 ha or 63 percent by groundwater (Figure 5).

FIGURE 5  
**Source of irrigation water on area equipped for full control irrigation**  
 Total 57 300 ha in 1993



The total sprinkler irrigated area has been in steady decline with the privatization of the state farms operating the systems and the subsequent lack of finance. Producers growing crops on irrigated areas experienced high operation costs, huge energy consumption and shortage of skilled and trained labour on the farms. It was not possible to fully exploit the production potential of the irrigated areas.

Sprinkler irrigation was difficult to operate and sometimes this method leached the soil. It also had high operation and maintenance costs, and produced overcapacity, which sometimes could not be harvested (FAO, 2003). In 1992, only 52 percent of the total area under sprinkler systems, or 22 000 ha, was operational. Of the remaining area, 11 000 ha are classified as abandoned for irrigation purposes, while the other 10 000 ha are defined as non-functional owing to failed or missing equipment. Individual irrigators have established plots on schemes as the farming companies have withdrawn from irrigation.

### **Role of irrigation in agricultural production, the economy and society**

Because of the dry character of the country, especially in the Gobi and steppe zones, a reliable harvest vegetables or other crops is possible only using irrigation; rainfed crop production is limited. As most precipitation falls in summer little humidity is kept in the soil (FAO, 2003).

During the 1980s, fodder crops accounted for approximately 50 percent of the area irrigated under sprinkler systems, annual cereal crops (mainly wheat) for 20-40 percent, potatoes for 5-10 percent, vegetables (mainly cabbage, onions, carrots and turnips) for 5-10 percent, and fruit (seabuckthorn, blackcurrant and Siberian apples) for less than 2 percent. Unregistered irrigation schemes have focused primarily on potatoes, vegetables and fruit production, with significant areas of fodder production in the west and south. Fodder, cereals and potatoes have suffered from the reduction in irrigation extension. Vegetables, some fruits and early potatoes are the main crops currently grown on irrigation schemes.

In 1986, total crops harvested amounted to 869 300 tonnes with 15 700 tonnes (2 percent) from irrigated areas. In 1999, the total harvest was 171 200 tonnes with 2 500 tonnes (1.4 percent) from irrigated areas. In other words, over a period of 15 years there was a steady decline to only one-fifth of the original production (by tonnage). Comparing 1999 with 1986, the production of wheat declined 3.9 times, potatoes 1.1 times, vegetables 1.1 times, and planted fodder crops 40 times. In the past Mongolia was self-sufficient in crop produce. In 1999, because of the hot weather, there was a poor harvest (FAO, 2003).

According to cost estimates provided by the Ministry of Food and Agriculture in 1993, registered irrigation investment averaged US\$ 1 300/ha at 1993 prices, with infrastructure representing 87 percent of this amount. In 1995, an FAO mission estimated new irrigation establishment costs at approximately US\$ 2 000/ha and rehabilitation costs at approximately US\$ 700-1 000/ha.

## **WATER MANAGEMENT, POLICIES AND LEGISLATION RELATED TO WATER USE IN AGRICULTURE**

### **Institutions**

The main institutions dealing with agriculture and water resources development are the Ministry of Food, Agriculture and Light Industry (MOFALI) and the Ministry of Environment (MOE). MOFALI is responsible for rural water supply and contains the Department of strategic planning and Policy, which is the Water Policy and Regulation Unit (Batnasan, 2003). MOE is responsible for water conservation. Under this ministry is the Agency of Meteorology, Hydrology and Environment Monitoring and the Agency for Nature, Forest and Water resources, which contains the Center for Water Research.

Currently, Mongolia has no fully developed integrated institutional infrastructure on river basin management issues.

In 2000, the National Water Committee (NWC) was established to coordinate and monitor the implementation of the National Water Programme (Batsukh et al., after 2005). In addition to the MOFALI and the MOE other ministries are involved in the NWC, such as the Ministry of Industry and Trade, the Ministry of Defense, the Ministry of Health and the Ministry of Infrastructure (Batnasan, 2003).

## Water management

The management of the country's water resources is detailed in the Law on Water, enacted in 1995 to regulate the protection, effective use and restoration of water. It also focuses on capacity-building in the water sector and the decentralization of water management (Asia Foundation, 2010).

Dutch engineering companies, in close collaboration with UNESCO-IHE, plan to support the Mongolian Ministry of Environment in its mission to modernize water management in Mongolia. The project entitled 'Strengthening integrated water resources management (IWRM) in Mongolia' aims to introduce IWRM into the country as well as expand the knowledge and skills in the Mongolian water sector. The project initiators aim to transfer their know-how to the local community by providing training for the project partners. Meanwhile, two university courses on water management will be set up in Mongolia. The Mongolian water sector is currently facing a variety of challenges. There is a lack of safe drinking water and insufficient sanitation for the entire population (MDGs). The project started in January 2009 and is set to finish in four years. The total budget estimated for the project is €6.5 million (UNESCO-IHE, 2009).

## Finances

Mongolia's pricing policy is decentralized and local authorities are entitled to set up and revise the water tariffs (UN, 2006a). Mongolia's Law on Water covers pricing policies intended to ensure cost recovery and the equitable allocation of water resources. In 2008, however, only 65 percent of water costs were recovered through pricing, partly because of the country's present economic conditions. For example, although the regulation states that all water used by industry will be charged, industries are not making enough profit to pay for the real costs of water. Water use for agriculture is free, although every user must establish a contract for the use of water, while household users pay small fees for their use (ADB, 2008).

## Policies and legislation

A Water Law has been in force since June 1995 and was amended in 2004 to integrate river basin management practices with the goal of better use of water resources while protecting ecosystems. The Water Law also recognizes the economic value of water, requires capacity-building in the water sector, focuses on the decentralization of water management, puts forward the need for environmental impact assessments and sets new penalties for violating water legislation (Batsukh et al., after 2005).

In 1995, the Law on Water and Mineral Water Use Fees was also enacted, establishing fees for the use of water by citizens, companies and other organizations. Other laws related to water are the Environmental Protection Law, enacted in 1995, and the Environmental Impact Assessment Law, enacted in 1998 (Asia Foundation, 2010).

The Mongolian Action Programme for the twenty-first century, the National Water Programme and the National Action Programme on climate change were approved on 1998, 1999 and 2000 respectively (Batnasan, 2003).

The United Nations Framework Convention on Climate Change (UNFCCC) and the Ramsar Convention on Wetlands were ratified by the Mongolian parliament in 1993 and 1997 respectively, and entered into force in 1994 and 1997 (Batnasan, 2003).

## ENVIRONMENT AND HEALTH

Freshwater ecosystems of Mongolia are subject to increasing and multiplying threats, including overgrazing, dams and irrigation systems, growing urbanization, mining and gravel extraction, climate change impact and lack of water management policies and institutional framework (Batnasan, 2003).

The Asia Foundation's Securing Our Future (SOF) programme is a three-year initiative designed to promote the sustainable use of Mongolia's natural resources that is focused on responsible mining and land-use practices. It is being jointly implemented by The Asia Foundation, The Netherlands, and a coalition of non-governmental, public and private sector partners. The overall purpose of the programme is to ensure that future mining activities in Mongolia generate long-term benefits for the people of Mongolia without compromising the nation's ecological and social heritage.

SOF involves seven programme areas. Maximum community participation is sought in the decision-making process, in long-term collective management and use of the country's vast natural resources. One of the seven areas focusses on the development of a Mongolian river water quality monitoring network. This will enlist citizens and students to work in partnership with Mongolian and expatriate scientific experts in the collection and dissemination of data on the quality of river water across the nation. It will lead to the compilation of a complete ecological inventory of Mongolian waterways (Asia Foundation, 2010).

Overuse of groundwater resources and climate change has led to lowering of the groundwater table, which has consequently caused some springs, lakes and their associated ecosystems to dry up.

Since the systematic observation period, from 1940 onwards, serious floods have been observed at Mongolia rivers, which have caused severe property damage and loss of life. About 18 flood events have been observed from 1996 to 1999 and have resulted in 54 lives lost and much property damages (Davaa et al., 2007).

Out of 10 000 cases of diarrhoea every year, almost 70 percent have occurred in the capital Ulaanbaatar. Dysentery and hepatitis are also common. These infections stem from a lack of access to safe water and sanitation infrastructure (UN, 2006a).

## PROSPECTS FOR AGRICULTURAL WATER MANAGEMENT

Solving the stressed present freshwater situation in Mongolia would require a coordinated approach of governmental institutions, donors, NGOs and key stakeholder groups on river basin level. Currently, however, there is no fully developed integrated institutional or legal infrastructure handling Integrated River Basin Management (IRBM) issues. Thus, there is an urgent need to consider implementing the IRBM principles for sustainable water management (Batnasan, 2003).

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