

Mongolia: The Water Situation in Ulaanbaatar

Hiroshi Sato*

I. Introduction

To many, Mongolia is a country of steppes and desert. Geographically, the country can be divided into three main regions: north, central and south. These regions vary greatly in terms of terrain, climate and other natural elements. The west of northern Mongolia is a wooded region covered in Siberian taiga forest. Meanwhile, the central region is home to Mongolia's vast, characteristic steppes, and southern Mongolia is full of desert steppes.

In 1990, Mongolia abandoned socialism and its one-party rule as the People's Revolutionary Party introduced a multiple party system with influence from the Soviet *perestroika* movement. Then in 1992, the constitution was amended and the nation of Mongolia was born. Through these reforms, Mongolia ushered in a new democracy and transitioned from a planned economy to a market economy.

As the economy flourished following the transition, a number of issues came to the surface. Of the issues raised, environmental issues are a major one in Mongolia. Currently, the impacts of domestic economic stimulation and problems such as recent global warming on the environment can be seen everywhere. Mongolia's environmental problems are wide-ranging; air pollution, waste management, water pollution, overcentralization in the capital, energy issues, water resources, and urban environmental issues are but a few of those plaguing the capital of Ulaanbaatar. Although it is hard to imagine for a place known as the Steppe Country, these environmental issues are certainly mounting.

Traffic conditions are one example of an obvious urban environmental problem. Rush hour congestion in Ulaanbaatar is no different than the morning and evening traffic in developed countries. The large amounts of exhaust from cars, along with dust, soot and smoke from power plants, and smoke from burning coal for heat in the winter are all just further spurring on air pollution. Air pollution is a serious problem not limited to Ulaanbaatar that is spreading to local Mongolian cities.

I visited the Mongolian capital of Ulaanbaatar in May 2011. The purpose of my visit was to survey the environmental situation of Ulaanbaatar water. In particular, this was a study of the Tuul River as a Ulaanbaatar water resource flowing through the city. Mongolia is known as the Steppe Country for its rich natural environment. Its image may give the impression that Mongolia is impervious to our global environmental woes; be that as it may, Mongolia is no exception. It has its own environmental problems amidst the global issues.

Of all the numerous environmental issues in Mongolia, this paper discusses the current state

*Professor, Research Institute of Social System, Chuo Gakuin University

of water resources in the Ulaanbaatar area, specifically touching on the water situation.

II. Overview of Mongolia's Water Resources

Sharing borders with Russia and China, Mongolia is a landlocked country in northeast Asia between 41.4° and 52.1° N latitudes and 87.5° and 119.6° E longitudes. It has a land area of 1,564,100 km², which makes it roughly four times the size of Japan¹⁾. Wooded regions in the north house coniferous forests stretching to the Russian borders. Grasslands stretch over the central region, and the Gobi Desert dominates the south. Almost the entire country is 1,000 m above sea level at its lowest, with the average elevation exceeding 1,500 m. The highest point is atop Tavan Bogd in the Altai Mountains near the western border at 4,374 m, and the lowest point is at 553 m. In addition to the Altai Mountains on the western border, Mongolia has many other mountain ranges, including the Sayan, Hangai and Hentii Mountains. With its collection of 33 small deserts, the country also has the second most desert area in the world²⁾. The grassland region is worthy of the title "Steppe Country," with the steppes comprising 80% of Mongolia's land stretching as far as the eye can see.

According to a report from the 2010 Mongolian National Statistical Commission (NSC), the total Mongolian population was 2,780,800. Of the total, 1,151,500 live in Ulaanbaatar, the Mongolian capital and largest city. With close to half of the total population calling it home, Ulaanbaatar is overconcentrated³⁾.

Mongolia's chief industry is minerals, followed by livestock. There are a total of 32,729,200 livestock between the five major types⁴⁾ in the still mostly nomadic nation, meaning almost 12 livestock for each person. Breaking livestock down, there were 14,480,400 sheep, 13,883,200 goats, 2,176,000 cattle, 296,600 camels and 1,920,000 horses⁵⁾. Truly the world's leading nomadic nation, nomadism is Mongolia's identity. Even in the Mongolian Constitution, it states that "The livestock of the country is national wealth and subject to state protection." To Mongolia, the livestock industry truly is the nation's backbone⁶⁾.

There are 5,300 rivers, 7,800 springs, 3,600 lakes, and 362 mineral springs in Mongolia⁷⁾. Mongolia's rivers are sparsely distributed; most flow from the mountains of the Siberian taiga forests in the northwest, leaving the east and south dry regions with deserts.

One of Mongolia's more representative rivers is the Selenga. The Tuul River flowing through Ulaanbaatar and Orkhon River flow into the Selenga River, which then flows into Lake Baikal. From there, it flows into Russia before finally emptying into the Arctic Ocean. The Kherlen River in the east flows into Hulun Lake in China, called *hölön nuur* in Mongolian. Of the rivers originating in Mongolia, 60% flow into either Russia or China, with the remaining 40% either flowing into lakes in the southern Gobi region or running underground to recharge aquifer.

The main Mongolian water resources are rivers, lakes, marshes and groundwater. Particularly prevalent are the lakes, which account for 84% of all water resources⁸⁾. Many of the country's lakes are in the northwestern mountains, but there are some distributed widely in the dry regions. Less than 5% of all lakes have surface areas greater than 5 km². There are many smaller lakes, however, with more than 3,500 lakes of at least 0.1 km² in area⁹⁾. Between 70–90% of Mongolia's rainfall evaporates, with the remainder recharging the rivers and

groundwater. Most of the country's water is concentrated in the lakes, leading Mongolia to be called a lake-resource country. Annual water resources for Mongolia are estimated 500 km³ from lakes, 62.9 km³ from glaciers, 34.6 km³ from surface water¹⁰⁾ and 10.8 km³ from groundwater. Of these resources, 63.5% is surface water and the 36.5% is actually groundwater¹¹⁾.

III. The Water Situation in Ulaanbaatar

In 1992, the Mongolian People's Republic reemerged as Mongolia, introducing democracy and a market economy. There has been confusion on many number of issues since the rise of this market economy, including traditional values and system reforms. A diverse mix of issues have been highlighted over the years since: confusion of values in a free market, economic inflation, the wealth gap, collapse of the traditional nomadic system, overgrazing, destruction of the natural environment, melting permafrost due to global warming, progressive desertification, water crises, water pollution, and more¹²⁾. Such problems are also environmental issues in the capital of Ulaanbaatar.

Ulaanbaatar is positioned in a basin at an elevation of 1,300 m slightly northeast in the central steppe region of Mongolia. Acting as the cultural, governmental and economic center of Mongolia, the city is overconcentrated with roughly half the country's total population. The urban areas are rather densely populated.

Ulaanbaatar's annual average temperature is 1.3°C below freezing and its annual average precipitation is 281.7 mm. Average temperatures are around 17°C in July and around –23°C in January, although it reportedly often gets colder than that. Spring is the driest season, with humidity under 30% sometimes persisting for three to four months straight¹³⁾.

Table 1. Average temperature and the amount of rainfall in Ulaanbaatar

	Average temperature (°C)	Amount of rainfall (mm)
January	– 22.3	1.9
February	– 17.2	2.9
March	– 9.0	3.3
April	0.9	10.0
May	9.4	14.0
June	14.4	49.5
July	16.9	69.5
August	15.1	79.9
September	8.3	33.5
October	– 0.3	9.9
November	– 12.2	4.4
December	– 19.9	2.9
Whole year	– 1.3	281.7

Source: Prepared by the author based on “wikitravel.org/ja”



Fig. 1. Ulaanbaatar and the Tuul River (taken from *Zaisan huill*)

Picture taken May 10, 2011 by: Hiroshi Sato

Mongolia's climate is that of an arid region and is classed as either a subarctic climate or a steppe climate. You can see how low precipitation is overall—in comparison, the annual average for precipitation in Japan is around 1,700 mm, and average precipitation in Ulaanbaatar is less than a quarter that of Tokyo. The Mongolian climate is truly arid¹⁴⁾.

Ulaanbaatar has a number of environmental problems. First, its population has increased to over one million due to overconcentration. In contrast, the next largest city has roughly 90,000, and other provincial capitals range from 20,000–30,000. These figures show exactly how gigantic Ulaanbaatar is in terms of Mongolian cities¹⁵⁾.

Further, the urban environment is in a serious state. Urban air pollution is afflicted by things like increased exhaust from the sudden increase in vehicles, smoke from power plants and soot from coal combustion for heat. There are a number of other mounting issues, such as the water shortages and pollution that come with increased population and construction, as well as problems with waste.

The population influx to Ulaanbaatar is relentless; more and more are building their *ger* homes to live in the suburbs. Life in these gers is causing new environmental problems for the area, including air pollution, water pollution, flood damage and water supply shortages¹⁶⁾. One issue in particular for Ulaanbaatar is their cogeneration system¹⁷⁾. There is a large, state-managed power plant in town. This plant has a system for using its waste heat to send heat and hot water to the apartment district¹⁸⁾, but there is no cogeneration system for the gers. As such, *ger* residents burn coal to get their heat in winter. The coal they use, lignite, does not burn very hot and has resulted in air pollution and dry distillation gas.

Rapid population increases lead to other environmental destruction besides air pollution; namely, water shortages. These water shortages are ruining the balance of supply and demand for water resources and effect the entire ecosystem, not just human social activity. The government

is working on plans to build 100,000 apartments as a measure for these *ger* residents, but if the apartments fill with residents it will without doubt increase per capita water usage¹⁹⁾.

In the past, water consumption in Mongolia was reported at roughly 400 million km³. This came to a per capita water usage of a mere 8–10 l a day, or between a third and a fourth of the global average. This was likely the result of water usage limits. Approximately 30% of the water is supplied via a central water supply system, 25% by water wheel and 36% by well drainage facilities. The remainder is supplied from small rivers, melted ice and melted water²⁰⁾. Almost one third of the Mongolian population—about 31%—obtain their water from the main water resource, groundwater from water service. Another fourth of Mongolians—about 25%—get their water from mobile tanks loaded with groundwater. Another 36% of Mongolians get groundwater directly from wells, and 10% or so use rivers²¹⁾. In 1990, there were 4,879 pit wells in Mongolia, along with 9,721 mechanical wells in operation. There were also another 20,000 simple wells, but 40% of these were reportedly not in operation²²⁾.

In Ulaanbaatar in 1992, 250,000 tons of water were supplied a day from 133 wells at depths of 30–70m from four alluvium water sources along the Tuul River, which runs through the southern part of the city²³⁾.

The Tuul River which flows through Ulaanbaatar is one of its water resources. The Tuul extends for 704 km from its source in Gorkhi-Terelj National Park in the Khentii Mountains with a river basin covering an area of 49.84 km². It connects with the Orkhon River and flows into the Selenga River, which then empties into Lake Baikal²⁴⁾. In some parts of the gently rolling hills of the steppes, the Tuul flows free and uncontrolled through steppe valleys. In some areas of Ulaanbaatar, however, concrete levee protection is in place. There have been 150 wells developed along the Tuul River to depths of 30–70 meters below ground level providing residents 170,000 m³ of groundwater a day²⁵⁾.

The Central Sewage Center provides all the water for Ulaanbaatar. The center has a running capacity of 177,500 m³/day and design capacity of 230,000 m³/day, but is not used to its full capacity²⁶⁾. City plans estimate that an additional 240,000 m³/day will be needed to cover water demands from population increases. Ulaanbaatar is approaching levels where water shortages could become a daily problem. Water demand is estimated to reach 510,700 m³/day by 2030²⁷⁾.

According to Table 2, 55.5% of Ulaanbaatar's total water supply is for domestic use with 53% supplied to apartments and 2.5% supplied to private residences and the *ger* district. Meanwhile, 41.5% is water for industrial use split between power plants, organizations, companies and businesses, and 3.7% is for agricultural use, also including livestock. Half of Ulaanbaatar's total water supply is for domestic use, followed by industrial use and agricultural use. Worldwide, two thirds of the water supply is for agricultural use, followed by industrial use and then domestic use; however, Mongolia's agricultural water consumption is vastly less than in farming countries due to differences between farming and the nomadism that thrives in Mongolia.

Clean drinking water supplies are available in 77% of Ulaanbaatar, and sewerage for sanitation is available in 35% of the city. Sewerage significantly lags behind drinking water in other regional towns and cities, where 41% have access to drinking water and 10% to sewerage²⁸⁾. According to the WHO and UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP), 57% of the world had clean drinking water sources in 2008. By comparison, the rate for cities in developed countries was approximately 79%²⁹⁾. Looking at

Table 1. Surface Water

Interval	Spring (IV-VI)	Summer (VII-IX)	Autumn (X-XI)	Winter (XII-III)
1945-1950	11.5	34.2	5.6	0.19
1951-1960	25.7	66.5	10.3	0.20
1961-1970	32.6	71.1	10.4	0.21
1971-1980	35.7	66.3	13.1	0.53
1981-1990	32.9	87.2	11.7	0.321
1991-2000	25.4	98.6	12.3	0.47
2001-2008	19.8	28.6	7.16	0.10
Average	27.5	68.3	10.5	0.28

Source: 『Туул голын сав газрын усны нэгдсэн менежмент 2010-02-11』

these figures, Ulaanbaatar rates are close to those for developed countries, but those for regional towns and cities are quite low. Looking at global water supply averages by area, urban areas have 79% availability and rural areas have 34% availability. By global regions, the rates are 94% for developed countries, 84% for Latin America, 83% for East Asia and 16% for West Asia and sub-Saharan Africa³⁰⁾.

To secure water sources in the future, Mongolia plans to dig 10,000 wells and enhance irrigation by 2020. Mongolia's National Development Strategy for 2016–2021 lists a number of goals. It sets forth an intensive agricultural development plan, calling for wheat production to quadruple its 2006 rates by 2015, and also setting a target of 1.5 times the current production for potatoes and vegetables. These production targets will require a stable source of water³¹⁾.

There are pollution reports for Ulaanbaatar's main water source, the Tuul River. These reports show the main factors in pollution as domestic wastewater from Ulaanbaatar and riverside communities, as well as drainage from gold mining development in the Zaamar district of Töv Province. Zaamar is reported as the worst polluter in Mongolia³²⁾.

An example of the pollution in Mongolia is the mercury used mining in gold mines in the Khongor district of Darkhan-Uul in northern Mongolia. Reportedly, this mercury is poisoning the water supply. Mercury disrupts and pollutes the environment. There are concerns that the great impact mercury has on plant life may have organic ramifications in the future, affecting the food chain. Some mining locations use sodium cyanide in place of mercury, also raising issues with miner health disorders together with environmental damage³³⁾.

Water in Mongolia is a scarce and highly valued resource, and its pollution is extremely damaging. Water resources are maintained by balancing supply and demand. Immediate action needs to be taken to avoid interfering with industrial development in Mongolia's mainstays of mining and livestock, as well as other industries.

IV. Concluding Remarks

The Mongolian economy is expected to become even more active in the future, getting

Table 2. Ulaanbaatar Water SupplyWater supplied: 60 million m³

Residential	Standard apartments 53%	Private residences (detached homes) 0.3%	Ger district 2.2%
Agricultural / Livestock	Agriculture 1.9%	Livestock 1.8%	
Municipal Water	Organizations 3.5%	Companies 3%	Business 11%
Power Plants	24%		

Source: Prepared by the author based on [‘Туул голын эхийн экосистемийн үнэ цэнэ’]
February 11, 2010.

caught up in the wave of a continuously expanding global economy. Mongolia's rich natural resources in particular have garnered worldwide attention. The Mongolian economy is expected to continue expanding to great heights, centered around development of vast natural resources including coal, oil, gold, copper, fluorite and molybdenum. Accordingly, mining is one of Mongolia's most important industries. Livestock is another major industry that is expected to sustainably develop in the future. As the economy and industry expand, water resources become more and more essential. Water is the source of all human activity, and society cannot function on any level without water.

Given this, water resources enable Mongolian economic development, and the domestic economy is expected to become even more active. Mongolian incomes will rise, making for more affluent lives and increased consumption and purchasing power. In turn, this will mean lifestyle changes, with rapid market changes trending for more modern housing, nonessential grocery items, luxury goods, fashion items and more. These changes will make Mongolians stop dreaming of affluence and start to actually demand it.

In terms of future outlook, a reclaimed water system is essential to account for water shortages in light of likely expanding water demands. Overconcentration in the Mongolian capital of Ulaanbaatar is expected to continue. The population will increase and the economic industries will expand, and water demand will continue to increase with these expansions. The supply and demand ratio for water for industrial and domestic use is concerning. Water recycling is imperative to effectively use Mongolia's limited water resources to their maximum potential. Primary raw water from groundwater and rivers should be used for drinking water, domestic use and industrial use in certain industrial products. Domestic wastewater, industrial effluent and wastewater should be used as secondary raw water, and reclaimed water should be used for things such as sewage water, cleaning roads, washing vehicles, agricultural use and planting.

There are some regions of Mongolia with rich water resources, but overall the country is in an arid region with water deficiencies. Mongolia needs to build an effective usage system for their limited water resources to balance water supply and demand. The urban environment in Ulaanbaatar has deteriorated with its economic development. Legal regulations on these environmental points are a given, but they also need to consider replacing fossil fuels with clean renewable and natural energy, reclaimed water, and other future environment and urban construction measures. In particular, drinking water for the many livestock grazing in the outskirts of Ulaanbaatar will have to be supplied using reclaimed water in the near future.

One of the big keys to attaining sustainable future economic growth in Mongolia will

be measures for building a water reclamation system and environmentally friendly urban construction. Ulaanbaatar is expected to continue to be overconcentrated as the population continues to increase. Water will be indispensable with the population increases and vitalization of the economy. Water is a limited resource, and its supply and demand must be balanced. A water reclamation system is essential to help cover these water deficiencies. In the interest of sustainable future economic growth, Mongolia needs policies which take its environment into account geographically.

This paper contains partial revisions and corrections from “Mongolia Environment and Water Resources: Focusing on the Water Situation in Ulaanbaatar” as found in the *Bulletin of the Research Institute of Social Systems, Chuo Gakuin University*, Vol. 12, Issue 2.

Notes

- 1) <http://www.mofa.go.jp/mofaj/area/mongolia/data.html>, accessed on November 24, 2011.
- 2) “Mongol History,” BAABAR (issue date unknown), 32.
- 3) <http://www.mofa.go.jp/mofaj/area/mongolia/data.html>, accessed on November 24, 2011.
- 4) The five major types for livestock are sheep, goats, cattle, camels and horses. “Mongol Light and Wind,” edited by Nobuto Iwata (Japan Institute for Community Affairs, 2008), 34.
- 5) Mongolia World Walker, 2011 Spring Edition, Vol. 1 (Adline Inc., 2011), 20–21.
- 6) “Sustainable Use and Management of Steppes in Nomadic Mongolia,” 2. www.env.go.jp/nature/satoyama/syuhourei/pdf/cwj_5.pdf, accessed on November 24, 2011.
- 7) Mongolia World Walker, 2011 Spring Edition, Vol. 1 (Adline Inc., 2011), 21.
- 8) aise.suiri.tsukuba.ac.jp/new/press/youshi_sugita7.pdf, accessed on December 20, 2011.
- 9) Introduction to Mongolia, edited by Shinji Aoki and Masaru Hashimoto (Heigensha, 1992), 263–264.
- 10) aise.suiri.tsukuba.ac.jp/new/press/youshi_sugita7.pdf, accessed on December 2, 2011.
- 11) “The River Basin Management Model Project for the Conservation of Wetland and Ecosystem and Its Sustainable Use in Mongolia, Pre-evaluation Survey Report,” Japan International Cooperation Agency, Global Environment Department (2006), 21.
- 12) www.biwa.ne.jp/~michikon/workshop.pdf, accessed on December 21, 2011.
- 13) Introduction to Mongolia, edited by Shinji Aoki and Masaru Hashimoto (Heigensha, 1992), 263.
- 14) Japanese Water Resources, 2011 Ed., Ministry of Land, Infrastructure and Transport (2011), 57.
- 15) “Report on Sewerage Support for Mongolia,” Japan Sewage Works Association Journal, Vol. 1, No. 201, Japan Global Center for Urban Sanitation Mongolia investigation team, 2.
- 16) “Pre-study Report for Water Supply Improvement Plan for Ulan Bator, Mongolia,” Japan International Cooperation Agency and CTI Engineering International Co., Ltd. (2010), 3.
- 17) “Cogeneration refers to concurrent production of electricity, heat, steam or other energy. In contrast with generating power with gas turbines or diesel engines, effectively using energy by using waste heat to cover thermal demand for hot water and heating. Waste heat power generation.” <http://dic.yahoo.co.jp/dsearch/0/0na/06513870/>, accessed December 23, 2011.
- 18) Seo, Kasumi, “Notes on Mongolia’s Move to a Free Market Economy and the Environment,” Aoyoma Gakuin Univ. International Politics and Economics Journal, issue 74 (2008), 89.
- 19) “Pre-study Report for Water Supply Improvement Plan for Ulan Bator, Mongolia,” Japan International Cooperation Agency and CTI Engineering International Co., Ltd. (2010), 3.
- 20) “Pre-evaluation Survey Report for The River Basin Management Model Project for the Conservation of Wetland and Ecosystem and Its Sustainable Use in Mongolia,” Japan International Cooperation Agency, Global Environment Department (2006), 21.
- 21) aise.suiri.tsukuba.ac.jp/new/press/youshi_sugita7.pdf, accessed on December 21, 2011.
- 22) “Pre-evaluation Survey Report for The River Basin Management Model Project for the Conservation of

- Wetland and Ecosystem and Its Sustainable Use in Mongolia,” Japan International Cooperation Agency, Global Environment Department (2006), 21.
- 23) *Introduction to Mongolia*, edited by Shinji Aoki and Masaru Hashimoto (Heigensha, 1992), 263.
 - 24) <http://ja.wikipedia.org/wiki/>, accessed December 1, 2011.
 - 25) “Environmental White Paper on Asia, 2003–04,” edited by the Japan Environmental Council and the Asian Environmental White Paper Editorial Committee (Toyo Keizai, Inc., 2005), 213.
 - 26) “Pre-study Report for Water Supply Improvement Plan for Ulaanbaatar, Mongolia,” Japan International Cooperation Agency and CTI Engineering International Co., Ltd. (2010), 2–35.
 - 27) “Pre-study Report for Water Supply Improvement Plan for Ulaanbaatar, Mongolia,” Japan International Cooperation Agency and CTI Engineering International Co., Ltd. (2010), 3.
 - 28) “Report on Sewerage Support for Mongolia,” *Japan Sewage Works Association Journal*, Vol. 1, No. 201, Japan Global Center for Urban Sanitation Mongolia investigation team, 2.
 - 29) *Water Environment Facilities Handbook*, edited by Fumiki Kinoya (Ohmsha, 2011), 25–32.
 - 30) *Ibid*, 25–32.
 - 31) *Lessons from Genghis Khan: Global Environmental Issues and the Mongolian Steppes*, edited by Noriyuki Shiraishi (Douseisha, 2010), 72.
 - 32) <http://ja.wikipedia.org/wiki/>, accessed December 1, 2011.
 - 33) “Environmental White Paper on Asia, 2010–11,” compiled by the Japan Environmental Council and the Asian Environmental White Paper Editorial Committee (Toyo Keizai, Inc., 2010), 343.