Forestry Development and Best Practices
of Forest Management in Mongolia

Asia−Pacific Network for Sustainable Forest
Management and Rehabilitation

China Forestry Publishing House

Forestry Development and Best Practices of Forest Management in Greater Central Asia
Editorial Board

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● Capital
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Map of the Asia

KAZAKHSTAN

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UZBEKISTAN

Tashkent

KYRGYZSTAN

TURKMENISTAN

TAJIKISTAN

Ashgabat

Dushanbe

PEOPLE'S

Irtysh

LEGEND

● Capital
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MONGOLIA

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EAST CHINA SEA

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Foreword

Strong social, economic and cultural connections exist among economies across Central and Northern Europe, Central Asia, the Middle East, North Africa and Greater Central Asia (GCA). The GCA region, in the widest sense, encompasses Kazakhstan, Tajikistan, Uzbekistan, Turkmenistan, Kyrgyzstan, Mongolia and western China and harbors unique biodiversity. Various species of fauna and flora mingle with endemic species not found elsewhere.

Forests in this region are vital natural resources that provide important environmental services including climate regulation, soil protection, clean water supply and many more. They also play a leading role in socio-economic development, supplying people with food, fuel, medicinal plants and recreational areas. Meanwhile, forests are suffering the effects of increasingly severe land degradation and desertification due to a host of natural and human factors. The most significant of these factors include overgrazing, land clearing for agricultural use, illegal logging and poaching, firewood collection, excessive water consumption, and insufficient financial and technical support.

Economies in GCA are actively involved in international and regional commitments focused on climate change adaptation, biodiversity conservation and desertification control. However, a comprehensive overview of the history, status and outlook of forestry development in GCA has been lacking.

Given this, the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) identified the GCA region as one of its seven geographical priority areas for strategic interventions. Desk research and field surveys have been conducted since 2014 with the financial support of the Department of Science and Technology (DST) of the State Forest Administration of China (SFA), the active involvement of officials from different forest authorities, as well as consultants from international organizations, which has culminated in a series of six books being published.

This book, one of the six, gives a holistic overview of the current state of forests and forestry, the contribution of forests to economic development, forestry policies and legislation, and forestry education and research, in Mongolia. In particular, sustainable forest management best practices in relation to soil and water conservation, desertification control, forest fire and disease prevention, biodiversity conservation and rehabilitation of degraded forests etc., are covered in-depth.

We hope that this book will be of value to foresters, from policy makers to grass root practitioners and those working in forest authorities, academia, international organizations and civil society organizations who have an interest in forestry development in Mongolia.

APFNet Executive Director

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Abbreviations

CMEA	Council for Mutual Economic Assistance
EC	European Commission
EPAP	Environmental Public Awareness Programme
FAO	Food and Agriculture Organization of the United Nations
FRDC	Forest Research Development Centre
FUG	Forest User Group
GDP	Gross Domestic Product
GEF	Global Environment Facility
GNP	Gross National Product
GOM	Government of Mongolia
GTZ	German Technical Cooperation
JICA	Japan International Cooperation Agency
KKPA	Khan Khentii Protected Area
MAP 21	Mongolian Action Programme for the 21st Century
METF	Mongolian Environmental Trust Fund
MHDR	Mongolian Human Development Report
MNET	Ministry of Nature, Environment and Tourism
MNT	Mongolian Tugrug
NFAP	National Forestry Action Plan
NGO	Non-governmental Organization
NSO	National Statistics Office
NTFP	Non Timber Forest Product
PFE	Private Forest Entity
PFM	Participatory Forest Management
PIU	Project Implementation Unit
RA	Rapid Appraisal
RAPA	Regional Office for Asia and the Pacific
SEU	Sheep Equivalent Unit
SEV	Sovet Ekonomicheskoy Vzaimopomoshchi
TACIS	Technical Assistance to the Commonwealth of Independent States
TFAP	Tropical Forestry Action Plan

UNCED	United Nations Conference on Environment and Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
WTTC	World Travel & Tourism Council
WWF	WorldWide Fund for Nature

Chapter 1   Current state of forests and forestry

1.1 General information of the economy

Mongolia is one of the world's highest economies, located in the heart of the Central Asia, landlocked between Siberia and China, on the same latitudes as parts of the Central Europe and Northern United States, with an average altitude of 1,580 m. Half of its territory lies over 1,400 m, 63% higher than 1,200 m, and 81% over 1,000 m above the sea level.

Mongolia is largely mountainous economy, especially in the West, but most part of the economy is steppes and pastures: typical landscape, a nature-lover's paradise, is an undulating steppe land providing fine pastures. The southern one third of the economy's lands is dominated by the Gobi desert. There are 4,000 lakes and about 7,000 hot springs. The largest river is Selenge. Almost all rivers flow northwards, including the inflow to Lake Baikal in Siberia that is the largest freshwater reservoir in the world.

Its continental climate is much harsher than that in other economies of the same latitudes, and is characterized by the extremes in both temperature and fluctuations. During six months of the year, average temperatures fall below the freezing level. A remarkable feature is the number of clear, sunny days, some of 220-260 days per year. The cold winter is relieved by the almost continuous sunshine. The summer is sometimes hot, sometimes cool. The frost-free growing season averages 115-120 days. Precipitation, concentrated to the summer period, is low with annual average of about 230 mm, higher in mountainous areas in the North but less than 100 mm in desert regions in the South. The average precipitation in the Northern forest zone is about 300 mm. The windiest seasons are April and May, often with significant wind erosion. Natural disasters are common.

In large parts of Mongolia, almost two-thirds, permafrost occurs, i.e. under a certain depth, the soil is permanently frozen. Permafrost down to 500-800 m has been recorded in high mountain areas. In certain large areas in the north and the west, permafrost is continuous with depth averages of 50-200 m. In other parts, permafrost is discontinuous, i.e. land with permafrost is mixed with land without permafrost. Southwards, permafrost is more and more discontinuous, with depth decreasing, until ceasing. Southern parts including the Gobi desert have no permafrost. Practically all forest lands in the economy have permafrost. During the summer period, the frost melts in the upper active layer down to averages of 1.5-3 m.

Mongolia's nature and environment are its biggest assets. Mongolia is an ecologically unique area of global importance where the Siberian taiga forest, the central Asian steppe, the Altai Mountains, and the Gobi desert converge. "Not only is the natural resource base rich in biodiversity and natural beauty, it also presents one of the economy best opportunities for improving livelihood through livestock rearing, tourism and mining."

The total land area of Mongolia is 156 million ha. The largest part (nearly 75%) is steppe and pastureland; less than 0.5% is currently cultivated; about 11% is under forestry. Its six basic natural zones are high mountain, taiga forest, mountain forest steppe, steppe, desert steppe, and desert that are different in climate, landscape, soil, flora and fauna. They have a mixture of plant and animal species, many of which are endemic. There are almost 150 of the some 3,000 vascular plant species. Moreover, numerous globally threatened and endangered species occur.

The harsh climate, characterized by extremes, severe winters and low precipitation, on the other hand, produces fragile ecosystems which are easily degraded by human activities and, once damaged, slow to be recovered. Much of the land, furthermore, is desert or relatively unproductive. The top-soil is thin with an average depth of 20 cm, rendering it vulnerable to wind and water erosion. In large parts of the lands, permafrost occurs.

Major environmental issues are deforestation, alteration of surface water flow regimes, soil erosion through wind and water, loss of wildlife habitat and biodiversity, and, the most critical one, fire. Also the poor condition of economy roads and the consequent practice of driving off the road have inflicted widespread damage. Soil erosion is among the most serious environmental problems. Also overgrazing is degrading large areas, and partly also affecting wildlife growing on its territory.

Although Mongolia still maintains extensive relatively intact ecosystems, "unmanaged resource use and climate change have already resulted in the deterioration of water and air quality, loss of biodiversity and increased rates of desertification and land degradation" The traditional balance between the economy's low intensity use of resources and its fragile ecosystems is now threatened. The *Mongolian Red Book* lists endangered and threatened flora and fauna which is a problem throughout the economy.

The Government has responded by expanding the protected area system, enacting a series of environmental laws, and initiating biodiversity conservation programs, of which several ones are in association with international organizations.

The protected-area system has four categories of land protection (*Law on Special Protected Areas*) from most to least restriction in terms of human use:
● Strictly protected areas (10 areas).
● National conservation parks (4 areas).
● Nature reserves (7 areas).
● Monuments (natural monuments, and historical and cultural monuments; 5 areas).

From small reserves surrounding monastery ruins and sacred mountains to the massive Great Gobi Strictly Protected Area, the world's fourth largest biosphere reserve, the protected areas are as varied as Mongolian landscapes. The Great Gobi Strictly Protected Area has been

designated as an international biosphere reserve. The 26 areas cover about 12.3 million ha or almost 8% of the economy territory, but it is not sufficient to protect the wide variety of unique habitats and rare species.

1.2 Land use status

Although the industrial sector has expanded, especially since the 1970s, Mongolia is still a largely agricultural economy, based on nomadic livestock rearing. Most of the economy (some 75%) is pasture (Table 1-1). The cultivated area is small, currently less than 0.5%.

Table 1-1 Land area and land use in Mongolia

Land use	Land area	
	ha	%
Land used for agriculture:	119,398,000	76.2
pasture	116,783,000	74.6
hayfield	1,915,000	1.2
cultivated land	700,000[1]	0.45
Forest land (including certain non-forest areas)	17,852,000[2]	11.4
closed forest	12,808,000[2]	8.2
open forest	3,604,000[2]	2.3
non forest	1,440,000[2]	0.9
Other land	19,400,000	12.4
Land occupied by cities and settlements	469,000	0.3
Land used for state special needs[3]	16,267,000	10.4
Unused land or land unsuitable for utilization	2,659,000	1.7
GRAND TOTAL LAND AREA	156,650,000[2]	100

1. Currently cultivated area. Source: Specialist at Ministry of Agriculture and Industry.
2. Source: Forest Research and Development Centre (2016). See also in Table 1-3.
3. Including land allocated for state security and defense purposes, special protected areas, roads and communication network of national importance.

In the socialist system, the agricultural sector consisted of few but large units, of which the two main types were collectively owned and state-owned. The total area of agricultural land (about 120 million ha) is used as pasture (117 million ha), as hayfield (1.9 million ha), and for cultivation (currently about 700,000 ha). The last figure is provided by the Ministry of Agriculture and Industry. The total area of agricultural land per person is 50 ha, i.e. about 20 times more than the world average. Cultivated areas are largely located in the river valleys in the north, where wheat, barley, potatoes and oat are grown. Wheat is the most important

crop, grown on 60% of the cultivated area. Other crops, such as oat, potatoes and vegetables, are barley.

The mechanical structure of soil is important. At least moderately muddy soil is good enough, but there is not much such soil. About 90% of soil is only slightly muddy or sandy. Such topsoil is easily moving. Thin soil, unfit mechanical soil structure, short growing season, low precipitation, heavy wind, low relative air moisture, negative influence of machinery, etc. are important factors affecting cultivation in Mongolia. The soil degrades or disappears easily, and much previously cultivated land is abandoned.

The area of cultivated land, once 1.4 million ha and around 1990 still about 1.2 million ha, has continuously decreased to about 0.7 million ha currently, due to economic difficulties and soil degradation. Of the total cultivated lands, 46.5% are actually more or less degraded. Of the total degraded lands, 58.9% are slightly degraded, 28.2% moderately, and 12.9% severely.

For extensive cultivation, the short growing season and low precipitation are the most critical factors, and the harsh, dry climate makes most forms of cultivation impossible. Also thin soils, low fertility and to some degree the extent of permafrost constrain the potential for cultivation.

1.3 Forest resources

Mongolian forests cover two distinct forest regions: the northern boreal forests, and the southern saxaul forests in the arid desert regions. Forest cover in Mongolia covers approximately 17,911,123 ha of forest land consisting of 12,280,042 ha boreal and 5,631,081 ha saxual forests accounting for 11.8% of the economy area (FRDC, 2016). There are other continued efforts to undertake forest cover assessments and these will be utilized for the development of the National REDD Strategy. According to the FRDC's taxation inventories, 47,000 ha (0.4%) of closed boreal forests have been lost annually since 2004. Open forests, in turn, have increased by approximately 150,000 ha (11.3%) annually during the same period. Figure 1-1 shows the recorded area of forests from the FAO Forest Resource Assessment which is largely based on data provided by Mongolia using the FRDC taxation survey.

Northern boreal forests are part of the transitional zone between the Siberian taiga forest to the north and the grasslands to the south. They typically grow on mountain slopes between 800-2,500 m above the sea level. These forests are mainly coniferous, mixed with some broadleaf trees. According to the FRDC's forest taxation inventories, larch, birch and saxaul trees account for more than 60%, 10% and 15% of forest areas respectively. In terms of growing stock, larch

contributes close to 80%, while all other trees are below 10%, the average growing stock amounts to 131 m^3/ha. Mongolian forests have low productivity and growth, and they are vulnerable to disturbance from drought, fire and pests. Forests can easily lose their ecological balance under these circumstances, and they have a relatively low ability for expansion to currently non-forest areas, all of which are due to the boreal forests location in the southern boundary of the northern hemisphere's cold forested region with a harsh continental climate.
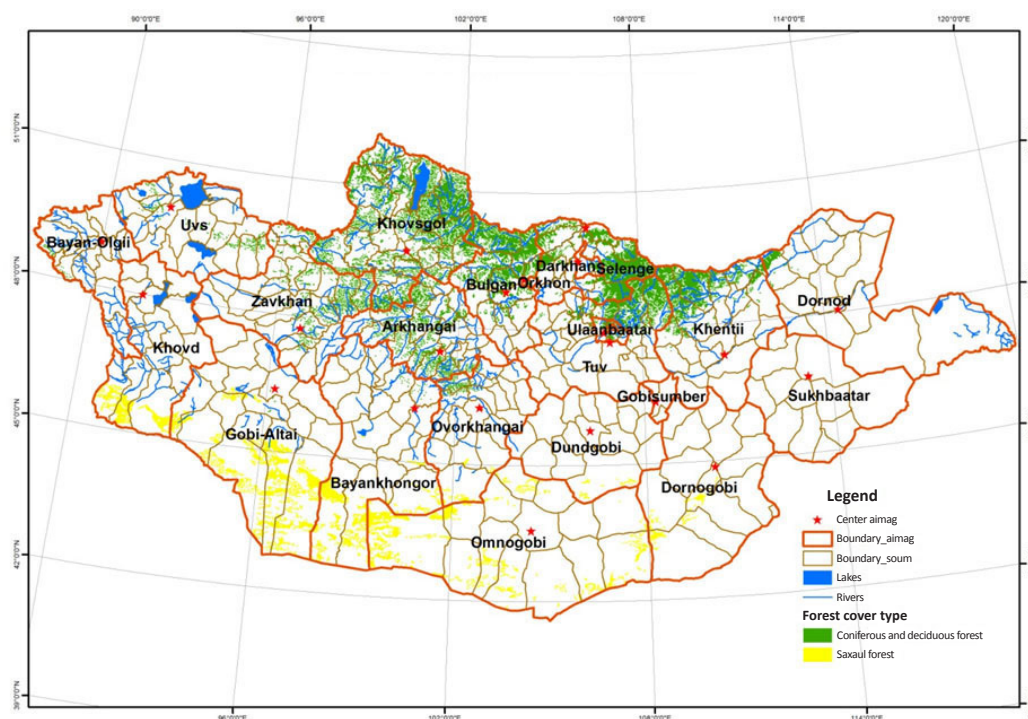
Figure 1-1 Forest cover of Mongolia (Source: eic. mn, 2015)

Southern saxual forests grow in the southern desert and on the desert steppe. The trees are less than 4 m in height, and predominant species include saxual trees and poplar. The average growing stock of such land in Mongolia amounts to less than 1 m^3/ha. Saxual forest also has low growth rates as is evident in the arid desert regions. Saxual forests are adapted for long periods of low moisture, and their roots are reported to be very deep. In the past, these forests were exploited heavily for commercial charcoal and fuelwood, and pressures still exist for mining and household fuelwood.

The National REDD+ Readiness Roadmap underlines that these provide most opportunities for forest-based emission reduction (Figure 1-2).
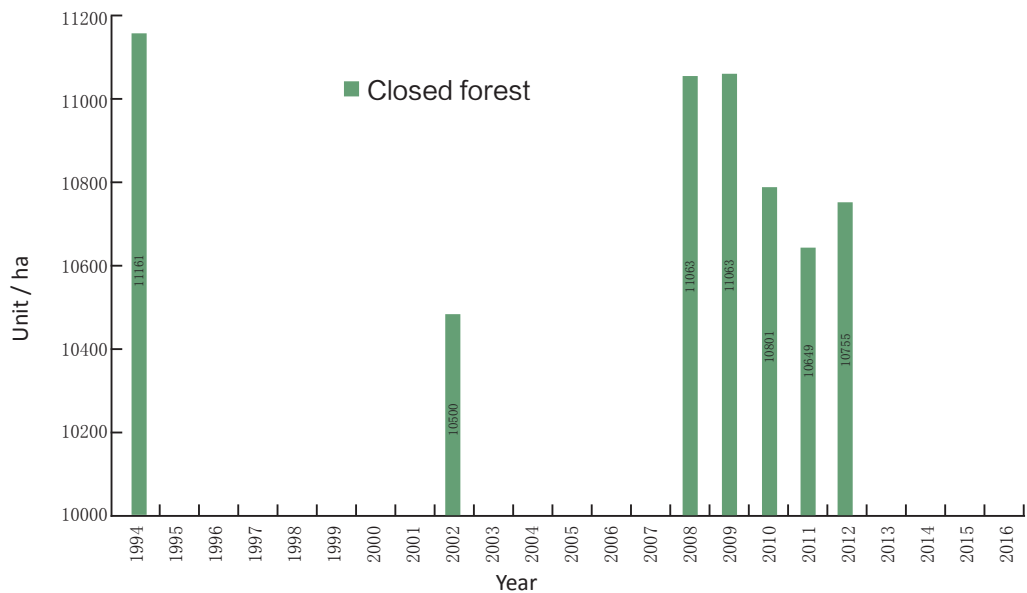
Figure 1-2 Boreal forest area by year reported by FAO Forest Resource Assessment (FAO, 2012)

1.4 Forest cover change

The most prominent direct drivers of deforestation were reported to result from mining impacts, severe pest damage and deforestation by continued degradation.

The latter was the most common cause of deforestation, and the result of several direct and indirect drivers, including the effects of grazing, forest fire, pest damage and environmental change which work together to lead to deforestation. These results in a situation where a forest can neither re-establish itself nor can remain trees survive. Once a forest site has been disturbed, it results in environmental change in microclimate and loss of soil moisture. In many cases, this results in the fact that the forest no longer can support or regenerate itself. Such changes may also occur in tropical areas; however, in boreal forests, it appears to be more of an important phenomenon since the capacity to recover as forest may be impacted greatly, with lack of soil moisture, microclimate change, grazing and short growing seasons resulting in long-term ecological change.

Mining leads to deforestation as a result of large-scale open-pit mining operations, which often remove vegetation and top soil, so that forest restoration is difficult. More detailed information on the current and future state of mining operations would enable a more quantitative assessment of the impacts of mining, and planning for mitigation measures could be implemented in priority areas.

Pests need to be considered carefully as they impact forest change at a range of levels, including as both a direct driver or deforestation and degradation, and as a contributory

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driver affecting deforestation by continued degradation. However, it should also be mentioned here separately as it is often the main cause resulting in significant tree death where severe attacks occur several years to lead to death of trees and subsequent environmental change of soil water regimes which prevents re-establishment of tree cover. Despite the government's strong ongoing pest monitoring and control programme, control techniques are often ineffective and can be improved.

Land use change through change to pasture, agricultural expansion and urban development is not currently a major driver but needs to be evaluated against future land use plans or government policies as they could possibly become significant future drivers. There appears to be no current reported threat to deforestation from hydropower or other large scale infrastructure development.

A combination between the forest taxation inventory, unpublished data at the FRDC and the integrated land classes report provided these area estimates (Table 1-2).

Table 1-2 Annual forest cover change

Factors that affect forest covers	Average annual area / ha	Source	Time frame
Forest fires	138,605	Forest taxation inventory, with degradation	2004-2014
Unsustainable logging and subsequent degradation	34,305	Forest taxation inventory, with degradation	2004-2014
Pest damage	9,000[1]	Forest taxation data	2004-2014
Tree planting	208	Forest taxation inventory, with degradation	2004-2014
Deforestation by continued degradation	3,229	Forest taxation inventory, with degradation	2004-2014
Mining	1,544	Integrated Land Classes Report, with fraction in forest area	2004-2014

1. It is reported in 2015 (FRDC, 2016) that 135,783 ha of pest infected / damaged forest area exists in Mongolia.

1.5 Fragmentation of the forest land

The forests and forest resources are classified in the new *Forest Law* according to ecological and economic importance into three categories: strict zone forests, protected zone forests, and utilization zone forests, accounting for about 1.7%, 31.3% and 67.0% of the closed forest area respectively (Table 1-3). These figures, however, are approximate estimates, based on a mix of old and new information from the aimags, and will continuously be made more accurate.

Table 1-3 Land classified as forest land in Mongolia (State of Forest Land 2012)

Forest types		Coniferous and broad-leaved forest		Saxaul and populus diversifolia		State forest land area	
Categories of forest land	Types of forest land	Forest area / ha	%	Forest area / ha	%	Forest area / ha	%
Closed forest area[1]	Natural forest	10,065.5	6.43%	1,660.5	1.06%	11,726	7.50%
	shrubs	687.9	0.44%	137	0.09%	824.9	0.53%
	Forest plantation	2	0.001%			2	0.001%
	TOTAL	10,755.3	6.88%	1,797.5	1.15%	12,552.9	8.02%
Unforested area[2]	Open stand	767	0.49%	2,709.7	1.73%	3,476.7	2.22%
	Burnt-over forest area	1,186.3	0.76%	10.5	0.01%	1,196.8	0.77%
	Logged area	120	0.08%	4.1	0.00%	124.1	0.08%
	Barren area	166.3	0.11%	55	0.04%	221.3	0.14%
	Blowdown area	0.9	0.001%			0.9	0.001%
	Reforested area	9.1	0.01%	0.05	0.00%	9.2	0.01%
	Insects wormed area	95.7	0.06%		0.00%	95.7	0.06%
	TOTAL	2,345.3	1.50%	2,779.4	1.78%	5,124.7	3.28%
Total of forest area		13,100.7	8.38%	4,576.9	2.93%	17,677.6	11.30%
Non-forest land[3]	Steep land	722.6	0.46%			722.6	0.46%
	Marshy area	64.6	0.04%			64.6	0.04%
	Degradation	3.7	0.00%			3.7	0.00%
	Nursery	0.02	0.00%			0.02	0.00%
	Sand	1.3	0.00%			1.3	0.00%
	Rocky land	122.5	0.08%			122.5	0.08%
	Fire-break	0.1	0.00%			0.1	0.00%
Total of non-forest area		914.8	0.58%			914.8	0.58%
Grand total area		14,015.5	8.96%	4,576.9	2.93%	18,592.4	11.89%

1. Area covered by trees, shrubs, and planted trees is closed forest area.
2. Area not covered by trees, possible to be regenerated, burnt or logged is unforested area.
3. Forest gap, peak of the mountain, and tree breeding nursery are non-forested area.

Strict zone forests, about 172,900 ha, include:

- Subalpine forests;
- Pristine zone forests and conservation zone forests within strictly protected areas;
- Special zone forests within national conservation parks.

Concerning parts of strictly protected areas and parts of national conservation parks are according to the *Law on Special Protected Areas*. In strict zone forests, activities are prohibited except measures to maintain natural feature and environmental balance and for protection against fire, insects and diseases.

Protected zone forests, about 3,260,000 ha, include (*Forest Law*): "forests within special protected areas, green zones, prohibited strips, saxaul forests, oases, forest areas covering up to 100 ha, small tree groupings, shrubs, sun-exposed forest areas and forests at slopes greater than 30 degrees. Clearing and maintenance cutting for protection, and for enhancing natural growth and restorative capacity are required, and harvesting of timber and fuelwood for household use can be allowed.

Green zone forests are established around towns and villages within a radius of 30 km concerning Ulaanbaatar (60 km) according to government decision, "in order to maintain the environmental balance and provide a clean environment for the people".

Prohibited strip forests are established to prevent soil degradation and regulate "the balance of underground and surface water" and include:
● Areas of up to 5 km "around lakes and the sources of rivers and streams";
● Areas of up to 3 km "along river banks and around sources of mineral water and springs";
● Areas of up to 1 km "along both sides of railways and roads of national importance".

Utilization zone forests (commercial or industrial forests), about 6,969,000 ha, include all other forests. Harvesting of timber and fuelwood for household use is allowed and for commercial purposes according to license after payment of cutting fees.

1.6 Tree resources in rangeland

Most forests in Mongolia are larch forests (Siberian larch, *Larix sibirica* Ldb.), covering about 59% of the closed forest area (Table 1-4). Important are also Scots pine (*Pinus sylvestris* L.) and Siberian pine (*Pinus sibirica* Du Tour.), covering over 5% and almost 8% respectively. Birches (*Betula platyphylla* Sukachev., white birch, mainly) cover almost 9%.

Table 1-4 Natural forests in Mongolia by tree species (by 2012)

Tree species	Forest area / ha	Percent	Resource / m³	Percent
Siberian larch/Larix sibirica	7,402,267	63.1	1,035,072,801	78.6
Scots pine/Pinus sylvestris	496,544	4.2	63,711,811	4.8
Pine Siberian stone/Pinus sibirica	684,159	5.8	120,848,602	9.2
Siberian spruce/Picea obovata	26,409	0.2	3,592,030	0.3
Siberian fir/Abies sibirica	1,370	0.01	238,800	0.02

Tree species	Forest area / ha	Percent	Resource / m³	Percent
Birch/Betula plathyphylla	1,236,572	10.5	83,954,090	6.4
Poplar/Populus laurifolia	43,708	0.4	2,609,903	0.2
Aspen/Populus tremula	21,832	0.2	1,290,829	0.1
Elm/Ulmus	4,064	0.03	94,290	0.01
Willows/Salix	149,616	1.3	3,087,567	0.2
Tooroi/Populus diversifolia	225	0.002	15,110	0.001
Saxaul	1,659,273	14.2	1,787,186	0.1
TOTAL	11,726,039	100	1,316,303,019	100

Siberian pine (*Pinus sibirica* Du Tour; also termed cedar in English in Mongolia and kedr in Russian) is a relative of *Pinus cembra* growing for example in the Alpine area of Europe. Scots pine with two needles and Siberian pine with five needles are grouped together. Old Siberian pine has in general smoother and lighter bark than that of Scots pine. The seeds of Siberian pine are widely collected and sold as nuts.

Compared with larch, Scots pine requires better site conditions and is in general growing on lower altitudes, for example in plains, and is the dominating species in certain parts of the economy. Siberian pine is in general growing on relatively high altitudes and is protected due to its own protection values. Larch, Scots pine and Siberian pine are mostly growing unmixed except in border areas, or together with birch or aspen or sometimes with much less common conifers: Siberian spruce (*Picea obovata* Ldb.) or Siberian fir (*Abies sibirica* Ldb.).

Birch (*Betula platyphylla* Sukachev., and other *Betula* spp.), aspen (*Populus tremula* L.) and willow (*Salix berberifolia* Pall*., and other *Salix* spp.) are common, also outside the forests. Birch and aspen generally colonize bare forest areas. The largest resources of aspen are rapidly declining, where aspen wood is used by the match factories. Two elm species (*Ulmus pumila* L., and *U. macrocarpa* Hance.) and an oak species (*Quercus mongolica* Fisch. ex Ledeb.) can also be mentioned.

Willows (*Salix* spp.), partly together with poplars (*Populus diversifolia* Oliv. and certain other *Populus* spp.) and tamarisks (*Tamarix* spp.), grow along rivers and other watercourses. There are fourteen birch species (*B. platyphylla* being the most common), one aspen species (*Populus tremula* L.), and four poplar species (*Populus diversifolia, P. laurifolia, P. pilosa, P. suaveolens*). Other woody species are: *Caragana*, *Nitaria*, *Elaeagnus*, *Cynomorium*, *Salsola* and *Artemisia*.

Large arid areas in the southern and south-western parts of the economy, dominated by the Gobi desert, carry shrubs of saxaul (*Haloxylon ammodendron)* and tamarisks (*Tamarix* spp.), about 90% and 10% respectively. Saxaul is a woody shrub that plays an important ecological

role. Almost leafless, it grows to a height of up to 2-4 m or more in moving sand, rocky valleys, and on hillsides. These shrub forests protect fragile soils against erosion, regulate water supply, and serve as a barrier to sand movement. They are protected according to law and subject only to limited exploitation to meet local fuel needs. They also provide habitat for animals.

Growing stock of the closed forests is estimated at 1,363 million m^3 (Table 1-3), of which about 600 million m^3 are considered exploitable. Average density is estimated at 0.53. Average volume per hectare is estimated at about 125 m^3 (Table 1-4), average tree volume to vary between 0.45 m^3 and 0.58 m^3. Annual increment is low, estimated at about 12 million m^3 and 1.3 m^3/ha (Table 1-4), or 1.5-2.0 m^3/ha at best. It is approximately estimated as total wood volume for each species, divided by estimated average age of the respective species. More than 50% are growing in inaccessible or protected areas.

1.7 Afforestation and reforestation

Reforestation is to regenerate old forest after cutting; afforestation is to extend forest area. Due to the adverse climate conditions in Mongolia, these processes are slow. Reforestation, furthermore, lags far behind losses due to cutting, fire or other causes (Figure 1-3).
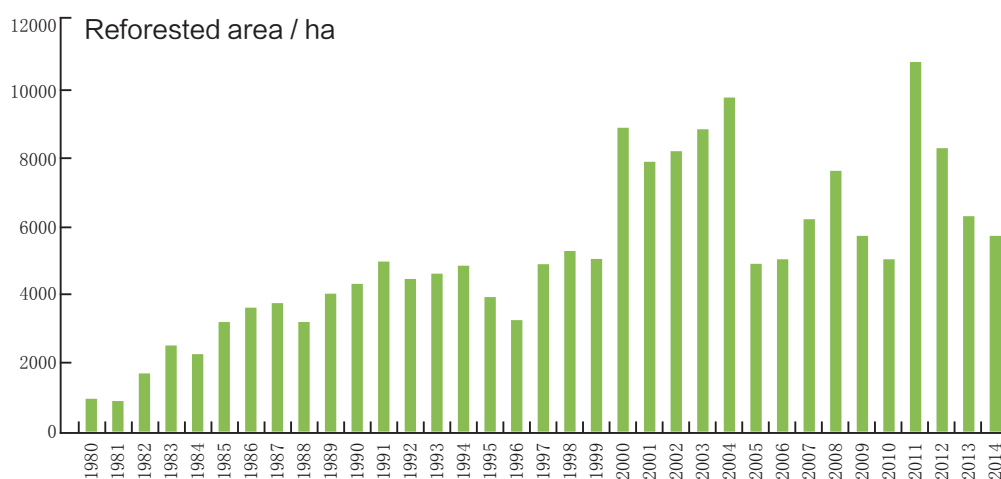
Figure 1-3 Reforested areas in Mongolia since 1980-2014

Reforestation in Mongolia began in the 1970s. It was reported that of every 6,000 ha planted, only approximately 2,000 ha are regarded as successful after the first year. The state forest policy proposes that naturally regenerated and planted forests will be increased to 310,000 ha in 2020 and 1.5 million ha in 2030. Assuming that about 70% of rehabilitation would be through natural regeneration, there would be a theoretical need for tree plantings of 90,000 ha in 2015-2020 and more in 2020-2030.

The Private Forest Entity (PFE) implements most tree planting activities. Most activities are carried out through a tendering process that considers incorporation as the PFEs or other organizations with access to nursery, capability of staff and cost profiles. Beyond the actual planting, the PFEs or other organizations need to provide for irrigation and protection of the reforested areas for 3 years and achieve high survival rate. Typical conditions release full budget for survival rates more than 75%, but dictate replanting at rates more than 50%, and full reimbursement of advances at rates less than 25%. However, field observations indicate that planting stock is poor, often sites are poorly planned, grazing can impact success rates, and the provenance of tree seedlings is not known. Future efforts should consider improved maintenance and after-care, consideration of weeding regimes, better strategies to remove the impacts of grazing, and strategies to improve planting stick. In addition, most reforestation schemes focus on planting pines; however, in some cases, broadleaved species may grow better.

1.8 Urban forestry

The term "urban forest" is quite new, and its planning just started since 1990 in urban planning. By 2010, urban forest or city green areas including parks and gardens should be extended 15 m^2 per person according to the city planning of the capital Ulaanbaatar until 2030 (Institute of Capital City Architecture, 2013). Yet by 2010, the urban forest area was estimated only 202.34 ha which means only 1.89 m^2 per person. The current urban forest areas including parks and gardens in city center were established in early 1960s-1980s. Due to sharp rising of buildings and settlement areas in the cities, some of the parks and gardens in the cities were demolished and a very few of them were renovated or rehabilitated yet in smaller area. Moreover, the diversities of woody plant species were decreasing year by year. From Table 1-5, it's clear to show that urban forest areas did not increase in the capital, Ulaanbaatar city since 1990.

Table 1-5 Urban forests areas in Ulaanbaatar

Categories of urban forest areas / ha	1990	2010	2011
Public Parks, stadiums, small parks and gardens Streets and squares with trees and shrubs Avenues and green zones around rivers and waterbodies	315	410	142.64
Restricted access Around apartment buildings, office buildings, sports complex and industrial areas	334	360	14.7
Special areas Botanical gardens, greenhouses, horse racing, airport water sewage, buffer zones of highways and railroads	676.7	680	45
Natural scenes River valleys, greening areas of city	9,687	19,098	9,687

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1.9 Community-based forestry

During the era of Soviet influence in Mongolia, all the forests were the state owned, and Collective Forest Farms managed the forests. Forests remain under the state "ownership". However, the government has introduced an approach of forest management by user groups through support and encouragement of the bilateral and international agencies. The broader concept is heavily influenced by the community forestry in Nepal, even to the extent that in English the program is called "community forestry" and user groups are called FUGs (Forest User Groups) in the same way as in Nepal. Despite these similarities, the program is closer to the Indian JFM approach. The FUGs sign an agreement with the forest department and receive agreed benefits in return for carrying out the tasks. The benefits include subsidized prices for forest products for household use and the right to sell the specified quantities of fuelwood and timber on the market. In practice, the income is limited and forest department maintains the high degree of direct control. The existing marketing regulations and local government policies complicate the marketing process.

Since about 1990, there has been an increased rate of forest loss and forest degradation in Mongolia, including increased susceptibility to fire. Participatory Forest Management (PFM) has become an important strategy for improving forest conservation and management. Government Resolution #122 of 1998 (on the "National Forest Programme") specifically identified PFM as a strategy to improve the forest management, resulted in the setting-up of a number of "community forestry" trials in northern aimags. These trials were limited by a number of factors, including lack of legal status for community groups and lack of rights to forest resources.

The 1995 *Forest Law* stipulates the possibility of leases on forest areas to be issued to communities and industries. However, there were conflicts between these provisions and the *Land Law*.

In 2005, an amendment to the *Law on Environmental Protection* was made, which was aimed at formation of user groups (Mongolian: Nukhulul) for forest areas. This became the legal basis for formation of the FUGs, which could be issued with leases to forest areas. Since 2005, the significant numbers of the FUGs have been formed and issued with leases. It is fair to say that many of these FUGs were formed in a rush of interest and enthusiasm with a limited base of experience to inform the process of establishing viable local institutions for forest management.

The *Mongolian Forestry Law (2007)* indicates significant progress as an important paradigm shift from state forest management towards private and community-based forest management has been advocated. However, the required by-laws are currently under the formulation process.

After the Law enactment, forest resources are allocated to the private companies and communities. However, before 2005 forest resources were not yet allocated to the local

communities. The legal changes were aimed at balancing the rights and responsibilities of forest users, and local community interests has again revived.

Almost 3 million ha or just 1/3 of the boreal forest estate is being managed under contract by the Private Forestry Enterprises (PFEs) and community FUGs. Over 900 FUG, with more than 20,000 members, are operating in the boreal forest aimags.

The government is in the process of setting in place a variety of mechanisms, which will provide transfer payments and other incentives to the FUGs, including the preparation of the secondary legislation that will allow payments to be collected for forest use and management. Fees will be based on a percentage of the costs of forest management with using a standard cost norm calculated to apply to all FUGs. It is provisionally calculated at 15% of costs for 0-500 m^3 of removals, and 20% of costs for 500-1,000 m^3 of removals.

More than 100 PFEs are involved in managing and utilizing almost 700,000 ha of boreal forest. By the law, the PFEs are required to replant logged areas. The fund administered by MNET has been established to enable the reforestation of areas deforested due to the past logging activities, and afforestation of the considered areas shall be done. Funding is available for the PFEs for activities which are aimed at "facilitation of natural regeneration" and afforestation of bare or degraded lands. Payments are set at a maximum in the range of MNT 100,000-135,000/ha for planting activities in the forest steppe zone, and MNT 57,000/ha for facilitating natural regeneration (from Dorjusen and Sainbayar 2004 cited in Mühlenberg *et al* 2006). Fifty percent of this fee is paid in advance, and transfer of the balance is dependent on tree survival rates (Mühlenberg *et al* 2006). The funding for replanting, reforestation and afforestation by the PFEs is provided by public funds. It effectively represents a transfer payment from the state budget, and therefore is covered in the figures presented above on the government funding to the forest sector.

In addition to the forest management and utilisation contracts held by FUG and PFE, at least one area of boreal forest is planned to be put under management by government and the private sector to generate carbon credits under the Clean Development Mechanism (CDM). This project is managed by the Mongolia Forest Forum, and involves the reforestation of 300 ha of grassland in Selenge aimag through planting 750,000 *Pinus sylvestris*. The project is anticipated to generate 19,008 removals to the year 2030 at a planned investment of US$ 328,000 over 3 years and operating costs of US$ 573,000 over 17 years. Annual CER sales are projected to be US$ 14,250. As the project concept states that there will be no harvesting of the forest for 100 years, it is not immediately obvious how this project will avoid running at a loss. None of the other four CDM projects that are registered for Mongolia or that are listed by the government as being in the official pipeline as a concept, PIN or PDD under development (MNET 2011a) concerns afforestation or reforestation. However, it is not yet fully implemented due to inadequate funds being available to pay compensation.

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1.10 Production, consumption and trade of forest products

The forest industry in Mongolia has been steadily declined since the economic crisis of the early 1990s; in the 1980s, the forest industry made up around 10% of Mongolian Gross Domestic Product (GDP). The harvest amounted to around 2 million m^3/year. In the 1990s, Mongolia underwent economic crisis and large wood harvesting and processing centralized industries and factories collapsed. The majority of wood harvesting and processing PFEs ceased manufacturing wood products and took to exporting roundwood and sawn timber to China. In 1999, environmental concerns led to the parliament passing legislation but halted export of roundwood and sawn material. During the recent years, official timber harvesting rates have oscillated around approximately one million m^3/year (Figure 1-4). Much of this harvest has been met through sanitation cutting or forest cleaning whereby timber is removed from forests affected by fire, pests and diseases. From the total, 9.1% were harvested through harvest cutting, 4.6% from thinning, and 86.3% from forest cleaning and sanitation cutting. There is an average 18.8% of total harvest for commercial wood and 81.2% for fuelwood; the latter is used for householder consumption, charcoal making and sale to urban areas.
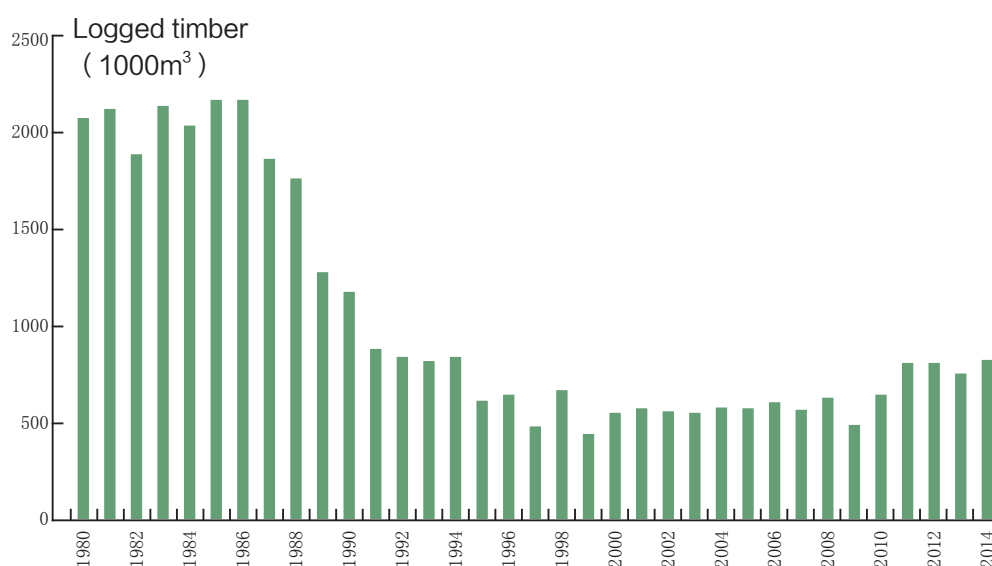
Figure 1-4 Total volume of official timber harvested in Mongolia, 1980-2014

In Mongolia, regulation limits logging to so-called 'forest cleaning', taking to salvage and sanitation cutting following forest fire or severe pest outbreak. According to the provision 3.1.15 of the *Mongolian Law on Forest,* such 'forest cleaning' consists of removal of dead trees, fallen twigs and trees that have died due to forest fire, defoliating insects, disease, strong wind and snowfall. In an international context, salvage cutting is usually understood to remove dead or severely damaged trees to recover economic value that would otherwise be lost. Sanitation cutting is usually understood to remove trees to improve stand health by stopping or reducing the spread of diseases.

There is also evidence that salvage cutting reduces fire risk, but this evidence is not uncontested and other studies have highlighted possible negative impacts on ecosystems. Currently, most legal logging activities in Mongolia are conducted as "forest cleaning" and fall short of national targets for timber production. Official data indicate that annually 729,000 m^3 of timber were harvested during 2011-2014 (Figure 1-5). This volume falls short of official planned requirements to support Mongolian wood industry and its emerging needs. An ongoing governmental programme for forest cleaning targets covers 315,000 ha and 1.4 million m^3 of timber and fuelwood every year until 2020, primarily in the forest-rich provinces.
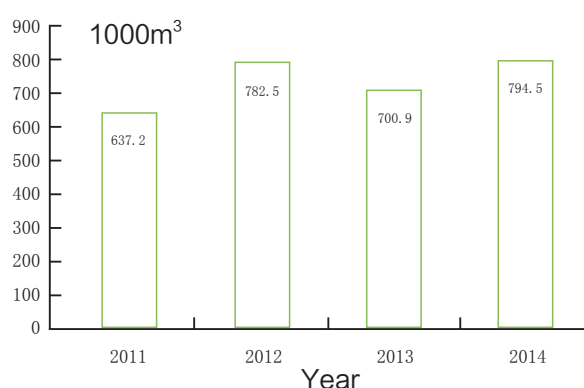
Figure 1-5 Volume of timber harvested through forest cleaning in 2011-2014 (MEGD, 2014)

The Government policy promotes timber import through tax exemptions and reducing import tariffs. In 2013, wood and wooden materials were exempt from customs tax and value added tax. During 2013-2014, import volumes sharply increased, and around 140,000 m^3 of sawn wood were imported (Table 1-6). Import volumes, mainly from Russia, remain relatively low for several reasons. First, there is a minimum order size for exports (from Russian), prices are high, and export taxes amount to 80% on roundwood and timber. Second, taxes, as well as payments for transport and storage are due in advance, which means that only a few large PFEs can comply with these requirements.

Table 1-6 Imported wood and materials during 2010-2014

	Amount in 2010 / m^3	Amount in 2011 / m^3	Amount in 2012 / m^3	Amount in 2013 / m^3	Amount in 2014 / m^3
Fuelwood	459	986	72,731	3,854	74,557
Roundwood	24	1,255	1,962	870	4,850
Wood for specific use	16,924	1,094	3	41	4
Railway sleeper	2,806	26,000	1,816	324	141
Sawn wood	1,947	11,707	6,321	18,768	33,529
Total	22,161	41,041	82,834	23,858	113,080

Source: Mongolian Customs General Administration.

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Unsustainable logging and subsequent degradation mainly take place as an illegal activity. Although there are no official statistics available, there is a gap between official supply and demand statistics that can be explained through unofficial activities. Since 2011, official harvest rates have been lower than 1 million m^3/year (Figure 1-6). The FRDC estimated that there is demand of approximately 1 million m^3/year for commercial wood, and of approximately 2 million m^3/year for fuelwood. Similarly, a World Bank survey reported that around 1.2 million m^3 of wood consumed annually in Ulaanbaatar is supplied through illegal logging and thus exceeds official harvesting by a factor of two.
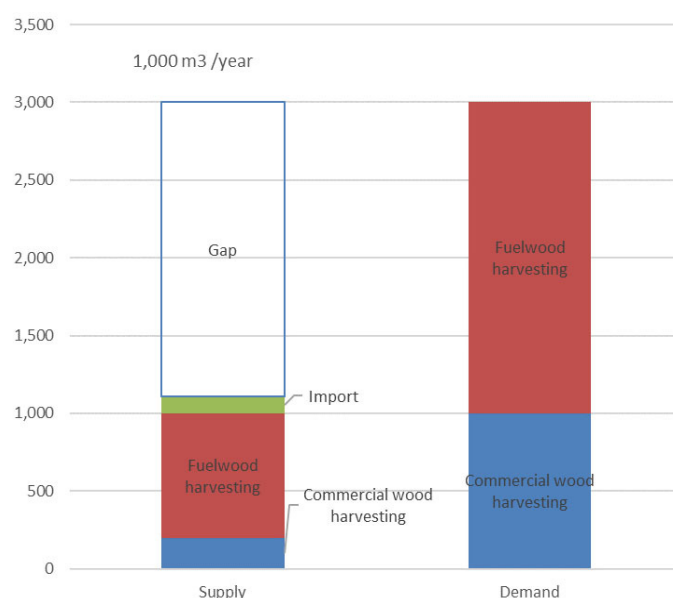
Figure 1-6 Fuelwood and commercial wood harvesting showing difference between supply and demand statistics

Community forestry takes place through a system of "Forest User Groups" (FUGs). The licenses granted to the FUGs allow fuelwood collection through "forest cleaning". Typically, FUG licenses do not allow for sustainable selective logging, although in pilot cases, more comprehensive licenses have been granted. The MET licenses PFEs for certain kinds of activities, according to six types of licenses, namely, for thinning, forest cleaning, forest restoration, reforestation and nursery operations. Special equipment and skills are needed for conducting forest inventory and taxation, for pest control and there are fewer PFEs in these fields. Commercial forest utilization licenses are provided to only few, bigger wood harvesting PFEs, which have staff, equipment and skills for harvesting, wood transportation, and saw milling. FUGs and PFEs ultimately implement many of the forest management activities. Both of these organizations work through licenses. At present, there are as many as 1,179 FUGs, together covering 3,119,635 ha. There are almost 83 PFEs active, together covering 681,378 ha (Table 1-7).

Table 1-7 Forest licenses held by FUGs and PFEs (MEGD 2014)

FUGs		PFEs	
Numbers	Areas / ha	Numbers	Areas / ha
1,046	3,037,857	83	677,978

Fuelwood collection is an activity conducted by the FUGs or by dedicated PFEs. It is reported through stakeholder meetings that currently it has low impact on Mongolian boreal forests. Fuelwood collection, if any, does not actually contribute to forest degradation, and could have a positive impact as helps to reduce impacts of pest attacks and forest fire risks. Fuelwood collection is not treated as a driver of forest degradation, as it seems to be not primary focus activity under community forest management efforts. Moreover, the forest taxation inventory does not include data on the fuelwood collection. However, in the past, it was reported that large-scale commercial logging was done for fuelwood, which greatly resulted in forest degradation and deforestation. In addition, impacts on saxual forests may be different as they have low above-ground biomass and may be more sensitive to commercial or household fuelwood collection.

MNET records showed that, in 2010, just up to 300 tons of spruce and pine nuts, wild berries and other NTFP were collected under permits in boreal forest aimags. At the current market prices, those may have a value in the range of MNT 1.5-2.7 billion (US$1-2 million), depending on whether they are home-consumed or sold. It should be noted that this figure is substantially higher than that cited in the FAO report (2004), which estimates that fruits, nuts, essential oil and resins with a market value of about US$360,000 or MNT 0.5 billion (based on the current prices) were harvested from forests and supplied to domestic markets.

As is the case for wood products, a large proportion of NTFP harvesting takes place outside the permit system. It is known that herder communities collect a wide range of plant products. Recent surveys on the FUGs have found that their members harvest fruits, berries, mushrooms, wild vegetables, pine nuts, preserved berries and medicinal herbs for personal needs and for sale on local markets. Detailed surveys on the use and value of NTFP for rural households have been carried out in Bayan-Ulgii, Khentii, Selenge and Tuv aimags (Emerton et al 2009). Extrapolating these findings to the total rural population living in soums with boreal forests, suggests that almost 65,000 households may regularly collect up to 4,250 tons of fruits, berries, wild vegetables, nuts and medicinal plants totally amounted to almost MNT 16.5 billion (US$12.18 million) per annum.
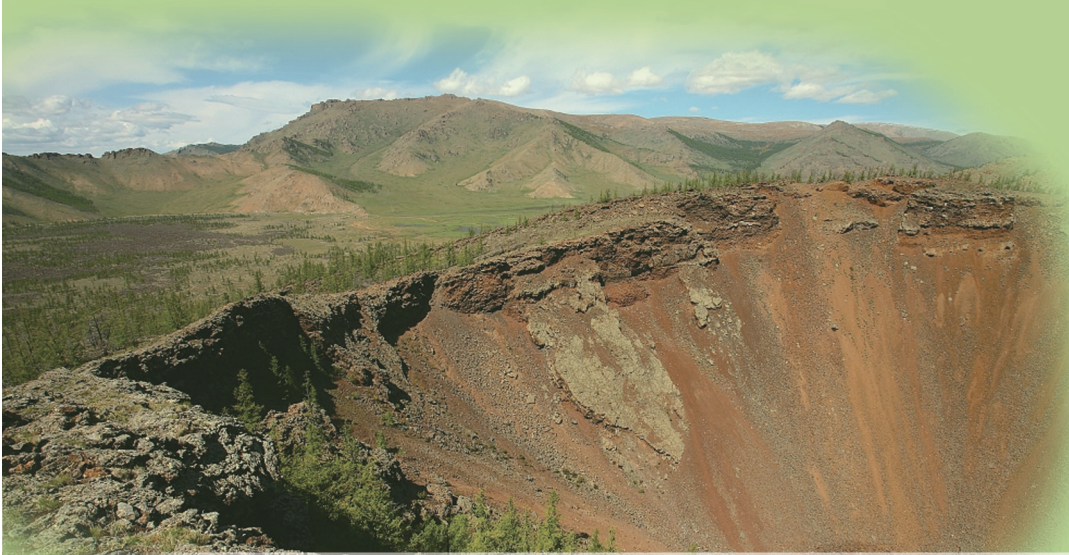
Chaptre 2   Contribution of forests to economic development

2.1   Economic and environmental significance of forests and woodland

2.2   Financing and investment in forests and forestry

2.3   Forests, livelihoods and poverty

2.1 Economic and environmental significance of forests and woodlands

The economic and environmental significance of forests in Mongolia are assessed by its value of goods and services to the Mongolian Economy (Figure 2-1), and describes their contribution to key growth and development indicators. Its main findings are as follows:
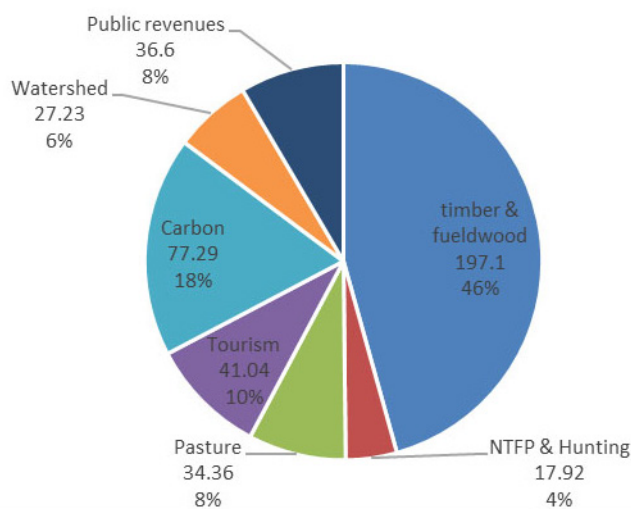
Figure 2-1 Partial estimate of the economic value of forest goods and services (2013, MNT billion)

- At current harvesting levels, timber may have an annual sale value of almost MNT 94 billion (US$ 68 million) and fuelwood MNT 104 billion (US$ 75 million), generating MNT 43 billion (US$ 31 million) and MNT 23 billion (US$ 17 million) in operating profits to producers. More than half of this value comes from unlicensed removals.

- Non-timber forest product collection has a total value of almost MNT 16.5 billion (US$ 12.18 million) per year, spread over around half of the rural population in soums with boreal forest. More than 90% of this value comes from unlicensed removals, and three quarters is accounted for the home consumed products which never enter the market.

- Forests are an important seasonal source of pasture for livestock and valued over MNT 34.5 billion (US$24.70 million) as contribution to the herders' gross margins. This comprises up to 5% of the value of livestock production in soums with boreal forests.

- Hunting under the permits in boreal forest areas generates products with the annual market value of approx. MNT 91 million (US$65,000), if sold locally, and MNT 2.7 billion (US$1.9 million), if hunted for sports.

- Forest-based leisure tourism directly generates over MNT 22.7 billion (US$16.34 million) in visitor spending and sales, supports up to 6,000 jobs and wage earnings of MNT 18.31 billion (US$13.17 million), and makes a direct contribution to GDP of MNT 55.26 billion (US$39.73 million). Across the economy, its multiplier effects are substantial: the total contributions to GDP may be in excess of MNT 144 billion (USS$103.75 million), including

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MNT 48.83 billion (US$35.11 million) in wage earnings, MNT 93.86 billion (US$67.48 million) in sales, MNT 28.07 billion (US$20.18 million) in value-added and MNT 17.07 billion (US$12.27 million) in capital formation.

- Boreal forests may sequester carbon in the amount that is worth to approximate MNT 77.29 billion (US$55.57 million) per year. Although unquantified, they also have a storage value, particularly in the context of REDD+.
- Forest watershed protection services in the Upper Tuul basin alone are worth to MNT 27.2 billion (US$19.6 million) per year to water users in Ulaanbaatar.
- The net value to users of forest goods and services is valued up to approx MNT 395 billion (US$284 million), equivalent to an average of MNT 40,000/year per hectare of the boreal forest estate (US$28).
- The government earns are over MNT 36 billion (US$26.3 million) in revenues from forest product harvesting and utilization activities, including tourism and water but excluding the taxes paid by other forest-based enterprises. This is equivalent to an average of MNT 3,600/year per hectare of the boreal forest estate (US$3).
- The net value-added to rural households of the fuelwood use, NTFP collection and forest grazing is equivalent to over 12.5% of the recorded per capita GDP.
- The total annual direct value-added of forest sector is equivalent to around 3.1% of GDP value, while public revenues are equivalent to approx 1.4% of all tax revenues.

2.2 Financing and investment in forests and forestry

The key findings of the review on the status of investment and funding flows to the forest sector in Mongolia conducted within the UN-REDD program (2013) are presented below:

- The Government of Mongolia provides funding for the forest sector in the range of up to MNT 12.5 billion (US$9 million) per year. This equals to annual public spending of MNT 125,000/km^2 (US$90) of boreal forest in total. On average, public spending on the forest sector is almost three times higher than the public revenues earned from timber, fuelwood and NTFP harvesting.
- Public funding for forest sector has been increased steadily, and more than doubled in real terms during 2008-2012. However, the share of forestry funding in the total environment budget has declined over the same period, from a third of all spending in 2008 to less than a fifth in 2012.
- Core institutional cost is accounted for less than 10% of government forest spending, and is dominated by staff-related costs. Over 90% of the recurrent budget is allocated for on-the-ground forest management activities: pest control, fire management; forest cleaning, thinning and enforcement; reforestation and rehabilitation; inventory and forest organization; nurseries and seedling preparation; and support to the FUGs.
- International donor assistance plays a relatively minor role in forest funding at an average of MNT 2 billion (US$1.5 million) per annum or MNT 21,000 (US$15) per km^2. Forest sector is accounted for 0.1% of total bilateral and multilateral development assistance during 1990-2010, and just 3% of environmental spending.

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● Most donor-funded forest sector projects have been initiated in 2005. The vast majority of activities are aimed at on-the-ground forest management, development and conservation, with a particular focus on supporting community forest management.

2.3 Forests, livelihoods and poverty

In Mongolia, forest resources represent an important part in livelihoods, and changes in the forest sector have had grave socio-economic impacts. Before 1990s, approx 2.2 million m^3 of timber were produced annually, and forest products contributed to 6% of Mongolian GDP. The contribution of the industry to GDP is less than 1% (although the contribution to the informal economic sector may be higher). Population growth and urbanization create demand for wood products, and the demands for lands to establish settlements and increase pressure on forests. While population has increased during the last decades, forest areas have continued declining at various scales and locations. Forest areas are declined mostly around Ulaanbaatar city, but in rural areas population growth results in economic growth and increase of pervasive rural activities: herding, hunting, gathering and others (Figure 2-2).
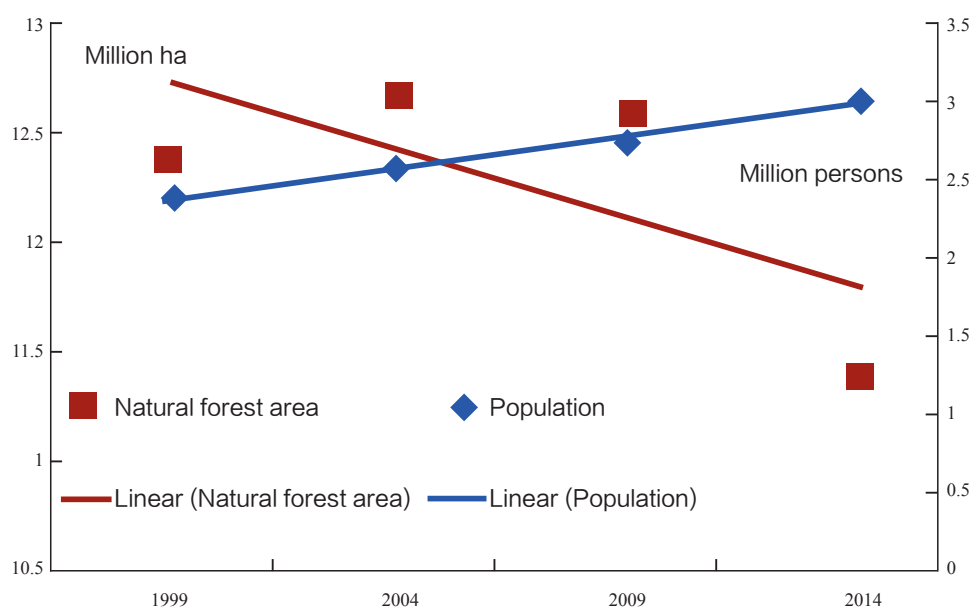
Figure 2-2 Relationship between forest area and population (NSO of Mongolia 2015)

Employment in the forest industry fell from 12,000 to less than 6,000. The population, previously employed in the state enterprises, has either migrated, or resorted to other forms of (temporal) employment or to (informal and primitive) logging and small-scale sawmill operations. Consequently, there is a serious and negative impact on the level of poverty. Communities in the forested areas of Mongolia are severely affected by the on-going forest degradation. They heavily rely on fuelwood availability, timber for household use, and wood for production of traditional gers (Mongolian felt tents).

Forest provides a range of "ecological services" to local communities as well as to a greater population, rural and urban, in the form of soil conservation, watershed protection, shelter for livestock, wildlife habitat, and is a resource base for the rapidly developing eco-tourism industry.

The arid Saxaul forests are very significant as reserve and winter pasture for camel. Traditional protected areas, grazing reserves and sacred sites revered by local communities are often in forest areas. Non-timber forest products, both floral and faunal, are traditionally important for household and subsistence use, and in recent years have been harvested on a hitherto unknown scale for lack of other income sources and opportunities for value addition.

Today, all forests in Mongolia are state-owned. However, government institutions for forest management have undergone changes and are weak. A previously trained cadre of forest management professional is not employed in the sector currently, and a provision to train rangers and inspectors in the frontline of law enforcement does not exist.

Under the current conditions, the forest management in Mongolia remains largely ineffective, and clear institutional responsibilities are lacking. Forest administration is partly decentralized and the soum governor is empowered to grant licenses and concessions according to quotas issued by the Ministry of Nature and Environment and Tourism (MNET) to individuals or economic entities, as well as to collect the respective fees. However, control over the logging locations and amount of the extracted wood is insufficient, and illegal logging is rampant.

The Mongolian economy has grown rapidly during recent years, fuelled by a mining boom; this growth was the backdrop for much of the dynamics in the forest sector too. Mongolia has developed from a low income economy to an upper-middle income economy. Mongolian GDP increased by 2.4 times during 2005-2009 and by 7.9 times during 2010-2014 (Figure 2-3). Much of this growth was fuelled by the mining sector, which increased 2.2 times and 7.4 times over the same period. During the last 10 years, the growth rates have been continuous and fluctuated around 10%.
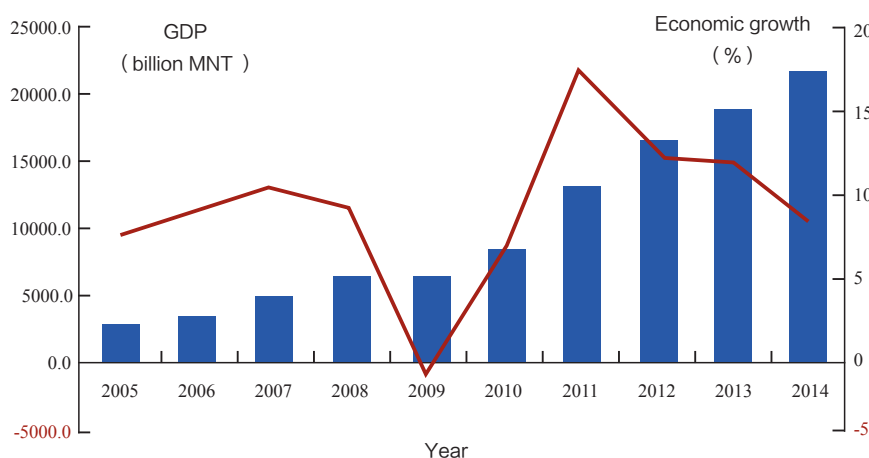

Figure 2-3 Mongolian GDP and economic growth rate 2005-2014 (NSO of Mongolia 2015)

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Grazing is one key sector of Mongolian economy. The livestock numbers have continued to grow during the last years (Figure 2-4), in part related to the growing rural population and also due to perverse government policy which encourages large herds and an increased demand for cashmere wool, leading to large herds which excessively graze in the steppe areas and may lead to increased grazing in forest areas. Community-based agreements on grazing and pasture management may help to improve productivity of grassland, reduce land degradation, reduce pressure on forests and may lead to higher quality livestock. Incentives should be investigated to ensure farmers maintain herds at optimal size for the carrying capacity of the grassland area.
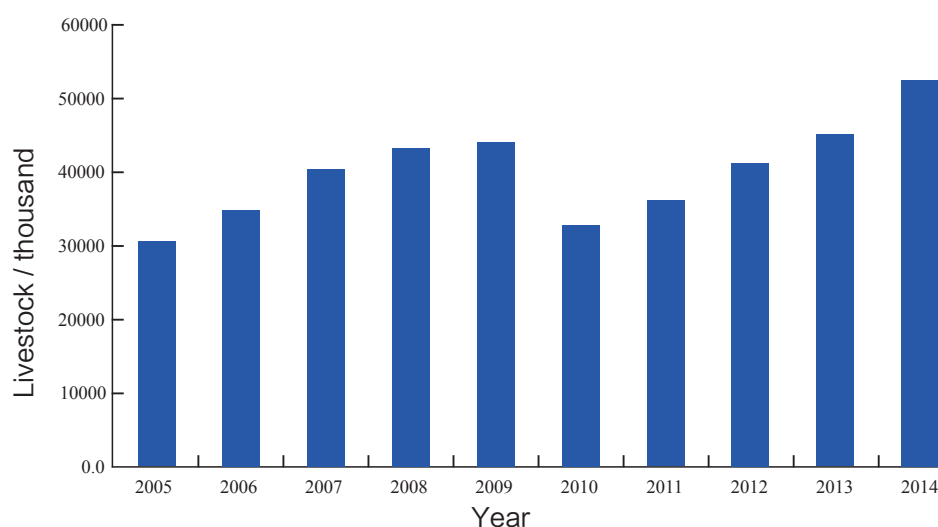
Figure 2-4 Number of livestock in Mongolia 2005-2014 (NSO of Mongolia 2015)

During the last 10 years, government spending on the protection and rehabilitation of natural resources has multiplied; albeit at a slower rate, forestry-related spending also increased greatly. Economic growth has led to growth in public expenditure by 740% across the last 10 years. Driven by a political environment favoring conservation, spending on the environmental sector outgrew overall national budget growth, but spending on the forest sector increased slower than overall environmental spending (Figure 2-5).

Increasing amounts of funding have been allocated to the traditional and protective forestry activities, such as implementing pest control. By the same token, the more recent economic downturns have resulted in a restrictive public financing environment in which the forest sector is often one of the first sectors to be affected. Moreover, such one-sided budget allocation may relate to the political environment favoring conservation, and there still remains a perception that such traditional activities would need to receive more resources (e.g., because only a fraction of areas with hotspot of forest pest were treated, and only a fraction of required areas were reforested.).

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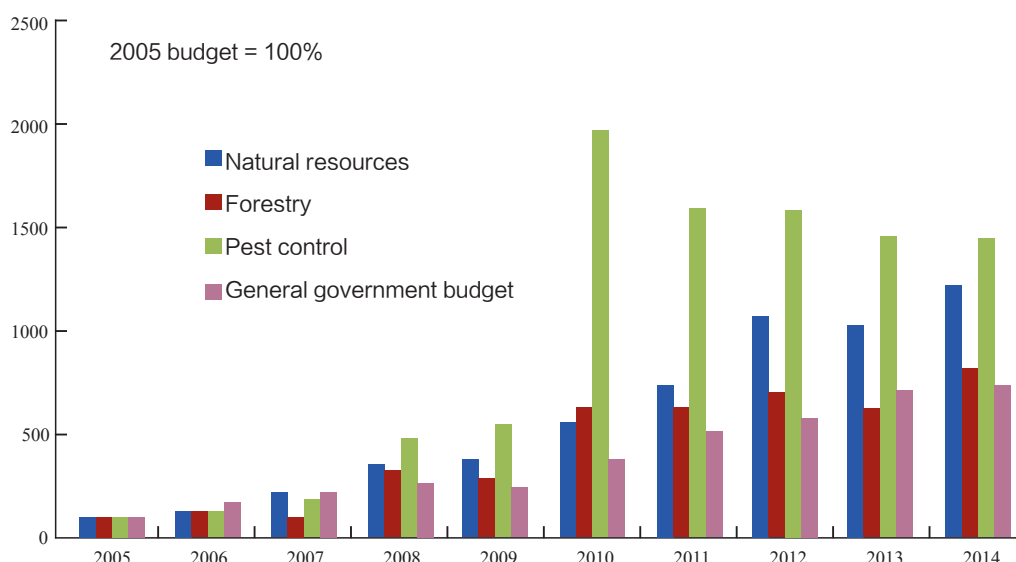
Figure 2-5 Public expenditure on forest protection and management 2005-2014 (NSO of Mongolia 2015)

Despite the economic progress, development challenges remain, and particularly the rural population relies on small-scale activities exerting pressure on forests. The poverty rate remains rather high, particularly among the rural population and population living in the countryside; in 2010, 39.2% of the population was poor and despite the rapid economic growth, poverty levels did not reduce (Figure 2-6). Much of the rural population continues to rely on small-scale rural activities for their livelihoods: hunting, gathering, herding and others. These activities exert pressure on the forest resource, and can spread forest fires, inhibit forest regeneration and ultimately lead to forest degradation.
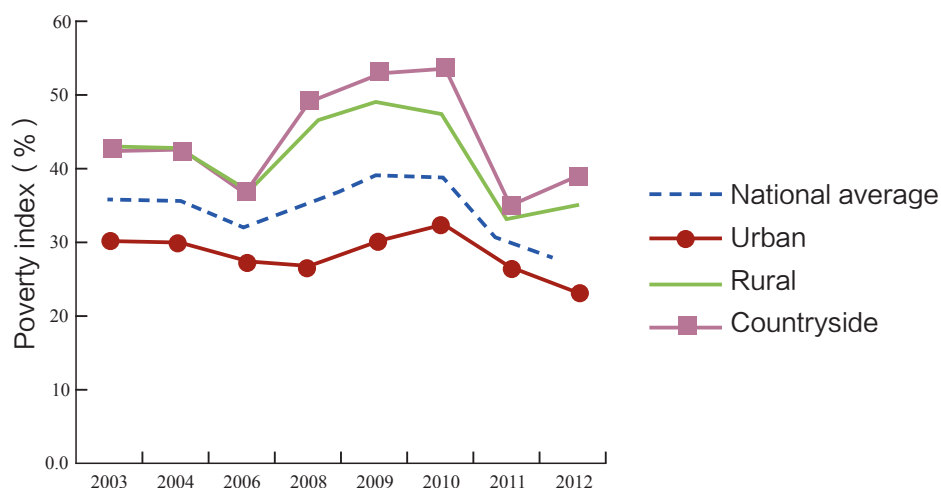
Figure 2-6 The percentage of population living below the Poverty Line, 2003-2012

Rural poverty is an underlying cause of deforestation. Across the provinces, poverty reduction (weakly) correlates with forest area change (3.0). In those provinces where efforts to reduce poverty were most successful, forest area tended to increase. In those provinces where efforts to reduce poverty were less successful, forest area tended to decrease (Figure 2-7).
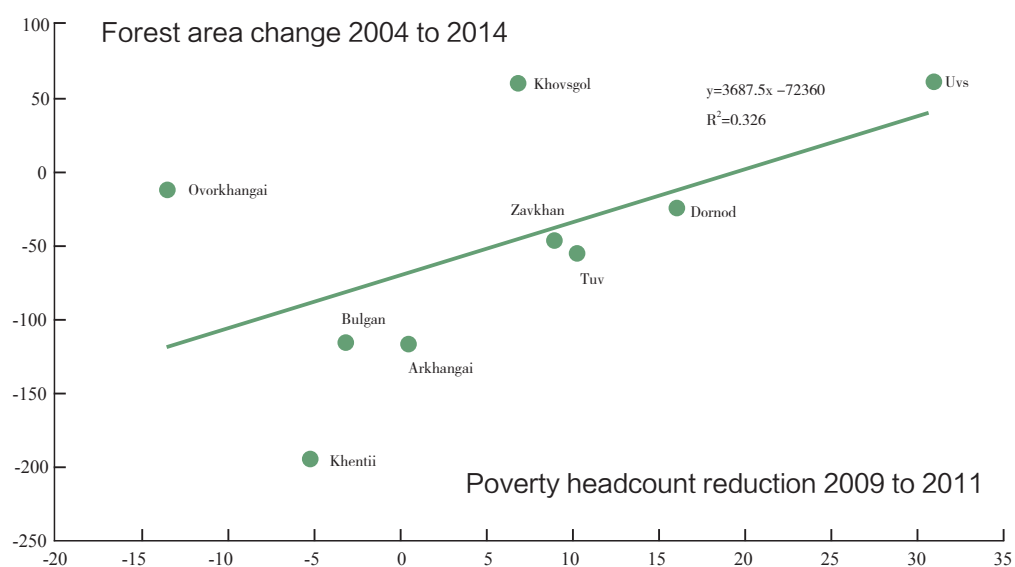
Figure 2-7 Link between forest area change and poverty reduction (NSO of Mongolia 2009-2012)
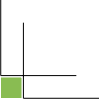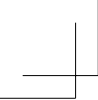
Chapter 3　Forest policy and legislation

Since 1995, the Mongolian Parliament has adopted 23 environmental laws, covering various aspects of land use, environmental protection, air, plants, animals, forests, toxic substances, environmental impact assessment, wildlife protection and protected areas, etc.

The *Forest Law*, originally enacted in 1974, was completely revised and the new law went into force from June, 1995. Also other environmental laws such as the *Land Law*, the *Environment Protection Law*, the *Law on Special Protected Areas*, the *Hunting Law*, etc., were revised. However, the package of forestry laws, passed during 1995-1996, including *Forest Law*, *Law on Fees for Harvest of Timber and Firewood*, and *Law on Fires in Forest and Steppe Areas*, will be reviewed in line with the new forest policy.

Clear-cutting of forests is no longer allowed. Harvesting shall be done through selective cutting and thinning. Another main purpose of the new law is to enhance reforestation. For each tree cutting, three to five seedlings (instead of two that were stipulated in previous law) shall be planted at the expense of the cutting person or organization. Allocations from the state budget for the forest protection and reforestation shall be at least 70% of the total cutting fees.

As stipulated in the *Constitution* and in the *Forest Law*, forest resources are the state property. However, the new *Land Law* and new *Forest Law* include provisions on granting citizens, economic entities, and organizations the rights of using forests and forest resources for the certain periods, and fees and conditions based on contracts or licenses are provided for the community-based forestry. Concerning the implementation and enforcement, some critical views have been expressed: "From the point of view of the policy and legislation, a lot have been set up. However, reviewing the implementation of laws and regulations showed that problems were not been solved. Enforcement of the laws is insufficient, and therefore the citizens and economic entities are still illegally logging and damaging the forest ecosystems".

In 1997, the State Great Khural passed the *National Policy on Environment Protection*. The higher priority on forestry shall be given to the following: forest resource development, improvement of forest inventory methodology, institutional strengthening for forest protection, high survival rate of planted seedlings, and improvement of harvesting technology and processing technology.

In Mongolia, there are several key focus areas of the legislation: Forest, Protected Area, Land, and Mining. There are three primary forest laws: *Law on Forest* (2007)*, Law on Forest and Grassland Fire Protection* (1996), and *Law on Fees for Harvest of Timber and Fuel Wood* (1995). The *Law on Forest* regulates protection, possession, sustainable use and reproduction of forests. As related to the forest fire, the *Law on Forest and Grassland Fire Protection* directly addresses the issue of prevention, suppression and restoration activities of forest and steppe fire.

Under the *Law on Forest*, the FUG is considered as a voluntary organization of local citizens established with the purpose of protection, appropriate utilization and rehabilitation of the local forests in accordance with the *Civil Law* and *Law on Protection of Nature and Environment* (1995). The *Law on Fees for Harvest of Timber and Fuel Wood* regulates the fees for harvesting forest timber and fuelwood by citizens, economic entities and organizations as well as procedures for paying fees to the state budget. Moreover, there is a draft *Law on Pastureland* to regulate the relations regarding to possession, use and protection of pastures; and forest transition zones would be particularly affected by this law.

Forest Agency under the Ministry of Nature, Environment and Tourism is currently in the process of finalizing national forestry policy with the FAO technical assistance. It is expected that the draft policy will undergo series of consultation at national, regional and local levels prior to its submission for official adoption provisionally by the end of the year. In general, new policy would continue to support transition towards the protection and restoration of the economy's forests with the greater emphasis on enhancement and utilization.

The majority of Mongolian forests are under protection in accordance with the *Law on Special Protected Areas (1995)* and *Law on Buffer Zones* (1997). The purpose of the *Special Protected Areas Law* is to regulate the use and procurement of land for state protection needs, and to preserve and conserve the original conditions for maintaining the specific ecological habitats and features that are important for the endangered plants and animals and in the historical context. The *Buffer Zone Law* aims at ensuring transition zones between the protected areas and surrounding areas where various economic activities are implemented to support preservation of integrity of the protected areas.

The concept of land ownership is still quite new for Mongolia, and therefore many aspects of "ownership" and "rights" are currently being elaborated and piloted. Definition and meaning of the land tenure is one of the more complicated issues in Mongolia, given the rapidly changing economic and political landscape and increasing commercially competing interests. At the same time, the *Law on Land* (2002) regulates possession, use of land by citizen, entity and organization as well as other related uses.

The mining affects the state of forests in Mongolia, and the *Law on Minerals* (2006) and *Law on Subsoil* (1988) regulate exploration, mining and related activities but they are also regulating use and protection of subsoil in the interests of the present and generations to come.

The lack of consistency and coherence between these laws also affects the Sustainable Forest Management (SFM). Poor interlinkages between the laws on mining, environmental protection and forest management raise the considerable concerns. Moreover, the limited implementation and enforcement capacities of the national institutions are another major challenge.

Chapter 4   Best practices for sustainable forest management

The policy framework that guides the protection, conservation and utilization of Mongolian forest resources comprises both international treaties and national environmental and development policies. Mongolia is signatory to several international treaties with important implications for forest management. The most significant ones of these include *The Convention on Biological Diversity* (CBD), *Convention on the International Trade on Endangered Species* (CITES) and *The Convention to Combat Desertification* (CCD). The CBD obliges Mongolia to establish a system of representative protected areas. CITES requires it to introduce and implement measures to regulate the trade of endangered plant and animal species. The CCD requires it to work closely with local communities and other stakeholders to implement integrated approaches to combat desertification.

4.1 Soil and water conservation

In the areas where agriculture is being practiced in the climatically risky environment, the proper usage of fertilizers and pesticides can significantly increase the soil fertility. Crop yields have an increase of 560 kg/ha during the wet years, 310 kg/ha in normal years, and 210 kg/ha in dry or drought years when using fertilizers (www.mofa.gov.mn). However, the study titled as "Risk Assessment on the quality, safety, and health risks of widely used imported food products in Mongolia" confirmed that pesticide remnants having the higher levels than it is permitted can cause the health problems. Eight types of pesticide remnants with the higher concentration than it is permitted and posed the health risks were found in 55.6% (20 products) of the total evaluated products, or in 27.6% of samples (42 samples) (www.mofa.gov.mn). In terms of the biodiversity, chemical products including the pesticides are also hazardous to birds and some insect species. For example, after bees and wasps are poisoned in the areas affected by pesticides, plants pollinized by those insects can be a source of contamination to humans and livestock through foodstuffs such as honey.

The usage of chemical substances in and pollution from the leather processing and mining is also important to be mentioned. Nationwide, there are 35 leather-processing plants and 178 manufacturing plants of various sizes. From the 10.3 million rawhides being prepared annually, 25.8% is bought by the national manufacturers, while the remaining 74.2% is exported to China either as raw material or after the basic processing.

In 2008, the Government Resolution #127 of 2008 on neutralization of soil polluted by the mining activities has been implemented through transporting 92,956 m^3 or 139,410 tons of the slime accumulated in 130 locations of 21 soums in 6 aimags, and through performing soil removal on the area of 78,965 m^2 (National Statistical Office, 2013).

In 2010, the State Great Khural (Parliament of Mongolia) passed the *Law "On Prohibition of Surveying, Mining and Using Mineral Resources in the protection zone of water bodies*

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and forest resource areas". The 15th Target of the Millennium Development Goals (MDGs) states that 80% of water run-off should be under protection by 2015, and there should be at least 1,000 river and spring headwater areas that are fenced and are under protection. It has been determined that to achieve the goals outlined in the plan, water run-off areas should be included into the state protected area network, and the integrated policy for water management shall be implemented (5th Report MDGs, 2013). To reduce the chemical and nutrient pollutions to the safe levels applicable for ecosystems and biodiversity, it is important to strengthen protection of waterbodies and implementation of protection regimens, to institute the monitored usage of chemical compounds and reduce chemical pollutions.

4.2 Desertification control

The Mongolian government programme on establishing the "Green Wall" has been approved and implemented since 2005. Annually, forest green belts are established and replanted within the programme in desert and steppe ecosystems in Mongolia.

Mongolia is encountering the challenge of adverse impacts of the global warming and climate change that are significantly affected the national economy, social life and people's livelihoods. In the face of the intensifying sand movement, dust and sand storms and desertification, potential environmental benefits can be achieved through reforestation activities.

The goal of the programme is to create the "Green Wall", which totally covers the transitional area between the Mongolian Gobi and steppe regions, and to decrease the present intensification of forests losses, desertification, sand movement, dust and sand storms caused by climate change and inappropriate anthropogenic activities. The long-term programme shall be implemented through the step-by-step process that involves local communities, and harmonizes environmental and socio-economic development policies/measures that take into account features of the respective areas.

The Green Wall national programme has three phases and will be implemented over a 30 -year period. The Green Wall or Ecostrip, with a total length of up to 2,500 km and a width of not less than 600 m, will be established with crossing the Gobi Desert and steppe regions. The total covered area will be 150,000 ha. Moreover, a sub-strip covering 50,000 ha will be planted in the adjacent areas of the Gobi Desert and steppe regions, synchronously with the main eco-strip to prevent sand moving and desertification.

The national programme "Green Wall" includes three phases as follows:
● First Phase (2005-2015): Not less than 20% of the planned programme shall be completed through ensuring the legal coordination and building capacity, and implementation of the required methodologies and technologies;

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- Second Phase (2015-2025): Not less than 30% of the planned activities shall be completed through assessment of progress achieved within the First Phase, and strengthening the national capacity; and outcomes shall be improved;
- Third Phase (2025-2035): Not less than 50% of the programme shall be completed based on improving the ecological and socio-economic efficiency of the programme, and mastering methodologies and technologies aimed at reducing the adverse impacts of desertification and sand moving.

To support implementation of the whole programme, reforestation activities will be implemented with expanding the range of afforestation in the Gobi Desert and steppe regions by planting trees and bushes, and establishing nurseries in desertified areas.

The funding required for the programme will be obtained from the budgets of central government and local government, donors, loans of the international organizations, and through technical assistance, gratis aid, donations from institutions, economic entities, and others.

4.3 Rangeland degradation control

One of an important economic value of Mongolian boreal forests for surrounding communities is as a source of pasture for grazing and hay-making. Forest grazing appears to have been intensifying over recent years, as herders have become more sedentary and have reduced their seasonal migration patterns.

Based on the data on livestock ownership and production, incidence and frequency of forest grazing provided by soum administrations, it is possible to come up with an approximate figure for the value of forest pasture. There exist various estimates on forest carrying capacity as well as actual and optimal stocking rates.

The actual rates are recorded as something around 1.1 SEU/ha in forest-steppe zones and 0.62 SEU/ha in high mountain meadows and in the above forest belt, somewhat over the suggested carrying capacity of 0.63 SEU/ha and 0.71/ha respectively. The work carried out in the four Northern boreal forest aimags (Bulgan, Tov, Uvs and Zavhan) cites that the actual stocking rate was in average of 0.85 SEU/ha as compared to the biologically optimal stocking rate of 0.70 SEU/ha and economically optimal stocking rate of 0.66 SEU/ha.

To ensure that the value estimates reflect sustainable values, an average stocking rate of 0.7 SEU/ha was applied for 10% of forest area (including glades, meadows and logged areas) that are supposed to make contributions towards the local herders' annual hay and pasture needs (further research is required to determine the actual forest area that is used for pasture, and sustainability of this use). In 2013, it provided the total value of MNT 34.5 billion (US$24.70 million) for contributions of forest pasture to the herders' gross margins.

Boreal forest pasture provides partial support for about 12.5% of herds, and accounts for up to 5% of the total annual value of livestock production in soums with boreal forests.

4.4 Forest fire and disease prevention

The most critical factor affecting the forest resources in Mongolia is wildfire, and therefore the "forest fire prevention is the most important part of every forester's work". In this regard, development of a programme on forest fire prevention should be the highest priority, and it should focus on the early fire detection, rapid response, and effective firefighting.

The National Action Plan on Disaster Mitigation including prevention from and mitigation of the fire and other natural disasters has been developed within the Project MON/96/004, approved by the Ministry of Nature and Environment, and submitted then to the Government for adoption. Moreover, the inputs into the Civil Defense Plan were provided and approved.

The *Forest Law*, revised in 1995, includes the *Regulations on Forest Fire Prevention* (Article 19). The *Law on Fires in Forest and Steppe Areas* contains a number of the relevant provisions, which oblige all government and legal entities to implement the government policy on fire prevention. In rural areas, people should be trained in fire prevention and fighting, and should be provided with all required information about climatic change and severity of fire. The Government can set up limits to, or halt, the resource-use and other activities in the areas where wildfire has destroyed the ecological balance.

The aimag and soum governors are requested to design fire prevention programmes and allocate the required financing (based on the *Forest Law*, Article 19). Governors of all levels are requested to mobilize people, vehicles and equipment to extinguish any fire immediately.

Citizens, legal entities and organizations that are using forests on the contract basis are requested to fund the fire prevention operations, and to implement the preventive measures against the forest insects and diseases.

The important forest areas should be identified and isolated by firebreaks from the most probable direction of the advancing fire. Those hazards are to be eliminated. For the early warning about the fire outbreak, radio and other communication systems are required along with the watchtowers in the large quantities. At present, only 15 towers are overseeing the one-third of the economy's forest areas. Forest roads should be constructed or improved to assist in regular patrolling and awareness raising activities, to speed up the fire-fighting and to help in preventing spread of fire.

During the period of 20 March - 10 June and 20 September - 10 November, the campfire is prohibited (according to the *Forest Law*, Article 19). Before gathering fuelwood or non-wood forest products or going on excursion or picnic during those seasonal periods, the

territory's ranger must be notified. Lit cigarettes and matches, sparks, and hot cinders shall be extinguished.

People's awareness about the fire prevention has to be strengthened through education (starting with the schoolchildren), extension activities, public-awareness raising campaigns, training courses and workshops. TV, radio, newspapers, videos, posters, etc. shall be engaged and used. Law enforcement is evident, including strict enforcement of stipulated penalties. Aimag and soum authorities need the assistance in equipping with the appropriate communication systems and firefighting equipment.

4.5 Biodiversity conservation

The Mongolian forest fund totaled up to 18,658,000 ha (as of 2014), which was 11.92% of the total territory of the economy, and 12,519,000 ha were forest covered areas, in which the forest quality was estimated as 8.0%. Forestlands in Mongolia are classified as two different zones, namely conservation and exploitation zones based on their environment and economic importance.

The forest conservation zone comprises alpine forest, forests of national protected areas, green zones of urban areas, forests in the areas prohibited for utilization, saxaul forests, forests of oasis, small-sized forests located at the areas that are less than 100 ha, and forest in the mountain slopes that are less than 30 degrees, and all together the forests occupy 82.8% of the total state fund lands (154,000 ha). The forest exploitation zone is the remaining forest fund territory, and it is 17.2% of the total state fund lands (3,187,735 ha).

Among the non-forest areas in the state fund lands, 3,476.7,000 ha are open or sparsely populated forest, 1,196,800 ha are burned forest, 124,100 ha are logged areas, 95,700 ha are forest land affected by harmful forest insects, 230,500 ha are naturally regrowing and reforested areas, and 900 ha are forests damaged by natural disasters. Of the total forest fund lands, 75.4% are coniferous and deciduous forest, while 24.5% are saxaul forest. As of 2010, 29% of total forest fund have been included into the national protected area network.

Within the national biodiversity program, the Goal 7 states that the forest cover shall be increased by 9% by 2025 through the improvement of forest management, and thereby this contributes to forest biodiversity protection.

The policies and action plans set up the goals and implementation provisions aimed at protection, sustainable use, and restoration of forests are as follows: "*State Policy for Ecology*" (1997), "*National Biodiversity Action Plan*" (1996), "*National Development Policy Based on Mongolian Millennium Development Goals*" (2005), "*National Action Plan for the Recovery of the Forestry Industry and Releasement of Employment and Social Issues in Villages Built to Serve the Forestry Industry*" (2010), "*National Program on Forests*" (2001)"

and *National Program "Green Wall"* (2005).

The local administrative revenue from the use of natural resources are mainly generated by fees collected from utilization of forest, water, natural plant and animal use. The revenue from the fees of using forest resources occupies tidy amount. The total area of forested land is about 18,592,400 ha, of which 17,677,600 ha are forest lands and 914,800 ha are non-forest lands. Comparing 12,552,900 ha of forested land to the total land area of the economy, the forest cover is estimated to 8.03% (MEGD, 2012). In total, 29% of forested land is included into the protected area network (Filling the Gaps to Protect the Biodiversity of Mongolia, WWF Mongolia, 2010).

About 5% of forests are degraded each year. The annual timber production amounts to 600,000 m^3, and considerable territory of forests is affected by fire resulting in deterioration of forest ecosystems. In addition, mining activities, increase of livestock and impact of urbanization threaten the forests. The forest degradation directly impacts wildlife habitat and forest ecosystem services, e.g. drying-up of headwaters, increased deficiency in food and fuelwood supply, which are indirectly influencing human development (National Human Development Report of Mongolia, 2011). The timber produced from the forest is mainly used for heating and construction, and due to inconsistency of wood processing technology, only 27% of timber is efficiently utilized. The forest cover change dynamics showed that within last 12 years 289,200 ha of forest totally lost. The non-forest land in forest land fund consists of 3,476.7 ha of sparse forest stands, 1,196,800 ha of burnt forest, 124,100 ha of cut forest, 95,700 ha of forest affected by pest insects, 900 ha of forest impacted by natural hazards and 3,700 ha of degraded forest due to human activities (MEGD, 2012).

The Ministry of Environment and Green Development is responsible for implementing state policies on protection, sustainable use and restoration of degraded forests. The Ministry of Industry and Agriculture is implementing policies related to timber production, the Ministry of Education and Science is managing forest related research work, the State Inspection Agency is monitoring compliance of forest related legislations and the National Emergency Management Agency is responsible for fire management. The amendment made in *Law on Forest of Mongolia* provided citizens with rights to protect and ensure sustainable use of forest resources as a result of which 1,062 communities and 382 economic entities have possessed 2,310,663 ha and 677,737 ha of forested land on the contract basis respectively.

The annual budget allocated to forestry sector is approximately 12.5 billion tugrugs but the income generated from the use of forest by-products is 3 times higher. 10% of total budget in forestry sector is spent for salaries and honorariums, and 90% is expended for forest protection and restoration activities. During 2008-2012, the financing of forestry sector has increased; however, it was still 5 times less from the budget necessary to sustain forest management measures. This becomes a main factor for diminishing forest management capability.

4.6 Rehabilitation of degraded forest

The major issue related to forest management in Mongolia is reforestation, due to complicated conditions. Considering the specific habitat factors existing in Mongolia, sufficient natural regeneration of desired species such as pine and larch cannot be achieved after logging operations and/or fire incidences. The share of non-coniferous species such as birch and aspen gets increased, and some areas may turn into the grassland. Given such situation, artificial planting or sowing of desired species is required to supplement the natural regeneration.

Reforestation activities in Mongolia were commenced in 1971, and total area planted in 1971 was only 67 ha but rate of planting has increased considerably since then. The area planted in 2000 was 9,030 ha. The key planted species were pine (Pinus silvestris), larch (Larix siberica), poplars (Populus spp) and elm (Ulmus macrocarpa and U.pumila). At the end of 2006, the total plantation area was recorded as 117,943 ha. Quality of plantations is generally poor and survival rate of seedlings is reported to be in the range of 30%-60%, but seldom reaches 50%. The main reasons for the poor quality of plantations are as follows:
- Lack of compatibility between the site and species.
- Poor site preparation.
- Poor quality of planting stock (resulting from poor seeds and obsolete nursery technique); inappropriate practices on plantation establishment.
- Lack of post maintenance of the established plantations.
- Inadequate measures of controlling fire, pests and diseases.
- Damages caused by grazing and lack of infrastructure.
- Impacts of harsh climate and funding constraints.

The expenditures related to plantations are minimal and inadequate to grow the successful plantations. Thus, in 1997, the budget allocations for growing 5,001 ha of forest plantations (along with maintenance of plantations established in the previous year) amounted to 196 million MNT or about 39,000 MNT per ha (about US$50/ha at the prevailing exchange rate at that time).

The major issue related to forest management in Mongolia is afforestation (another important issue is fire protection) due to the complicated site conditions. In many cases, forest plantations are becoming an intensive land management activity and an economic investment. Forest plantations can also serve for the site rehabilitation and conservation purposes.

For about 30 years, the Mongolian Government has implemented the program on tree replanting and plantation establishment. The area that was successfully replanted represented only 5%-7 % of the total forest area that was lost due to the low survival rate of seedlings. Currently, 150,000 ha of forest need to be restored. However, only 5,000 ha are being restored annually.

The area planted over the period of 30 years is very small compared to deforestation occurred (1.6 million ha) during the last 25 years, and to the degradation level of the remaining accessible forests. If the area harvested during the period is particularly considered, reforestation rate is still low. MNE assumes that annual planting will increase to 24,000 ha by 2020. Considering that under the present level of technology, the rotation age of coniferous plantations is about 120 years, it would require quite a long time before they start contributing to the wood supply.

4.7 Comprehensive utilization of forest resources and non-timber forest products

At the current time, the specific data on forest-related tourism in Mongolia are not available. However, very rough estimates of forest value for recreation can be extrapolated from the total leisure tourism figures. Around 0.5 million of international arrivals were recorded in 2011, of which 90,000 are stated to be leisure tourists; and average leisure tourist spending within Mongolia is estimated to be US$581 per trip. The length of international leisure tourists' holidays in Mongolia is 16 days averagely, and it is assumed that just under a third, or 5 days, of typical visit is spent in forested landscapes. Based on the share of leisure tourist days spent in forest areas, this translates into a possible annual value of MNT 22.73 billion (US$16.3 million) in direct spending on visits to forested areas. Forest-based leisure tourism may directly support up to 6,000 jobs and generate wage earnings of MNT 18.31 billion (US$ 13.17 million), and make a direct contribution to GDP of MNT 55.26 billion or US$39.73 million (extrapolated from the sector-wide estimates.

Both the United Nations Conference on Trade and Development (UNCTAD) and the World Travel & Tourism Council (WTTC) jointly with MRTT have constructed the tourism satellite which accounts for Mongolia. These consider the wider indirect induced and multiplier effects of the sector of the economy. Based on the contribution of forest recreation to all leisure tourism, the total contribution of the forest-related leisure tourism to GDP may be in excess of MNT 144 billion or USS$103.75 million (extrapolated from the sector-wide estimates in WTTC 2012). This reflects the economic activity generated by industries such as hotels, travel agents, airlines and other passenger transportation services as well as restaurant and leisure industries directly supported by tourists. If the wider effects from investments, the supply chain and induced income impacts are included, forest-related leisure tourism may in total generate up to MNT 48.83 billion (US$35.11 million) in wage earnings, MNT 93.86 billion (US$ 67.48 million) in sales, MNT 28.07 billion (US$20.18 million) in value-added and MNT 17.07 billion (US$ 12.27 million) in capital formation (extrapolated from the sector-wide estimates in UNCTAD 2012).

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Chapter 5 Forestry education and research

In Mongolia, a few universities are majoring in forestry and forest sciences. During the last 3-5 years, Mongolia has been reforming the higher education system, specifically the state owned universities. In some universities, the Forestry, Forest Science and Forest Production Departments have been merged with other natural sciences. The challenges that the forestry-related higher education institutions are facing with include the outdated curriculum design and delivery, lack of networking of those universities, and poor inter-linkages between forestry education and industry. Currently (as of September 2016), the five universities are offering forestry related education in the economy.

5.1 Forestry education

In Mongolia, until 1990, many forestry professionals were trained in Russia, Poland, Bulgaria and Romania. Professional forestry education in Mongolia began in 1985 with 4.5-year B. Sc. and 6-year M. Sc. courses in forestry at the National University of Mongolia (NUM) and in wood industry at the Mongolian Polytechnic University. Darkhan College offers a B. Sc. course in nature protection for a small number of students. Forest engineering graduates from the NUM have averaged 20-30 per year but only about a third of these have entered the forestry and natural resource sector because of very limited job opportunities. In addition, at one time there were as many as 4 sub-professional and 5 technical training schools offering 3-year technical diplomas.

These schools graduated about 20 students a year from 1985 until they were terminated in 1994. In Mongolia, a few universities are majoring in field of Forestry and Forest sciences.

In last 3-5 years, Mongolia has been conducting higher education reform, specifically in the state-owned universities. In some universities, departments related to Forestry, Forest Science and Forest Production are combined with other fields of natural sciences. Further challenges facing forestry-related higher institutes include outdated curriculum design and delivery, lack of network among those universities, and disconnection between forestry education and industry. Now (as of September 2016), five universities offer forestry-related education in the economy.

However, their departments are differently named:
● Department of Environment, Forest Engineering in the National University of Mongolia (DEFE, NUM);
● Department of Ecology, in the Mongolian University of Life Sciences (DE, MULS),
● Darkhan Branch in the Mongolian University of Life Sciences (Darkhan, MULS),
● Department of Wood Processing Technology in the Mongolian University of Science and Technology (DWPT, MUST),

● Department of Horticulture in the International University of Ulaanbaatar (DH, IUU).

In Mongolia, the survey on the national forestry education status was conducted by the National Forestry Education Consortium (NFEC), Mongolia in September and October 2016 based on the questionnaire developed within the Asia and Pacific Forestry Education Coordination Mechanism (AP-FECM). Altogether 5 universities were responded to the questionnaire. This report contains a review of the current forestry education status in Mongolia, and analysis of potential developments and changes related to the forestry education sector.

5.2 Teaching capacity

Among the 5 universities that are offering the forestry education in Mongolia, there are 3 full-time employed Professors. Associate Professors and Lecturers are pre-dominant while 5 Senior and Assistant Lecturers are in all departments (Figure 5-1). During the last ten years, staff graduated from abroad have been increased. The faculty members has obtained PhD degrees from the universities in Republic of Korea, Czech Republic, Russia, USA, Germany and Japan.
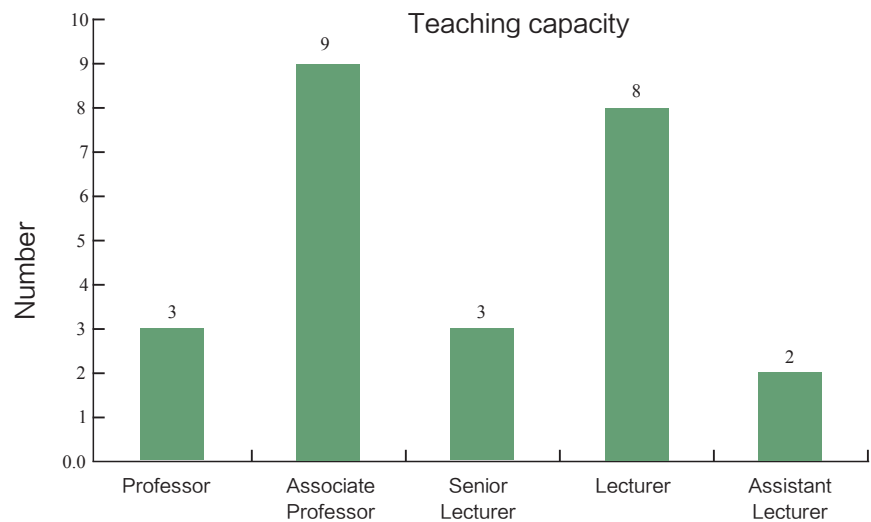

Figure 5-1 Information of faculty members in 5 universities

5.3 Gender ratio

As for the gender ratio of the students in the 5 universities, the male/female ratio of undergraduates and graduates greatly varies in terms of levels of education. Moreover, variation between the universities is very significant (Table 5-1).

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Table 5-1 Gender ratio of undergraduates and graduates

University	Department	Undergraduate		Graduate	
		Male	Female	Male	Female
National University of Mongolia (NUM)	Department of Environment, Forest Engineering (DEFE), NUM	15	21	4	11
Mongolian University of Science and Technology (MUST)	Department of Wood Processing Technology (DWPT), MUST	106	27	7	5
Mongolian University of Life Sciences (MULS)	Department of Ecology (DE), MULS	32	30	7	1
Darkhan Branch, Mongolian University of Life Sciences (MULS)	Darkhan Branch (Darkhan), MULS	16	5	0	0
International University of Ulaanbaatar (IUU)	Department of Horticulture (DH), IUU	25	18	8	7
TOTAL		194	101	26	24

5.4 Undergraduates and graduates

In the 5 universities surveyed, 474 undergraduates were reported in 2005-2006 academic year, 396 in 2010-2011 academic year and 371 in 2015-2016 academic year (Figure 5-2). Among the sampled universities, the doctoral degree was not offered in Darchan Branch of MULS and International University of Ulaanbaatar. IUU has delivered the special programme that focused on short-term courses for the certificate-based training that has significantly increased the number (up to 600) of the certified graduation (Figure 5-3). The study indicated that graduation with Bachelor's degrees is gradually decreasing, and to some extent the graduation with Master's and Ph.D.s is slightly increasing or is constant.
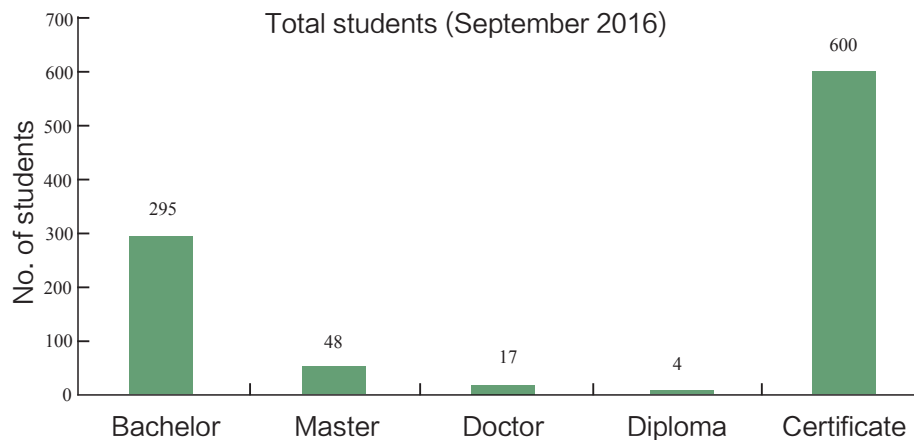
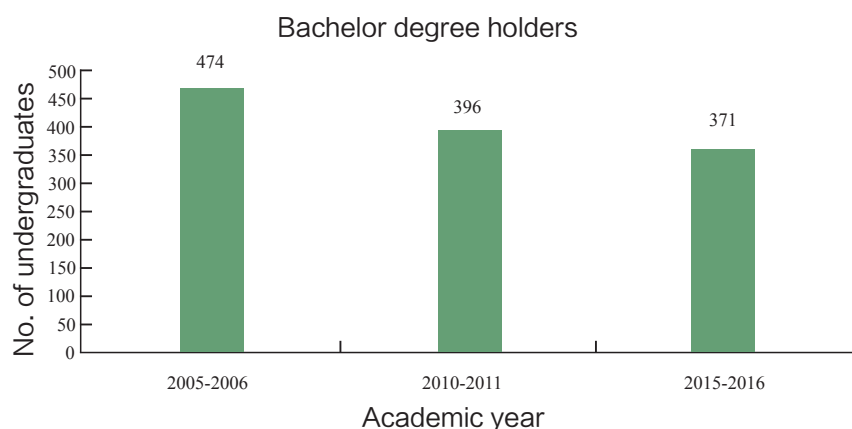**Figure 5-2 Number of undergraduates from the 5 universities**

Bachelor degree holders

Figure 5-3 Total students enrolled in last 10 years in the 5 universities

5.5 Employment

The survey also indicated that forestry employment in Mongolia is largely dominated by the public sector. Although the structure of job market varies across the economy, the chances for the PhD and MSc degree holders are higher than that for the Bachelor degree holders (Table 5-2). The traditional forestry jobs such as the forestry positions in forest departments, forest enterprises, research and education are dominated. Non-traditional jobs in the public sector, for example, dealing with the environmental issues, national parks, community development and NGOs, are also available for foresters, and seem to be increasing in terms of their importance.

Table 5-2 Employment rate of undergraduates and graduates

Year	PhD		MSc		Bachelor	
	No. of graduates	Employment number	No. of graduates	Employment number	No. of undergraduates	No. of graduates
2015	2	2	8	8	168	118
2010	5	5	18	18	54	38
2005	3	3	6	6	59	40

5.6 Priority needs

The priority needs most frequently reported from the 5 universities were:
- Curriculum development and enabled credit exchange mechanism between the universities.
- Improvement of teaching and support staff via exchange programme of AP-FECM.
- Improvement of facilities.
- Budget improvement.

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5.7 Conclusion

The roles of forestry sector are changing in Mongolia, because of recent socio-economic changes and unstable government institutional structure and these changes are being incorporated in curricula. Yet curriculum development remains the highest priority for forestry education institutions and demands further support from governments, donors and education specialists. Job opportunities for forestry graduates in a job market are still dominated by public sector. However, if well-managed, there are some opportunities in community-based forestry sector.
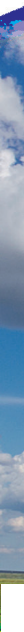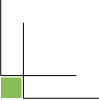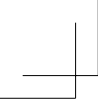
Chapter 6   Forestry projects and initiatives

In Mongolia**,** there are about 27 programs and projects registered at MNET, which are related to the natural resource and environmental issues.

Two of them are related to sustainable managements of natural resources:

- Biodiversity and Adaptation of the Key Forest Ecosystems to Climate Change: This programme combines national-level policy advice on climate, biodiversity and environment, with technical and organizational innovations at the regional level in Aimags and Soums. At the local level, the programme aims directly at the forest concession holders and user groups.
- Mongolian Network of Managed Resource Protected Areas: this project supports development of a comprehensive set of regulations to transform the LPAs into the "Community Conservation Areas" (CCAs) for ensuring a pathway to safeguard the currently vulnerable habitats for a number of globally significant and threatened species (e.g., argali, white-naped crane and Mongolian gazelle) outside of the existing PA system. Efforts will be directed towards empowering rural communities to alleviate conservation threats, and mitigating the negative impacts of wildlife harvesting, grazing and agriculture, habitat conversion and infrastructure development, and climate change. The project goal is to ensure the integrity of Mongolian diverse ecosystems for securing viability of the nation's globally significant biodiversity. The project objective is to catalyze the strategic expansion of Mongolian protected area (PA) system through establishing network of the CCAs through covering the under-represented terrestrial ecosystems.

The six projects and programmes are related to the national forest policy and forest management:

- REDD+National Forest Inventory Mongolia.
- The "Green Belt" Mongolian and Korean Joint Project: The project duration is 10 years (2007-2016) and it is aimed at planting trees at 300 ha in the Gobi Desert. The Korean Forest Service and MNET have joined hands to prevent desertification and mitigate impacts of dust and sand storms. Currently, the area of over 1,500 ha was covered by the project activities. Capacity building and joint research programmes are underway.
- Sustainable Forest Management to Improve Livelihood of Local Communities: ADB is proposed to support the government in achieving the overarching strategic goal of ensuring the inclusive and environmentally sustainable growth, and in particular, to help Mongolia in adapting to climate change impacts by supporting efficient use and sustainable management of natural resources. Moreover, it contributes to implementation of the ADB's Strategy on 2020s drivers of change, private sector development, gender equity, and partnerships, including cooperation with the civil society. The proposed technical assessment is included into the economy's operations business plan (2014 – 2016). The expected impact of the technical assessment would be sustainable livelihood and increased resilience of forest ecosystems. The outcome is the SFM practices developed and

implemented in the five North-Eastern soums.

- Mainstreaming biodiversity conservation, sustainable forest management and carbon sink enhancement into Mongolian productive forest landscapes: This project is supported and funded by GEF. The SFM in Mongolian forest landscape secures the flow of multiple ecosystem services and benefits, including biological diversity, reduced degradation, and carbon storage, while enhancing resilience to climate change. Implementing Agency is FAO and executing agencies are FRDC and MNET.

- Development of forests and gene pool of local forest tree ecotypes in Mongolia (2015 – 2017): It is a part of the international development cooperation with the Czech Republic and MNET.

- UN-REDD+ Program. In June 2011, Mongolia has become a partner economy of the UN-REDD+ Programme, and it has quickly undertaken the steps to start implementing REDD+ Readiness activities. A roadmap indicates how Mongolia could implement its REDD+ Readiness activities and develop a comprehensive National REDD+ Strategy in Phase 1 of REDD+.

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Chapter 7 International forestry cooperation mechanisms

During the recent years, Mongolia has joined 14 environment-related UN conventions and treaties, including the UNFCCC. Since 1992, the Parliament had passed several laws and regulations on environmental protection such as *Law on Environmental Protection* (1995, amended in 2007), *Water Law* (2004), *Forest Law* (2012, last amended in 2013), *Law on Air* (1995, amended in 2012), *Energy Law* (2001) and *Disaster Prevention Law* (2003). The government has also introduced a number of action plans, including the Mongolian Environmental Action Plan, Mongolian Action Programme for the 21st Century (MAP 21), and National Action Plan to Combat Desertification, National Biodiversity Action Plan, Action Programme to Protect Air Quality, and National Action Programme to Protect the Ozone Layer. MAP 21 includes the concrete considerations and recommendations related to adaptation to climate change and mitigation of GHGs emission. The *Law on Air Quality* and *Law on Environmental Protection* are also the central legal instruments for the climate change related issues.

In 2011, Mongolia became the partner economy of the UN-REDD+ Programme. Since then, FAO and UNDP have assisted the Government in developing the National REDD+ Readiness Roadmap. The Roadmap was prepared by the taskforce (20 members), and includes the broad range of representatives from various government agencies, private sector and civil society. In July 2014, Mongolian REDD+ Readiness Roadmap was completed and endorsed by the stakeholders. As a result, Mongolia has the first boreal forest National Programme to be funded by the UN-REDD+ Programme.

The projects REDD+ National Forest Inventory in Mongolia (2014-2016) and Biodiversity and adaptation of the key forest ecosystems to climate change II (2015-2018) are commissioned by GIZ and led by the Ministry of Environment and Tourism (MET).

Since 2012, Mongolia has been working on achieving sustainable development while reducing greenhouse gas emissions and adapting to climate change. In its Green Development Policy, the Mongolian Government develops the specific climate protection measures leading to the improved forest management systems. This will have a positive effect on carbon enhancement and carbon sink functions of the forests. One of the essential prerequisites is the national forest monitoring system that is required for collecting basic data on conservation and sustainable management of forest resources. This data will also underpin the each economy's forest-related climate change reporting to the United Nations Framework Convention on Climate Change (UNFCCC).

The shortage of resources and lack of clarity regarding the allocation of responsibilities between the Ministry of Environment and Tourism (MET) and Ministry of Mining and Heavy Industry hinder the efficient implementation of the SFM and conservation measures. There is also insufficient availability of basic data required for supporting conservation and

management approaches, and/or for the reporting required by the REDD+ mechanism. The project has provided advice on Mongolian forest-related climate change reporting.

At the national level, the National Forest Inventory (NFI) has provided the reliable information on forest developments under climate change impacts. This helps to establish the long-term silvicultural and adaptation strategies.

Based on the results of the NFI, the project contributes to development of silvicultural guidelines and improvement of forest planning procedures. These will be used as a basis for decision-making and as instruments for managing and monitoring the forest enterprises and concessions.

The NFI is compatible with REDD+ and is maintained on the permanent basis. Analysis and results of the inventory are summarized in the National Forest Resource report. For the Ministry of Environment, the inventory results form the basis for elaboration of technical and political models on implementation of the SFM in the context of REDD+.

This project is working on developing the concept and guidelines on silviculture, and on planning of forest concessions. New forestry and planning procedures are derived from NFI, and will be integrated into the forestry education activities. NFI will be promoted as the key requirement for transition from the demand-driven forest utilization to the longer-term, production-oriented, and climate-friendly forest management.

The project on adaptation of the key forest ecosystems to climate change II (2015-2018) is for conservation of biodiversity in Mongolia. It is of the global significance and covers the pristine vegetation zones. However, fauna and flora are acutely threatened. Species and habitat loss, deforestation and forest destruction as well as the largely unregulated overuse of the common pasture areas have resulted in the complex situation with the vulnerability that poses the growing threats to existence of the entire ecosystems.

The main root causes of this situation include rural poverty, lack of knowledge and resources. The current conservation practices and management of biodiversity and ecosystems still adhere to the planned economy principles; and this is particularly true in the case of forest management.

The adverse impacts of climate change that are already comparatively strong in Mongolia will further aggravate the situation. The impacts include rising temperatures and declining precipitation, increased incidence of extreme weather events and decrease of ecosystem capacities. The tried-and-tested strategies are available to stakeholders in the Mongolian forestry sector for implementation of sustainable use of forest ecosystems and conservation of their biodiversity. The stakeholders apply these strategies.

Chapter 8 Challenges and opportunities for forestry development

The main challenge for forestry development is to enhance financing for the SFM.

Building diversified portfolios which better reflect the full range of goods and services associated with the forest sector is key to enhancing long-term sustainable financing for the SFM, and increasing the effectiveness and impacts of forest funding. Another aspect of financial diversification is to extend funding towards non-traditional activities and approaches which will allow a much wider range of values to be generated by forests, and a more diverse group of stakeholders to become engaged in and benefit from their management. The other is to find new ways of capturing these broader values as concrete investments and financing flows for Sustainable Forest Management.

To these ends, ten financing instruments and policy recommendations are suggested which can be used to mobilize additional funding for the SFM, and increase financing effectiveness and impacts:
- Incorporate forests into the spending of other sectors;
- Combine sectoral values into forest management budgets;
- Create payments for forest ecosystem services;
- Present forest biodiversity to offset funding arrangements;
- Develop value-added from sustainable forest product markets;
- Organize credit and investment capital for the SFM;
- Make enabling incentives for the SFM;
- Rationalize forest sector fees and cost norms;
- Improve earmarking and retention of forest funds;
- Harmonize financial and management planning.

The creation of a forestry extension program is one important issue for the SFM in Mongolia. In this case, the following activities are recommended by the experts:
- Develop forestry extension programs including preliminary organizations at local level with forestry extension officers and forestry extension assistants;
- Identify forest extension approaches, activities, methods and field procedures which extension staff can apply to convert programs and plans into effective action;
- Make assessment of forestry extension needs and identify problems and priorities;
- Choose the type of forestry extension;
- Provide information and education; organize awareness campaigns and promote mass media and group media among local people;
- Start forestry extension research, specially extension-oriented inter-disciplinary research;
- Conduct research on agro-forestry and silvopastoral systems for the production of dry season fodder for domestic livestock.

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