ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY II

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MONGOLIA FORESTRY OUTLOOK STUDY

by

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Contents

INFORMATION NOTE ON THE ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY

The Asia-Pacific Forestry Sector Outlook Study (APFSOS) is a wide-ranging initiative to gather information on, and examine, the evolution of key forestry issues as well as to review important trends in forests and forestry. The main purpose of the study is to provide a better understanding of the changing relationships between society and forests and thus to facilitate timely policy reviews and reforms in national forest sectors. The specific objectives are to:

1. Identify emerging socio-economic changes impacting on forest and forestry
2. Analyze probable scenarios for forestry developments to 2020
3. Identify priorities and strategies to address emerging opportunities and challenges

The first APFSOS was completed in 1998, with an outlook horizon to 2010. During its twenty-first session, held in Dehradun, India, in April 2006, the Asia-Pacific Forestry Commission (APFC) resolved to update the outlook extending the horizon to 2020. The study commenced in October 2006 and is expected to be completed by September 2009.

The study has been coordinated by the Food and Agriculture Organization of the United Nations (FAO), through its regional office in Bangkok and its headquarters in Rome, and implemented in close partnership with APFC member countries with support from a number of international and regional agencies. The Asian Development Bank (ADB), the International Tropical Timber Organization (ITTO), and the United Kingdom's Department for International Development (DFID) provided substantial financial support to implement the study. Partnerships with the Asia-Pacific Association of Forest Research Institutes (APAFRI) and the Secretariat of the Pacific Community (SPC) supported the organizing and implementing of national focal points' workshops and other activities, which have been crucial to the success of this initiative. The contributions of many other individuals and institutions are gratefully acknowledged in the main APFSOS report.

Working papers have been contributed or commissioned on a wide range of topics. These fall under the following categories: country profiles, sub-regional studies and thematic studies. Working papers have been prepared by individual authors or groups of authors and represent their personal views and perspectives; therefore, opinions expressed do not necessarily reflect the views of their employers, the governments of the APFC member countries or of FAO. Material from these working papers has been extracted and combined with information from a wide range of additional sources to produce the main regional outlook report.

In general, working papers are moderately edited for style and clarity and are formatted to provide a measure of uniformity, but otherwise remain the work of the authors. However in this case the contents have been heavily edited; while all care has been taken, some errors may have been introduced as a result of editing and interpretation. Copies of these working papers, as well as more information on the Asia-Pacific Forestry Sector Study, can be obtained from:

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Preface

This study was carried out with technical and financial support from the FAO Regional Office for Asia and the Pacific according to a Letter of Agreement (LOA) signed between the Ministry for the Nature and the Environment of Mongolia by Dr. Ts. Shiirevdamba and the FAO Regional Office for Asia and the Pacific by Assistant Director-General and Regional Representative Mr. He Changchui.

A Mongolian forestry sector outlook study writing team and national consulting group were organized according to the LOA.

The main findings of the national outlook study were discussed at a National Stakeholders' Workshop, held on Thursday, 9 August, 2007, at the Continental Hotel, Ulaanbaatar, Mongolia. A briefing on "Mongolia forestry sector outlook study: the future of Mongolian forests" was presented by Dr. Hijaba Ykhanbai at the international conference on "The Future of Forests in Asia and the Pacific" organized by FAO, and held in Chiang Mai, Thailand, on 18-19 October, 2007.

The Mongolian forestry sector outlook writing team and national focal point thank Mr. Patrick Durst and Mr. Chris Brown of FAO for their valuable recommendations and comments.

EXECUTIVE SUMMARY

Mongolia is a forest-poor country (at the end of 2006, forests covered about 8.14 percent of Mongolia). The forests contain more than 600 species of medicinal herbs, and about 400 species of food and other herbs. Forest fires annually damage an average of about 500 000 hectares of forests. The area of forests adversely affected by insects, in 2006, totaled 600 000 hectares. Forest insects in Mongolia comprise 7 groups, 56 families, 168 types and 315 species.

The forest industry share of the GNP is currently 0.26 percent, compared with 4.1 percent in 1990. Each year about 1 million m^3 of timber are cut illegally. Illegal logging in Mongolia can be broadly divided into three types: (i) securing basic subsistence needs; (ii) enhancing livelihoods; and (iii) commercializing illegal logging (WB 2006). Animal grazing on the edges of forest areas often exceeds ecological carrying-capacities and negatively impacts on forest regeneration.

Annually 6 000-8 000 hectares are reforested by state and private companies. Also "Green Wall" forest belts are being constructed on about 500 000 hectares. The government's "Green Wall" programme was approved in 2005 and implementation has been carried out in subsequent years. Management structures in the forest sector are regarded as being presently inadequate to meet objectives; and the policy and legal situation, while improving, is not yet fully comprehensive.

Drivers of change and their direct and indirect impacts

Four major types of drivers of change are likely to affect forests in Mongolia:

1. Institutional, legal and structural changes
2. Climate change and desertification
3. Economic development and population growth
4. Community-based forest resource management

Institutional, legal and structural changes

A new Forest Law was approved in August 2007 and, accordingly, about 20 new rules and procedures will be adopted. Nationally, a new forestry agency will be established. In Ulaanbaatar and in *Aimak* (administrative units in provinces), forest bureaus will be established. In *Sum* (administrative units in districts), new forestry divisions will be organized.

Small- and medium-sized businesses are increasing throughout Mongolia. Private sector participation measured by contribution to the GDP increased from zero in 1990 to 70 percent in 2007. However, external assistance and close cooperation with other countries and international agencies remain important for Mongolia.

Climate change and desertification

During the past 10 years, Mongolia's arid area has extended by 3.4 percent.

Economic development and population growth

Higher economic growth is expected during the next several decades. The annual growth rate of GDP was 9.1 percent in 2006.

Community-based forest resource management

New community-based natural resource management procedures were approved by the Ministry of Nature and the Environment in May 2006. These procedures, in tandem with the new Forest Law, allow allocation of forests and other natural resources to communities.

Probable development scenarios

Five scenarios that may influence forestry development are considered:

1. National and local structures for management of forest resources will be built and strengthened and communities will lease most forest resources by 2021.
2. Due to climate change and desertification, forest fires and insect infestations may be increased, if capacities are not improved.
3. Illegal logging will be reduced and forest harvesting under forest management plans will increase two- or three-fold by 2020.
4. The extent and efficiency of reforestation and Green Wall construction will increase.
5. The number of goats in animal herd structures will be optimized at less than 31 percent (currently 45 percent).

What is likely to happen to forests and forestry in 2020?

By 2021, 1-2 percent of forests are expected to be under private ownership, and more than 50 percent of forest area will allocated to – and managed by – communities and companies under community management contracts. The area of forest cover may be increased and forest health will be improved.

A new forest policy will emphasize decreased consumption of domestic wood and increased imports of wood. Wood use for railways and electric power stations will be reduced.

Demand for timber will increase by a factor of 2-2.5 by 2021 and will total 1 million-1.8 million m^3. The majority of this demand (50-60 percent) is planned to be supplied (under the Forest Management Plan) by cleaning (especially thinning) operations in forests.

Priorities and strategies

The overall objective is to implement economic policies with an ecological orientation in order to protect forests, ensure sound use, restore forest resources, and reduce processes of desertification and overgrazing – and to increase citizen's participation in forest resource management.

- Objective 1: In the framework of strategic middle-term objectives – to improve forest resource management; set up and test new management structures to improve efficiency of forest use, protection and restoration
- Objective 2: To implement advanced forest management and sound use technology
- Objective 3: To ensure sound management on the basic of community-based forest management and community-based natural resource management approaches (2007-2021)
- Objective 4: To establish a connected and complete system of management capacity (2015-medium, 2021-higher level) with permanent installed capacities to protect against fire and harmful insects and diseases

- Objective 5: To build a "Park of Industry and Technology", and to start implementation of an activity to build a "Complex of Industry Processing Timber" using new and progressive techniques and technology

Impacts: The current level of forest resource depletion will be arrested and the current level of spending on forests and forest management (2 billion TUG[2]) will be increased by 2-3 times in 2021. Improved forest management will be reflected in green GDP accounting and incorporated in macroeconomic arrangements.

Wood production will increase and the forestry sector's contribution to the national economy will reach 2-3 percent of the GDP. The quality of wood products produced will be close to international standards.

[2] Exchange rate May 2008: US$1 = TUG 1 164.

1. CURRENT STATUS OF FORESTS AND FORESTRY INCLUDING KEY ISSUES

Mongolia is a forest-poor country (at the end of 2006 forest cover area was about 8.14 percent). Mongolia has a total land area of 157 million hectares (FAO 2006). Forest reserve lands comprise 18.3 million hectares, with 12.9 million hectares of forest-covered area; this includes 10.5 million hectares of coniferous and hardwood forests, which is equivalent to 67 percent of the forest reserve. The country spans the major transition zone between the deserts of Central Asia and the boreal taiga of Siberia, which comprises six broad bio-geoclimatic zones. The climatic zones are desert, desert steppe, steppe, forest steppe, boreal forest and mountain. The forest steppe, boreal forest and mountain zones all exhibit varying depths and distributions of permafrost.

Mongolia's northern forests – excluding saxual and other shrubs and brush in the south – extend over 11.5 million hectares, of which 10.4 million hectares are considered to be fairly intact (> 30 percent crown closure) and 1.1 million hectares are considered depleted. Until recently, most forestry data were compiled using representative sampling techniques, with detailed surveys of some areas produced as needed for specific enterprises. A comprehensive survey by political divisions (*Aimak, Sum*) has been ongoing since 1996, but the results of this study have yet to be released. Although the Mongolian law on forests requires a complete survey of the nation's forest resources to be conducted every 10 years, current capacities and spending level would allow for such surveys to be completed on average only once every 23 years (MNE 2002).

The forested areas of Mongolia can be divided into two broad types: the northern coniferous forests of the forest steppe, boreal forest and mountain zones, and saxaul forests of the southern desert and desert steppe. Mongolia's principal tree species are *Larix sibirica, Pinus sylvestris, Pinus cembra*, *Picea obovata* and *Betula* spp.

All forests and land in Mongolia are state-owned. The Ministry of Nature and Environment (MNE) has the overall responsibility for the management of forests. The *Aimak* and *Sum* governors are responsible for forest management at local levels.

The main objective of forest resource management is to protect and develop the existing forests of Mongolia so that they make maximum contributions to soil and watershed protection, and conservation of existing ecosystems. At the same time, the forests are expected to produce, on a sustainable basis, increased volumes of industrial wood, fuel wood and minor forest products for the needs of people, and earn foreign currency through the export of wood products. The proper management and utilization of forests would create employment and income for people in less-developed parts of the country.

Table 1. Forest resources and forest type: 1956-2007 (ha)

	1956	1990	1995	2007
Total	**10 414.6**	**15 218.6**	**17 516.2**	**19 286.7**
Natural forest	9 609.2	13 693.7	12 251.2	12 674.9
Others:				
Sparse forest	-	359.6	2 796.3	3 020.3
Burnt forest	216.6	199.7	194.8	587.8
Harvested area	14.8	9.8	176.3	201.6
Area to be reforested	394.8	70.4	254.5	422.3
Non-forest area	-	665.6	1 382.6	1 770.8

Table 2. Changes in forest area by type (2007) compared with 1990 (ha)

Years	Natural forest	Shrubs	Sparse forest	Burned forest	Timber harvested forest	Area to be reforested	Non-forest covered area
1990	13 693.7	219.8	359.6	199.7	9.8	70.4	665.6
2007	12 674.7	608.2	3 020.3	587.8	201.6	422.3	1 770.8
Changes	-1 019	+388.4	+2 660.7	+388.1	+191.8	+351.9	+1 105.2

In 2007, natural forest area had declined in comparison with 1990 by a total of 1 019 hectares. However, in the same period forest area under shrubs increased by 388.4 hectares, sparse forest area increased by 2 660.7 hectares, burned forest by 388.1 hectares and timber harvested area by 191.8 hectares.

Table 3. Growing stock of the 10 most common species

FRA 2010 category/species name			Growing stock in forest (million m^3)		
Rank	**Scientific name**	**Common name**	**1990**	**2000**	**2005**
1	*Larix sibirica*	Siberian larch	1 123.7	1 043.0	10 330
2	*Pinus sibirica*	Siberian pine	180.6	167.7	150.5
3	*Pinus sylvestris*	Scots pine	99.9	92.8	97.0
4	*Betula platyphylaa*	Betula	90.6	84.0	89.4
5	*Picea obovata*	Siberian spruce	4.0	3.7	3.7
6	*Populus spp*	Poplar	3.8	3.5	3.3
7	*Salix berberifolia*	Willow	1.0	0.9	0.6
8	*Abies sibirica*	Siberian fir	0.4	0.4	0.4
9	Name of 9th most common species		n.a.	n.a.	
10	Name of 10th most common species		n.a.	n.a	
Remaining					
TOTAL			**1 504**	**1 396**	**1 379**

Global warming, climate change and negative human activities are expected to directly and negatively influence Mongolia's forest resource area and quality. Without interventions, existing natural forest areas will likely be degraded to sparse and scattered forest.

Between 1990 and 2007, areas of sparse forest and harvested forests increased 10- or 20-fold. The area of burned forest trebled. In general, the increasing areas of scattered forest, burned forest and cut forest provide evidence that unauthorized influences are continually increasing.

Climatic influences, especially reduced precipitation over the past 20 years, have increased susceptibility to forest fires. Fire risk is high approximately 75 percent of the time, and 80 percent of fires are caused by careless human activities.

A number of negative influences have also promoted increased incidence of forest fire, especially degrading of forest quality, including degraded species composition, damage by insect infestations and deteriorating forest soils. To protect forest against fire, early-warning systems need to be developed to enable rapid responses to enable fires to be extinguished before they become serious.

Approximately 40 percent of Mongolia's forests are already suffering from degradation as a result of detrmental human activities, insect damage and fire. For example, around 50 000 hectares of saxaul forests – known in Mongolia as "zag" (*Haloxylon ammodendron*) a desert plant – have been heavily degraded or destroyed due to over-harvesting. In dryland *Aimak*, S*um*, and *Bagh* (administrative unit, sub-district) woody plants, shrubs and switch plants on common lands are often overexploited for firewood.

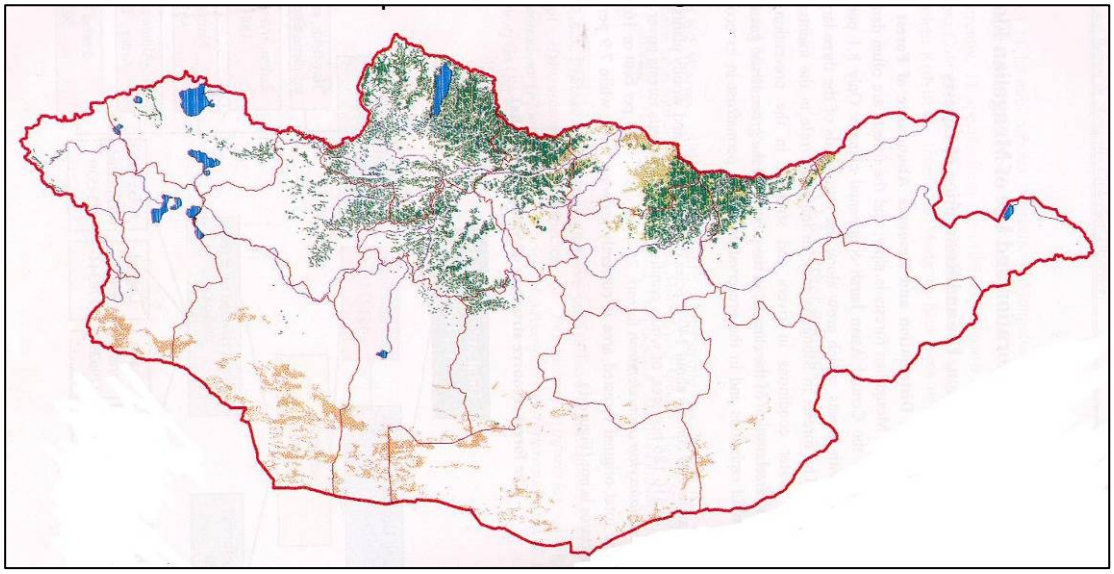


Figure 1. Forest cover map (green patches show forest locations)

Figure 1 shows forest resource locations in Mongolia. Forest resources are not evenly distributed with most forests in the north, while the south and west mainly comprise steppe and desert ecosystems.

Non-wood forest product resources

Mongolia has registered more than 600 species of medicinal herbs, more than 1 000 species of nutritional herbs, over 200 species of herbs for food and more than 200 species of technical herbs. Most of these herbs are found in forests.

A list of the major non-wood forest products and uses in Mongolia includes:

- Fruits and nuts
- Cones
- Mushrooms
- Medicinal herbs, raw materials
- Herbs for food
- Other herbs, raw materials
- Wild animals
- Bark for various uses
- Saps and pitches (tapped)
- Animal grazing
- Hay making

Desertification and drought

Mongolia's location, at the heart of Central Asia, as a landlocked continental country with low precipitation and average elevation of 1 580 metres above sea level, makes it susceptible to desertification. The Gobi Desert region constitutes 42.5 percent of the country's territory.

Mongolia is characterized by highly fragile landscapes. It is an arid region due to its geographical location, topography and ecological systems and it has been affected by desertification processes over time.

Over the past 60 years, the annual average air temperature in Mongolia has increased by 1.56 degrees Celsius. The increase is attributed to global warming and climate change. Surveys show that droughts that encompass 25 percent of the country's territory occur with a frequency of 2-3 years; droughts encompassing 50 percent of the territory happen every 4-5 years. In comparison with the 1960s, dust storms on the steppes and in the Gobi Desert region are now 3-4 times more frequent.

Intensification of the desertification process in the wake of climate change has resulted in perpetual snow melting, drying up of lakes, rivers and streams, a sharp decline in the yield of pastures, salinization of soil and water, soil erosion, land degradation, loss in fertility, acceleration of sand migration and movement and an increase in the frequency of natural disasters.

In addition to natural factors, multifaceted anthropogenic impacts have also added to the desertification process. In the last 10 years Mongolia's arid area has extended by 3.4 percent, with:

- The area of lands affected by desertification impacts extending by 5.4 percent
- Seriously desertified areas extended by 1.8 percent

As a whole, desertification has been increasing seriously in the Gobi Desert region.

In 1974 a national forest inventory was completed. In the intervening period of 30 years, 953 400 hectares of forests were degraded.

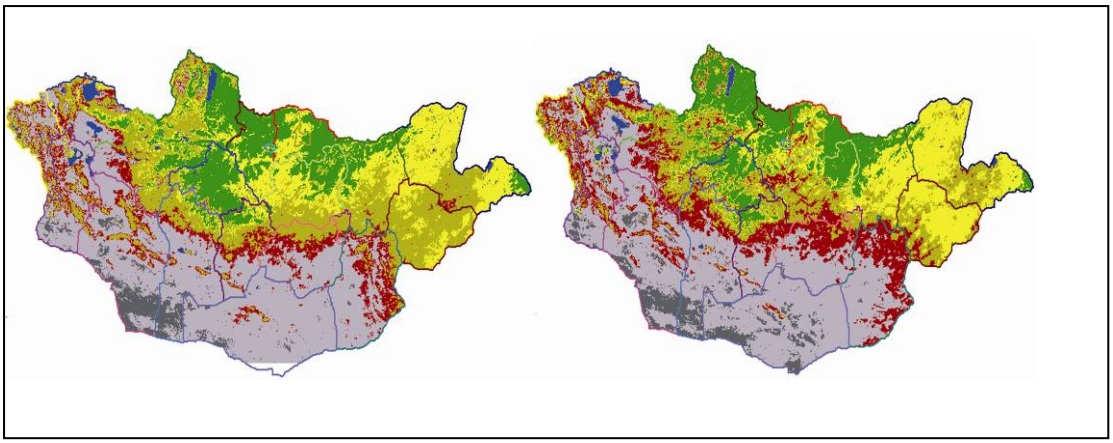


Figure 2. Desertification changes over the past 30 years (1974 and 2004)

Forest fires

An important factor that impacts negatively on forest ecosystems in Mongolia is forest fire. Since 1990, 6.47 million hectares have been damaged by forest fire.

The frequent fires damage and destroy newly planted forest areas, have adverse effects on river flows and generate forest soil erosion. Increasing forest degradation is increasing the potential and likelihood of forest fires.

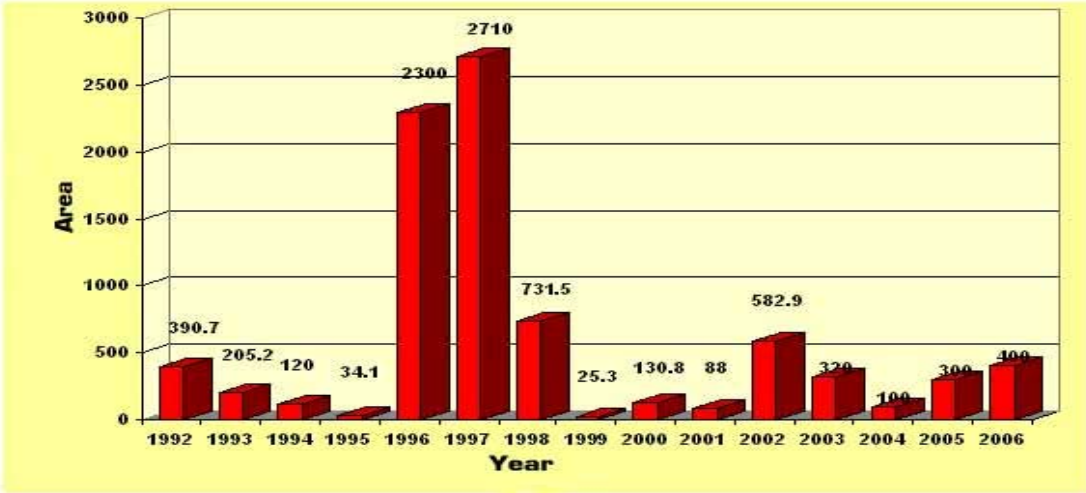


Figure 3. Area affected by forest fires, 1992-2006

Insects harmful to forests

A combination of factors, led by forest fires and creation of young and new growth forests are increasing vulnerability to infestations by harmful forest insects. Forest insects in Mongolia comprise 7 groups, 56 families, 168 types and 315 species. Insects that eat leaves, needles, stems and bark are causing increasing damage in Mongolian forests. The most damaging insects include (pers. comm. Dr. Dugarjav, 2007):

- Siberian silk moth (*Dendrolimus superans sibiricus*)
- Gypsy moth (*Ocneria dispar* or *Lymantria dispar*)
- Looper moth (*Erannis jacobsoni* Diak)
- Vapourer moth (*Orgyia antiqua* Linn.)
- *Descarpenthriesina variolosa* L.

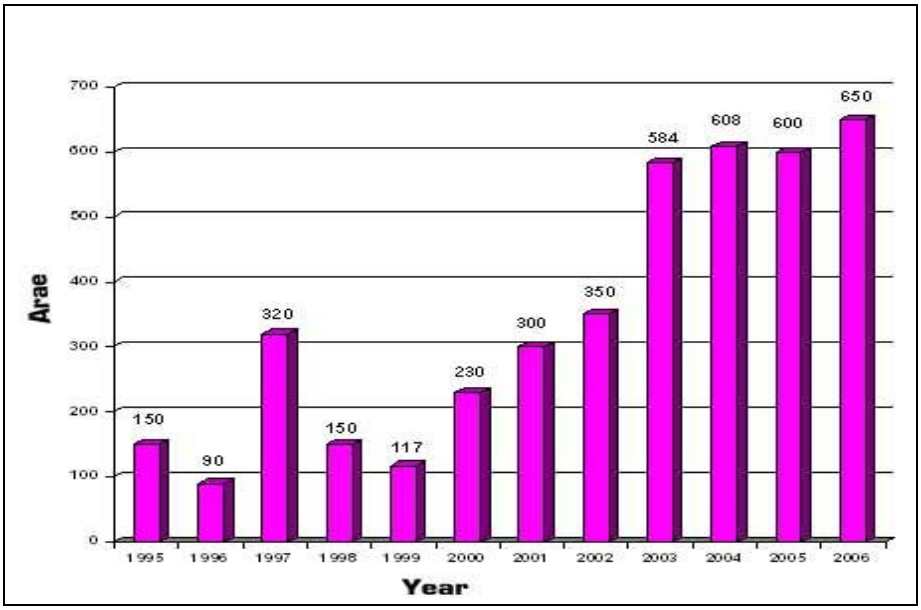


Figure 4. Areas affected by harmful forest insects, 1995-2006 (in ha)

2. TIMBER INDUSTRY SECTOR

The history of industrial development in Mongolia records that the forest and woodworking industry was officially established in 1924, one of the first industries to so commence, and has been operating for 84 years up to 2008. Mongolia's forest resources have been utilized for a wide variety of purposes; these include providing household needs, as well as those in industrial sectors such as construction, energy, mining and agriculture. Between 1940 and 2002, 45 million m^3 of timber had been cut from over 320 000 hectares of Mongolia's forests.

In recent years, increasing negative effects on natural forest ecosystems especially due to forest fires, spread of forest pests and diseases, and various other reasons including human influences, have been recognized. At the same time, the amount of wood available to meet demands is declining, while demands by households and industry are increasing. The government has recognized that wood imports are necessary to meet supply shortfalls, and to discourage illegal logging. Hence customs duties on some types of wood and timber imports have been removed.

According to the latest data, wood and timber-related imports totalled US$4.422 million in 2004, increasing by US$515 000 to US$4.937 million in 2005. The closest source of timber imports is the Russian Federation. However, log export duties imposed by that country restrict, and are likely to increasingly constrain, wood imports from the Russian Federation. There is, consequently, a need to increase production of wood, but using better management and better technology to ensure resources are efficiently utilized.

At present, Mongolia consumes about 180 000 m^3 of sawn timber each year, of which 38 percent is manufactured locally, 17 percent is imported from Europe and 45 percent is imported from Asian countries.

In the timber processing sector, there are more than 100 small enterprises and 40 incorporated companies, totalling more than 150 small- and medium-sized processing facilities employing over 4 000 workers. More than 90 of these companies are located in the countryside while more than 40 are in Ulaanbaatar.

In the woodworking sector, there is a proposal to encourage use of higher technology to minimize waste, improve raw material utilization, increase production of remanufactured and finished products and develop a competitive industry that can compete against – and minimize the need for – imports.

Some important trends that have been observed in the wood processing industry include a significant reduction in production of sawn timber in recent years but increases in the quantity of finished wood products being produced, especially products that are subject to value-added tax.

The principal areas influencing market demand in recent years are growth in the construction sector, with especially high demand for wooden doors and window frames. Demand in 2007 was more than double the levels in 2006. This increased demand has constrained Mongolia's capacity to export remanufactured and processed wood products. In 2004, the value of Mongolia's wood exports was US$1.1873 million, but this declined to US$1.0995 million in 2005.

Production decrease in the forest industry

The forest industries' share in the GNP has declined during the past 20 years. At present, the forest industry contribution to the GNP is TUG5-6 billion (0.13 percent of the GNP), and the wood processing sector contributes TUG4-5 billion (0.12 percent of the GNP). The total forestry sector contribution to the GNP is 0.26 percent, compared with 4.1 percent in 1990.

Forest product supply

Mongolia's forest resources are used extensively to support household demands for wood and to meet demands for wood from economic sectors, especially the construction, energy, mining and agricultural sectors. In recent times, more-and-more people and entrepreneurs have been recognizing the potential uses, advantages and efficiencies of wood, and demands have been increasing year by year.

Forest research centres and forest scientists estimate "allowable cuts" to be harvested from the forest resource each year. These estimates have been based on assessments of Mongolia's climate and environment to provide water protection and ecological balance, and prevent adverse effects on forest reserves.

Research over the past 20 years shows that the major cause of forest destruction in Mongolia is forest fire. On average, each year, 270 000 hectares of forests are destroyed by fire and 70 000 hectares of forests are seriously damaged by harmful insects.

During the last few years, the allowable cut has been reduced rapidly, because of severe impacts on forest ecology, especially increasing damage by fires, insect diffusion and other factors.

Shortages of quality wood to supply domestic households' and manufacturers' demands have focused the government's attention on importing wood and wooden products. Wooden materials have been exempt from import tax since 2005.

Government measures to support and regulate the timber industry

Modern wood processing equipment imported into Mongolia by incorporated members of the timber industry, for the purpose of improving woodworking processes and wood utilization, is exempt from customs duty and value-added tax.

To ensure the proper development of the forest sector, the government has implemented two forestry-specific programmes to be implemented in stages up to 2015:

1. *Measures pertaining to recovery of the timber and forest industry, employment and social issues of village people* was established by the State *Great Khural* (Parliament) in 2000.
2. The *National program pertaining to forest* was approved by Order 248 of the government in 2002.

Within the implementation framework for the programmes, the Industry and Trade Ministry will concentrate on issues such as: improving technical levels of woodworking processes by using better techniques and technology, utilization without waste, and improving product quality and diversity. The Ministry of Industry and Trade is implementing policy and coordination measures to support these activities.

The programmes are being implemented with due regard for the environment, with the objective being to ensure raw material is processed without wastage, while supporting and developing small- and middle-scale industries that will be equipped with new techniques and high-level technology. The measures are designed to help meet domestic demand for wood and wood products in an environmentally-friendly manner, while also developing a competitive wood product exporting industry.

An *Agency to advise small and medium-scale industries* has been established to implement joint technical activities supported by the governments of Mongolia and the Federal Republic of Germany. The agency's activities include organization of industry and technology training for timber industries, identifying potential markets for Mongolian wood products, improving the marketing of wood products, improving product quality, and improving the competitiveness of Mongolian wood products.

The following objectives have been implemented in order to achieve programme goals:

- Create an appropriate environment to improve levels of wood production, to introduce effective technology, and to increase the growth of production, profits and productivity
- Transfer forest ownership rights by contract to high technology enterprises that are working on increasing wood production through reforestation and forest conservation activities
- Establish a training and technical centre to conduct short- and long-term training in order to train, retrain and enable specialization of professional forestry workers
- Implement projects to develop production technologies, and improve production techniques by increasing cooperation with foreign countries and international organizations
- Take measures to achieve international standards in production of durable wooden products
- Create an appropriate environment to increase production and sales of wooden products by improving wooden product quality and meeting domestic demand, as well as competing in foreign markets
- Develop scientific wood research and development and introduce it into production processes

Forest product markets

The main wood products that are produced in Mongolia include logs, sawn timber, various construction materials, furniture, miscellaneous wooden products, wooden tools and kitset items. In first-stage wood processing, products such as encircled wood, planks and panels are produced. In secondary processing, various furniture items and other finished wood products are produced.

During the last several years, shipments of chopsticks and plywood covers with a total value of about US$100 000 have been exported to China, which is also the major export market for Mongolia's wood products. In addition, fruits, nuts, ethereal oil, and resins – with a market value of about US$300 000 – are produced by trees and supplied to domestic markets.

Wood products valued at about US$3 million are supplied in the domestic market and market demands (and harvests) are increasing annually. Most finished wood products are supplied by domestic production, but in the future wood product imports will increase. Many wood processing facilities are being transferred to private ownership. The main data source for wood product manufacturing is state statistical information and local forest organizations. Wholesale trade and small sellers are covered in the survey.

In order to increase types and quantity of wood and non-wood products, the government is implementing policies and regulations to support wood processors, such as exemption from custom duty for imports of modern, efficient, sophisticated technology and equipment for processing wood that is naturally aged, is afflicted by harmful insects or fire, and windfall trees. Other measures include reductions in fees for poor quality wood (as above) and transferring of ownership of forest resources.

Systematic training of wood processing staff by a number of forest organizations has led to a diverse work force capable of producing a wide variety of wood products, enabling continuity of supply of processed wood products to most sectors. Currently, specialized training in wood production is being carried out at two domestic universities, with some staff also trained overseas. Several forestry training centres have been established and these conduct a variety of training programmes including mid-career education, retraining, training in market research and training of professional consultants.

Timber production measures to be implemented by the government

- Create favourable conditions for utilizing advanced technologies thereby providing output growth through production efficiency and by improving wood processing standards and wood utilization conversion factors
- To develop procedures that enable transfer of forest management responsibilities and funds to processing facilities that have modern technology and ability to combine efficient wood processing with forest protection and restoration
- Establish training centres and organize long- and short-term training to upgrade skills and develop a qualified workforc
- Implement successive measures to ensure that timber products and production processes are internationally competitive
- Create a legislative environment that enables exports of manufactured wood products without tax, thereby increasing exports of wood products
- Make modern processing technologies exempt from customs duties
- Implement a programme to upgrade techniques and technologies in timber industries and for processing wood in cooperation with foreign countries and international organizations
- Ensure that forest protection, restoration and sound use are key objectives and outcomes in forest law
- Create favourable conditions for improving the quality of wood products, to meet domestic needs and increase the volume of production and marketing for internationally competitive products suitable for export

Table 4. SWOT analysis for Mongolian timber industry

Analysis of internal environment	
Strengths	**Weaknesses**
• Small- and middle-sized industries that are responsive to reform and change. Product mix that can be readily adjusted to produce different products • Trained workforce that includes qualified engineers, technical experts and specialized and skilled workers • Types of product produced are well established, and labourers are familiar and skilled in production of them • The utilization culture of Mongolians is well-established and people are knowledgeable about the timber requirements and needs for traditional housing	• Need for administrators with economic management and marketing knowledge skills to guide activities of industry • Too few work places that meet appropriate standards for labour conditions, hygiene standards, etc. Most industries are running their activities in leased premises • Wood raw materials often do not meet quality requirements and there is no integrated system for basic raw material supply • Technology transfer and reform is being done poorly. Training of experts in use of new technology is inadequate • Most processing facilities are using old-fashioned techniques and obsolete technology
Analysis of external environment	
Opportunities	**Threats**
• Possibilities to produce and export new competitive wood products by using modern advanced technologies. • The demand of windows, doors and other wood products is increasing due to intensive development of the construction sector • Domestic needs for wood products is increasing. • It is possible to produce chopsticks by mechanized production method. • Production of materials with high quality by using wood shavings from timber industries. • ▪Development of paper production capacity using timber raw materials through processing wood by chemical methods.	• Illegal wood harvesting is increasing. • The forest resource is being degraded due to forest fire and pest spread. • No regulation of wood harvesting and marketing. • Imports of furniture and wood products is increasing.

Table 5. Trends in timber mills and wood product manufacturers, 2000-2004

Number of timber mills and wood products manufacturers	2000	2001	2002	2003	2004
Nationally	355	420	518	646	678
Ulaanbaatar	92	117	196	258	270

Source: National Taxation Office .

In 2004 there were 678 mills and manufacturers disaggregated as follows:

- 175 producers of construction materials and components
- 207 producers of other wooden and woven products
- 48 producers of wooden panels
- 36 producers of wooden crates and containers
- 123 producers of timber
- 89 logging companies

The sustainable annual harvest volume for Mongolia's forest has not yet been unequivocally determined, although the most recent calculations put the amount at between 0.9 and 1.4 million m^3. The current rates of consumption are difficult to calculate, due to the lack of reliable data and the differences of opinion concerning the annual household consumption of fuel wood in areas outside the capital. The lower end of the estimated consumption, 1.74 million m^3 annually, is far above the sustainable harvest level, and the upper end, 5.5 million m^3, exceeds the sustainable harvest by a factor of five.

However, the large-scale, often illegal and generally uncoordinated logging practices encountered in Mongolia today have led to a depletion of available forest resources in certain areas, particularly those within easy reach of urban centres. In the short to medium term, it is likely that the disarray that has occurred within the forestry sector means there are large amounts of timber that can be extracted through thinning activities, which are necessary to maintain fire-resistant forest structure; this will provide employment and biomass for construction and energy needs. In the long term, Mongolia's slow-growing forests are unlikely to be able to sustain the current demand for timber and efforts will be needed to find alternatives.

Illegal logging practices

Illegal logging

Currently between 36 percent and 80 percent of Mongolia's total timber harvest is categorized as illegal. That is, the government receives no royalties or taxes on this and it severely distorts domestic prices for both construction wood and fuel wood. Fuel wood currently constitutes between 65 percent and 80 percent of the total wood harvest and is used by many poor rural and urban households for both cooking and residential heating.

Illegal logging in Mongolia can be broadly divided into three broad types, according to the socio-economic context in which it occurs:

1. Securing basic subsistence needs.
2. Enhancing livelihoods.
3. Commercialized illegal logging (World Bank 2006).

Methods of illegal timber harvest

Illegal loggers are becoming increasingly refined in their techniques; some of these are outlined below:

- People obtain permission to cut fire breaks, to thin trees, or to clear undergrowth. This provides an easy, virtually risk-free opportunity to illegally cut additional timber
- Loggers enter the forest in a small vehicle, cut timber as quickly as possible and then call for a truck to collect the logs. If questioned, they will claim to be vacationers. There have been reports of rangers being threatened with violence and therefore they may not be to keen to investigate further

- Illegal loggers track the whereabouts of the local forest ranger who is typically responsible for a much larger area of forest than can be monitored effectively. An accomplice informs the loggers as soon as the ranger leaves his post, or may mislead the ranger with false information about illegal harvesting or a forest fire in another area to ensure that the loggers can fell trees undisturbed
- During the day, trees are sawn part-way until they can be felled with a single push. Even if a ranger should hear the noise of chainsaws and come to investigate, the part-felled trees are difficult to find. The loggers return at night with their vehicle headlights off, knock down the trees, and load their truck
- Loggers. Each logger can earn TUG5 000-6 000 for cutting a truckload of 60-70 logs, which takes between a few hours and a day. Some loggers work year-round, others only when they need money or can find work. Most logging is done in teams of three or four people. The group manager can sell a truckload of logs for processing for TUG40 000, making a profit of TUG20 000
- Transport and sawmills. Drivers of special heavy-duty trucks move timber from the harvesting site to the landing and sell the timber to sawmill operators. The distance covered is only 1 to 5 kilometres, but road conditions are extremely difficult and as a result, drivers can only make one or two trips a day. Drivers earn TUG10 000 per trip in addition to fuel costs
- Sawmill operators. Sawmill operators share TUG25 000 per truckload of wood, while the owner makes a net profit of TUG45 000 from the timber and additional sums from the sale of offcuts and sawdust
- Transport to sales point. This is the easiest but riskiest stage of the operation. The minimium profit after expenses for transporting timber to the city, which takes one night, is TUG60 000. The driver's take-home pay can be considerably increased if he does not encounter inspectors along the way, or has contacts to avoid paying bribes or fines. In addition, drivers can increase their profits by purchasing 8 metre truckloads of timber and selling them on the market as 10 metres. Whereas bribes paid to police and traffic inspectors used to range from TUG10 000-30 0000, in the past year the rates of both fines and bribes have increased dramatically, reportedly now ranging between TUG100 000 and TUG350 000
- Transport to sales point. This method of transportation is only used by a small number of people with large amounts of money. There are 15 such traders in Ulaanbaatar; two of them are considered big players, with turnovers of more than TUG50 million and the remainder are small players with turnovers of around TUG10 million. After the costs of transport, loading, unloading, and bribes, the manager of the process stands to make around TUG300 000-500 000. In recent months, with increases in the costs of both gasoline and wood and the intensification of inspection activity, the costs of bribes has also risen, which has impacted the profitability of traders. Timber traders have therefore transferred the increased costs to the sales price of the wood, leaving their profit margin intact, with the result that the price rise is felt only by purchasers. However, timber remains cheap in comparison to alternatives and therefore demand is still high – sales have not decreased as a result of the price increases
- Merchants. Wood merchants specialize in the sale of either timber or fuel wood. In addition, some merchants saw lengths of fuel wood and sell them as timber. Commercial wood sellers make a profit of approximately TUG65 000 from one truckload of wood. They increase their profit by cheating on measures, for example selling 0.46-0.9 m^3 as 1 m^3. This is easily done because most buyers do not know how to measure the wood
- Assistants. Those at all stages of the timber business work for TUG3 000-5 000 per day, earning TUG90 000-150 000 each month. With bonuses, and sometimes by cheating on measures, some workers may earn TUG200 000-300 000 a month

Fuel wood

- Fuel wood traders at the market earn TUG45 000-50 000 from each truckload. If they sell wood by the sack, rather than by the cubic metre, they can increase their earnings by cheating on measures. Customers prefer to buy fuel wood in the form of individual logs because they can see what they are getting; however, even in this case it is possible to cheat for additional profit, as was demonstrated to researchers by a fuel wood trader.
- Cutting logs intended as fuel wood into timber increases the value of the wood; one truckload can bring a profit of TUG57 000, with additional revenues possible from cheating on measures. Offcuts and sawdust can also be sold for extra income. This form of trade has decreased somewhat since the MNE regulated that wood designated as fuel must be cut into 50-cm lengths upon entry into Ulaanbaatar.

Grazing land and forest

Mongolian society and and the country's economy are dominated by a handful of sectors, notably pastoral farming, agriculture, mining and manufacturing of agricultural products. Mongolia's basic economic sector is agriculture and this contributes 35 percent of the GNP, and accounts for approximately one-quarter of the country's exports. Agricultural potential is directly related to climatic conditions.

Forest grazing area

Animal grazing in the edges of forest areas often exceeds the ecological carrying capacity and hence, negatively impacts on forest regeneration. A strong need to improve integrated management of forest and pasture land resources based on community-based natural resource management approaches has been identified.

Table 6. Animal numbers in most forest-covered *Aimak*s of Mongolia

*Aimak*s	Total land ('00 000 ha)	Animal numbers (2006) ('000)					Total
		Camels	Horses	Cattle	Sheep	Goats	
Kubsygul	100.6	2.5	148.9	286.3	1 249	1 287	**2 973.7**
Zabkhan	82.5	6.6	113.2	127.2	1 251.5	1 052.3	**2 550.8**
Bulgan	48.7	0.4	147.8	114.8	825.4	584.1	**1 672.5**
Kentii	80.3	5.1	176	162.9	879.9	670.8	**1 894.7**
Tub	74	2.1	197.9	131.1	1 040.8	801.3	**2 173.2**
Arkhangai	55.3	0.8	205.2	281.3	1 162.4	880.7	**2 530.4**
Total	**441.4**	**17.5**	**989**	**1103.6**	**6 409**	**5276.2**	**1 3795.3**
National	1 564.1	253.5	2 114.8	2 167.9	14 815.1	15 451.7	34 803
Percent	28.2	6.9	46.8	50.9	43.3	34.1	39.6

Source: Dr. B. Binyie, 2007.

Reforestation

The MNE prepared a report forecasting new areas of planting to 2010. The report provided a medium-term forecast describing the five years out from the year 2000. The report estimated new planting to be between 6 000 hectares and 8 000 hectares per year during this period, with a best estimate of 7 000 hectares. In the longer term, from the year 2005 to the year 2010, the report expected new planting to be between 8 000 hectares and 40 000 hectares with a best estimate of 24 000 hectares per year.

Even if some areas regenerate naturally after logging, the situation is not satisfactory. Without artificial regeneration, the share of birch and aspen will increase, and some areas may be converted into grassland in the harsh climate.

The most common planted species are pine and larch. The survival rate of seedlings is reported to be only 30-65 percent.

The low survival rate is due to the following reasons:

- Harsh and dry climate
- Poor quality of seedlings produced in nurseries
- Inadequate site preparation and poor planting techniques
- Neglected maintenance of plantations
- Uncontrolled grazing

As the areas requiring reforestation are much larger than the available resources, optimum working methods need to be developed. In the first phase of this development, the whole regeneration system should be thoroughly analyzed.

Table 7. Reforestation and forestry activities

Activities	Unit of measurement	Year					
		2001	2002	2003	2004	2005	2006
Reforestation	Hectares	8 000	8 275	9 036.7	9 861.3	4 552	4 596
"Green Wall" sites	Hectares	-	-	-	-	307	430
Forest inventory	Thousand ha.	1 190	1 200	1 188	920	839	1 660
Study of harmful insects and forest disease spread area	Thousand ha	311	350	554	500	600	217.1
Fighting harmful insects & diseases	Hectares	14 000	10 749	51 788	51 912	49 095	17 295
Seed collection	Thousand kg	4.2	3.9	4.3	2.79	1.42	1.1
Timber harvesting Total -Industrial -Fuel wood	Thousand m^3	593.2 85.5 507.7	568.3 74.7 493.6	576.6 69.3 507.3	596.5 39 557.5	609.9 39.9 570	638 68 570
Forestry budget -State -Local -Economic units	TUG millions	560	560	521	669.5	768.4 494.8 75.7 197.9	788.1 485.5 34.9 267.7

Bugant Sum *of Selenge* Aimak *has a base supply of seedlings and sample data, but reforestation is still not always carried out efficiently*

"Green Wall" programme

The government programme to establish a "Green Wall" has been approved and implemented since 2005. Each year, the programme constructs and replants forest green belts in the desert and steppe ecosystems of Mongolia.

Mongolia is encountering the challenge of combating the adverse impacts of global warming and climate change that are significantly affecting the country's economy, social life and people's livelihoods. The country has recognized the potential environmental benefits of reforestation in the face of intensifying sand movement, dust and sand storms and desertification.

The goal of the programme is to create a "Green Wall", which totally covers the transitional area between the Mongolian Gobi and steppe regions, in an effort to reduce the present intensification of loss of forest reserves, desertification, sand movement and dust and sand storms, caused by climate change and inappropriate anthropogenic activities. The long-range programme will be realized in a step-by-step process involving the local community, harmonizing environmental and socio-economic development policies, and measures that take into account specific 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 will be built, crossing the Gobi Desert and steppe regions with a total length of up to 2 500 kilometres and a width of not less than 600 metres. The total area covered will be 150 000 hectares. In addition, a sub-strip covering 50 000 hectares will also be planted in adjacent areas of the Gobi and steppe regions – synchronously with the main ecostrip with the purpose of preventing sand movement and desertification.

The Green Wall national programme will be implemented in three phases as follows:

- First Phase (2005-2015): Not less than 20 percent of the planned programme shall be completed on the basis of forming legal coordination and capacity, and acquiring implementation methodologies and technologies
- Second Phase (2015-2025): Not less than 30 percent of the planned activities shall be completed on the basis of assessing the First Phase progress and strengthening the national capacity. Outcomes shall be improved
- Third Phase (2025-2035): Not less than 50 percent of the programme shall be completed on the basis of improving ecological and socio-economic efficiency of the programme, and mastering methodologies and technologies for reducing adverse impacts of desertification and sand movement

To support this whole programme, practical activities of reforestation will be implemented, expanding the range of afforestation in the Gobi 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 central government and local government budgets, donor governments, loans from international organizations, technical assistance, gratis aid, donations from institutions, economic entities, and others.

A detailed plan for programme implementation will be reviewed and approved by the Cabinet every two years and planned activities will be reflected in the "Annual Basic Trends in Socio-Economic Development" report/plan.

Local citizens, organizations and economic entities will be encouraged to develop project and action proposals that reflect their local features in accordance with the format for planting trees, bushes and vegetation and building protection zones in the Gobi and steppe regions. The proposals will be reviewed for compliance with relevant procedures.

Projects and action proposals for building the green strip and afforestation in Gobi regions shall also be reflected in bilateral and multilateral agreements to be made with foreign countries and international organizations. Afforestation components shall be included in relevant projects, in harmony with the overall programme, to create synergies.

The expected outcome of the program is increase in Mongolia's forest reserve by 1.6 percent and positive changes in the Gobi and steppe ecosystem. In addition, saxaul forest reserves will be conserved, areas of deciduous forest expanded, a favourable microclimate will be established, and ecological balance will be maintained. The legal environment that protects

the cultivated forest and forest strip in the Gobi and steppe regions will be improved and strengthened as a result of the successful implementation of the Green Wall programme.

In the first three years, since the approval of the programme, the main belt and supporting ecostrips have been established on 951 hectares in 80 *Sum* of 18 *Aimak* with financing of TUG839 million. From 2005 to 2007, the average survival rate of the Green Wall strip was 70-75 percent. For the first three-years, implementation of the annual objectives of the Green Wall national programme was 50-60 percent of the target.

From 2007, the programme has been implemented with the involvement of other donor countries. For example, the Green Wall programme is being implemented in collaboration with the Korean government for 10 years, with total budget support of US$10 million.

An important feature of the programme is to increase the effectiveness of new forest establishment in all ecoregions of Mongolia, in particular steppe and desert zones. Through the implementation of the programme, there are expected to be benefits through improved participation of citizens and working units in planting trees and greening the environment.

In 2006, studies to determine appropriate tree species, to select areas for establishing green strips and to identify land where desertification and sand movement might be combated, were implemented in 78 *Sum*s of 18 provinces. Field studies were conducted on four major topics, with the involvement of scholars and reseachers.

In the future, improvements in agrotechnological and scientific bases of planting will be required, to ensure establishment of the main belt and supportive strips in accordance with the overall plan.

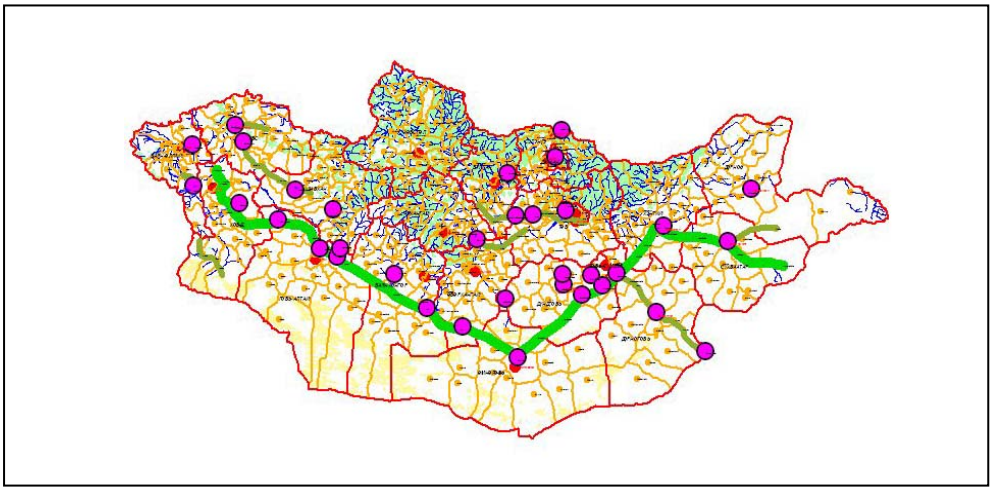


Figure 5. Location of Green Wall sites constructed and planted in 2005-2006

Salix seedlings planted with other species

Green Wall site in Kovd Aimak

South Govi Aimak *Green Wall site*

Wintering seedlings

Box 1. Forest Community ("Nukurlul") Definition According to the New Forest Law (2007) – Selected Sections from the Forest Law (2007)

3.1.8. "Forest community" referred to as "community" is considered a voluntary organization of local citizens, established with the purpose of protection, appropriate utilization and rehabilitation of the local forest, organized and acts according to the paragraph 1, article 481 of the Civil law, and the paragraph 8, article 3 of the Law on Protection of Nature and Environment.

18.8. A community consisting of the local area residents and willing to run activities in the direction of protection, appropriate utilization and rehabilitation of forest, has privileges to possess the forest reserves, and needs to submit following documents...

18.6. Not lower than 80 percent of all the community members should be residents of the local area, and be able to constantly look after and control the forest reserve area possessed under contract.

The Green Wall programme and increased interest of citizens in planting trees

The new *Community procedure for community-based natural resource management* is a major achievement. By Ministerial decree N369 issued on 22 December 2005, Dr. H. Ykhanbai, the Director of Forest Policy and Coordination Department, was appointed as Chairman of the *National Working Group for the development and facilitation of activities on CBNRM*. This Working Group was established through the (newly approved by *Ikh Hural* [Parliament]) *Amendment to the Mongolian Law on "Environmental Protection"* (18 November 2005). The new community procedure developed by the Working Group is named *Procedure for the allocation of certain natural resources to the communities for their protection and sound use*, and was approved by the Nature and Environment Minister's Decree N114 of 2006. It has become the main policy and guiding document for the national level implementation of community-based natural resource management approaches in the country.

Private partnerships are the voluntary association of citizens formed under common interest. In Mongolia over 283 community partnership groups operate and they have leased so far 343 691 hectares of forest area. The first partnership groups were established by the late 1990s by international donor project support and initiatives. Their basic goal was nature

conservation and sustainable use of natural resources. On the basis of Article 481, Paragraph 1 of the Civil Law, Article 38, Paragraph 2, Clause 8 of the Law on Environmental Protection and Mongolian Law on Forestry, these groups have the right to lease natural forest areas for up to 60 years with possible extension; and a partnership group could have a maximum of 6 000 hectares of forest area territory. They could use timber and other natural resources from their forest area in accordance with the Forest Management Plan (FMP). Moreover, they could own the forest resources planted by their own capacities. On the other hand, partnership groups have the responsibility to provide annual reports on the status of given forest area, enforcement of related environmental legislations, rehabilitation, reforestation, recruitment of voluntary rangers and conservation management including wildlife impact mitigation, harmful pest and forest disease management.

The new *Forest Law*, which was approved in 2007, was developed through the close involvement of the stakeholders and government, and is largely supporting community-based co-management of forest resources on the base of leasing and allocation of forest resources to local communities. According to this law and the new forest policy, the target is to allocate almost 50 percent of national forest land to local communities by 2021. Mongolia has a vast area under forest cover, but in the past, management of these resources has been minimal. The new Forest Law allows for the establishment of Forest User Groups or other kinds of forest "communities." How to put these concepts into practice is a challenge. Some important issues and constraints include:

- Structures supporting forest management in some parts of provincial or local areas have been dismantled and lost and capacities are mainly low
- Since the forest law of Mongolia was confirmed, 12 years have passed and additional changes were made to the law only three times. The law has only recently been updated and approved again
- Proprietary and ownership structures are inappropriate in comparison to the current situation and objectives

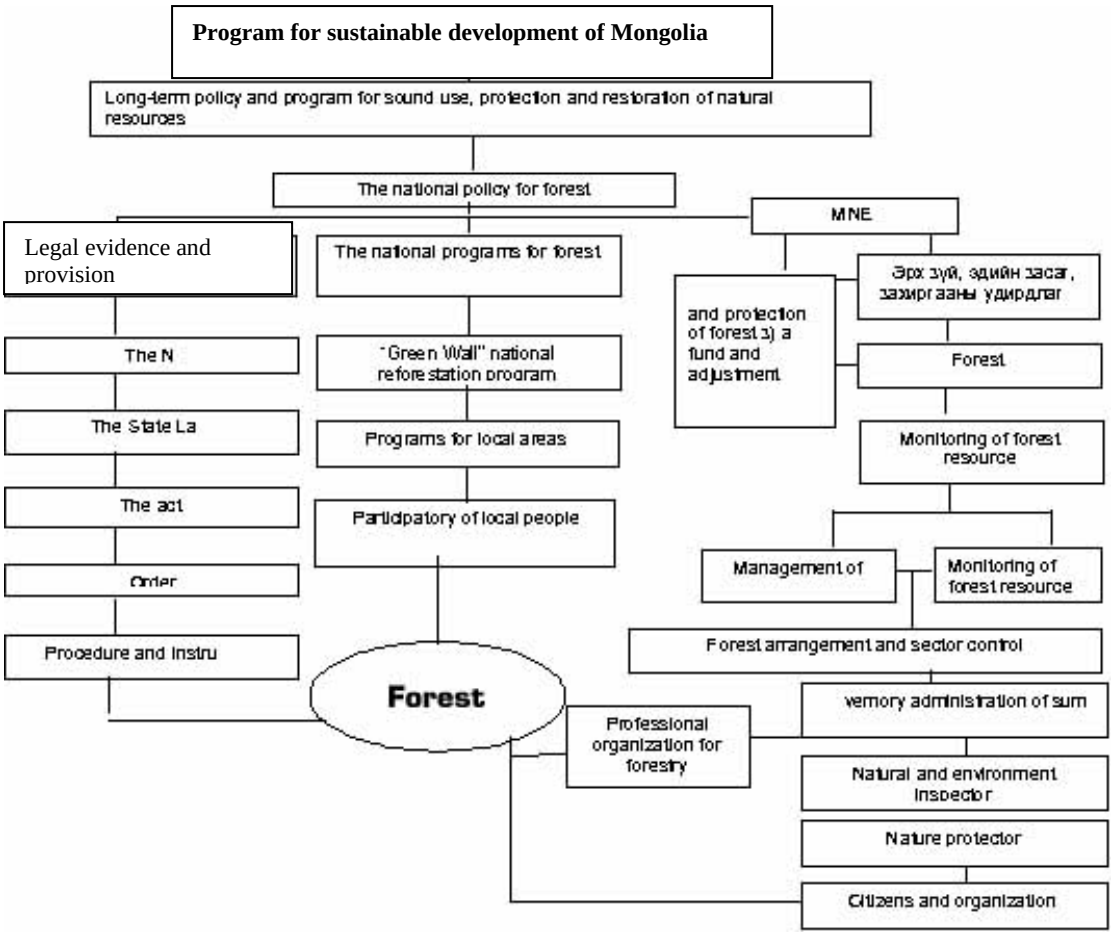


Figure 6. Forest management structure

At present, most forest resources belong to the state. As mentioned earlier, the MNE manages forest through its bodies like the Forest Division, Protected Area Management Division and Forestry Agency. Moreover, local authorities have strong power over their forest resources. The state allocates forest to these organizations for unspecified periods and these government organizations have power to allocate the forest resources to other actors who have interest in forest management. Moreover, they do not pay taxes on the forests they manage and the state allocates budget for their operation.

The policy framework that guides the protection, conservation and utilization of Mongolia's 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 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.

A National Forest Policy was prepared in 1998. It focused on forest utilization, forestry resources, conservation and social welfare concerns. Three of the seven principal objectives of the document dealt with exploitation and utilization of forest resources, illustrating the preoccupation of the government at that time. The forest policy was revised in 2006 as the National Program on Forestry (NFP). This document represented a shift in government

priorities away from utilization, towards conservation and protection. Of the NFP's five objectives, two relate to improved resource management, two to conservation and only one to utilization. The NFP priorities are institutional restructuring, forest fire and pest management, reforestation and enhancing the quality and efficiency of timber processing.

Box 2. Energy Resources in Mongolia

The Mongolian energy sector should be developed within a regional energy context while at the same time taking advantage of new technologies. It should improve energy security and sources of energy that might further promote economic efficiency and environmental sustainability. Energy sources include:

Coal: Total demand, 5.4 million tonnes per year; 3 mines produce 4.5 million tonnes/year; 29 small mines with capacity up to 700 000 tonnes/year. Future demand is expected to be 6-7 million tonnes/year. Proven reserves of over 20 billion tonnes of coal.
Fuelwood: Total annual demand: 1-2 million m^3. Government permits: 0.6 million m^3. Produced in northern *aimaks*. Future demand: 2-3 million m^3 per year.
Petroleum products: 100 percent imported from Russia. Gasoline (52%), diesel (34%), other fuel (oil, jet, lube) (14%). LPG imports by canisters. Other gas supply options being pursued include CNG for vehicles and LPG for household use.
Electricity: Three centralized systems; 5 isolated systems. Imports from Russia. Installed capacity of 879 MW, of which 823 MW come from coal-fired power-plants.
Hydropower: Mongolia has significant hydropower potential (3.5 MW existing). Has started projects with capacity of 19 MW. Identified projects with capacity of 6-220 MW.
Solar power: 71 percent of land receives solar energy amounting to 5.5-6 kWh/m^2 with 2 900-3 000 sunny hours per annum; 18 percent of land receives 4.5-5.5 kWh/m^2 with 2 600-2 900 sunshine hours per annum. A 100 000 solar ger (tent house) program has been established. A solar energy utilization study was carried out in 2000.
Wind: Wind resources are suitable to use in 70 percent of the country. Wind regimes are in the order of 150-200 W/m^2 and duration of 4 000-4 500 hours per year.

Protected area forest

NPAs cover almost 20 percent of total forest fund and forested area. At the UN Earth Summit in Rio De Janeiro In 1992 Mongolia proposed to protect 30 percent of its territory by 2030. Today Mongolia has 61 types of NPAs which cover 21.8 million hectares equivalent to almost 14 percent of the total territory. This decision was based on a study indicating that 40 percent of the total Mongolian territory houses threatened or endangered species. A modern protected area system was established in 1994 with the Law on Special Protected Areas.
Under this Law protected areas are classified into four categories: (1) strictly protected areas, (2) national parks, (3) natural reserves, and (4) natural and historical monuments. Twelve percent of forest funds is for strictly protected area management. PAs are responsible for biodiversity conservation, eco-tourism promotion and traditional livelihood supporting activities in cooperation with the local government. NPAs do not have a time limit for management of given areas, however parliament can remove some areas due to critical development needs or change in the protection regime.

Table 8. Stakeholder share in forest tenure type

Stakeholders	Forest fund estimation (ha)	Forest tenure management	Duration
NPA	3.087.772		Unspecified
Private enterprises	160.000	Contract	Up to 60 years
Ccommunity groups	343.691	Contract	Up to 60 years
Total	**3.591.463**		

3. DRIVERS OF CHANGE AND THEIR DIRECT AND INDIRECT IMPACTS

Main drivers of change in Mongolian forestry

The main drivers of change in Mongolian forestry are:

1. Institutional, legal and structural changes.
2. Climate change and desertification.
3. Economic development and population growth.
4. Moves toward community-based forest resource management.

Institutional, legal and structural changes

The New Forest Law was approved in August, 2007 and in accordance with the new law, about 20 new procedures will be adopted.

- At the national level – the Forest Agency of Mongolia was set up in June 2008, according to the Forest Law and it was included in the organizational structure of the Ministry for Nature, Environment and Tourism (MNET) of Mongolia
- In 2009, new organizational structures may be developed in *Aimak* and Ulaanbaatar (forest bureaus); in *sum* and districts (new forest divisions will be organized)

Under the implementation of the new Forest Law, there are 14 new procedures that must be developed. These include:

- Those that the government must approve (3)
- Those that members of the government in Finance or Nature and Environment sectors must approve together (6)
- Those that members of the government in the Nature and Environment Sector must approve (5)

One of the most important legislative changes in the new forest law are the new provisions for community-based forest maangmeent. Rights and responsibilites under the new law are outlined in Box 3.

Economic incentives pertaining to community-based forest management:

- Private ownership of forest will be established
- Forest resources will be allocated to communities
- The system of fees for using resources will be improved
- Domestic prices will reflect international costs and price levels
- Forest resource accounting will take place
- Compensation will be calculated on the basis of ecological and economic value
- Different forms of financing will be available
- Resource accounting will be employed

Box 3. Forest Resource Allocation (Possession) to Communities and Rights and Obligations of the Community – Selected Section of the Forest Law (2007)

4.5. For issuing the ownership of forest reserves into the possession of communities, economic entities and organizations under a contract, it is allowed to have the duration of the possession to be one year as a starting phase. This phase could be used for preparations and could be followed by a 10 year – and up to 60 year – contract, based on the local *bag* and *khoroo's citizens' public khural* proposals, and resolutions of *citizens representatives' khural* at the *Sum* or district level.

4.6. A part of forest reserve possessed by local communities, economic entities and organizations under the legislation and contracts is considered as possession forest.

4.7. In a possession forest, the possessor can utilize trees and non-timber forest products and implement forest rehabilitation and cleaning treatments according to an approved management plan.

18.1. A community should have programmes of activities and a management plan aimed at protection, appropriate utilization and rehabilitation of forest, as stated in the paragraph 3, article 9, of this law.

18.2. A community should have rules to run its activities within the framework of the legislation.

18.3. A community's number of members, capacity, forest area of responsibility, resources and ecological speciality should be considered before the hand-over of the specific part of the forest reserves to the community, according to the established possession contract.

18.4. A community should submit reports on the implementation of its program of activities and management plan dedicated to protection, appropriate utilization and rehabilitation of forest riches to the local *citizens representative khural* of *Sum* or district on a yearly basis.

18.5. According to requirements and conditions stated in paragraph 8, article 25, the *Law on Protection of Nature and Environment*, a community can employ volunteer rangers in its possession area of forest reserves.

18.11. A community has [defined] rights with regard to appropriate utilization and possession of forests of the possessed area under contract in accordance with legislation and as stated in the contract:

Climate change and desertification

Mongolia's arid and desertified areas have been seriously expanding in the Gobi Desert region, which occupies 41.3 percent of the country's territory. Desertification has been expanding year-by-year in this region and the desert zone is moving to the north. Mongolia needs to maintain the strategy towards the development of international cooperation in combating desertification. The Mongolian government adopted the "*Second National Program for Combating Desertification* in June 2003. The aims of this programme include:

- Decelerating negative impacts of climate change and desertification processes
- Step-by-step planning and implementation of socio-economic policies and a related package of measures

Declining water resources: Mongolia is the catchment of three major water sources. Rivers and streams mainly flow out of the country. Consequently, Mongolia has limited water resources. Potential water resources of the country are estimated to be 34.6 km^3, of which groundwater resources are estimated to be 6.1 million m^3.

Box 4. Nationwide Water Census in 2003

- 334 *Sums of 21 aimak* provinces were surveyed
- 5 153 rivers and streams were counted, of which 573 dried up
- 9 582 springs were counted, of which 1 158 dried up
- 3 854 lakes counted, of which 573 dried up

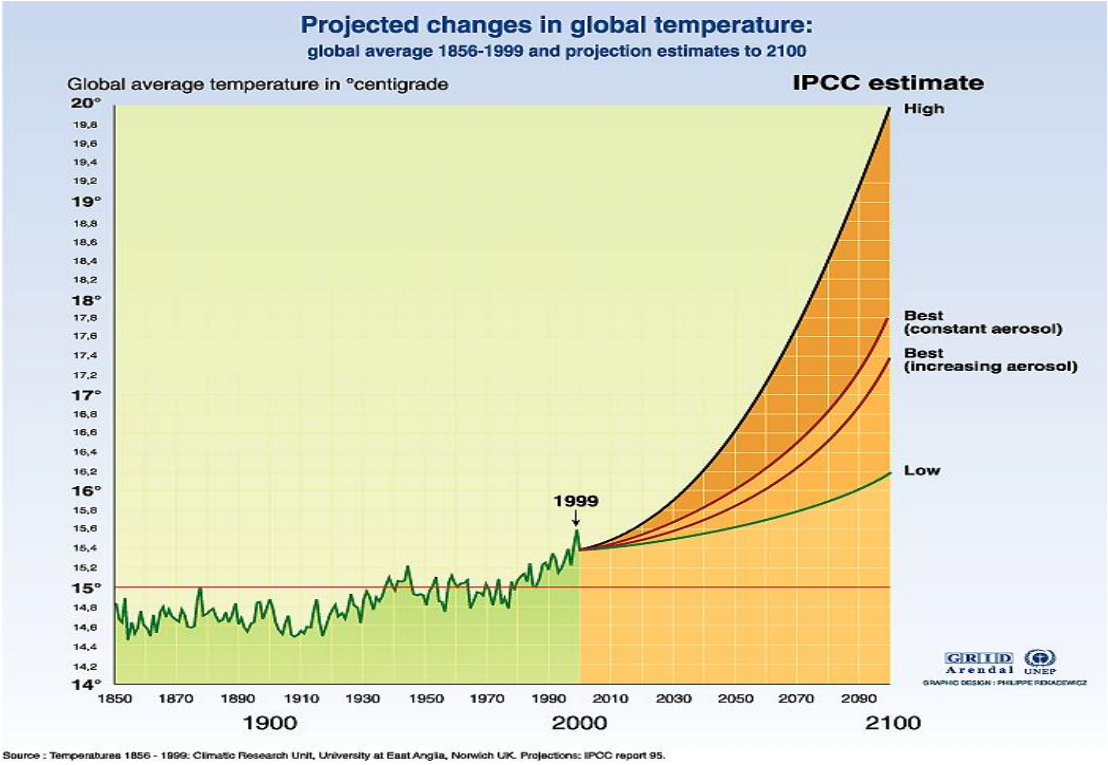


Figure 7. Projected changes of global climate change

Economic development and population growth

Some general conclusions about the impacts of economic development and population growth on supply and demand for wood can be drawn:

- Wood consumption for housing and fences will increase as the proportion of population in urban areas grows.
- Wood consumption will increase as a result of growth in the construction sector.
- For over 500 private forest and timber management entities (information from the Tax Service) that run their activities today, the opportunity for autonomous power will increase.

Development of forest infrastructure is major factor affecting the sustainable management of forest resources in Mongolia. Attention needs to be paid to the development of infrastructure, initially through appropriate study, with implementation to expand and improve networks of forest roads, communications and transport.

Figure 8 shows that the population in Mongolia will grow at a moderate rate through to 2021. The population is expected to increase from 2.6 million in 2007 to 3.1 million in 2021. Mongolia's population growth rate is estimated at 1.54 percent (2000 census). About two-thirds of the total population is under age 30, 36 percent of whom are under 14. About 40 percent of the population lives in Ulaanbaatar alone, and a further 23 percent lives in the cities of Darkhan, Erdenet, or other towns and permanent settlements. Approximately 30 percent of the country's population comprises nomadic or semi-nomadic people (source: Wikipedia).

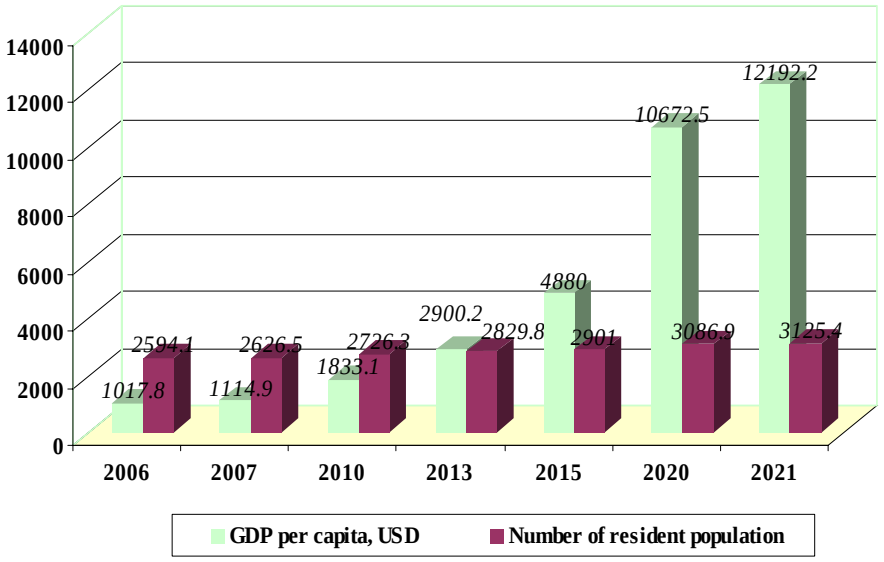


Figure 8. Economic development and population growth

GDP per capita in 2007 was estimated to be US$1 115. The current GDP growth rate is 7.5 percent. Figure 8 envisages extremely rapid growth to 2021 (approximately 19 percent per annum).

Table 9. Wood consumption growth

Wood consumption growth for 2007-2021 (development scenario)	2007	2015	2021
Indicators			
GDP, constant prices in 2000, bln TUG	2 974	16 767	31 125
Population (thousand people)	2 627	2 901	3 125
Industral wood, '000 m^3	160	901	1 674
Fuelwood, '000 m^3	900	1 000	1 070

Table 9 shows that industrial roundwood consumption is expected to largely mirror economic growth, increasing by approximately 18 percent per annum to 2021. However, demand for fuelwood will increase much more modestly, increasing by approximately 1.3 percent per annum to 2021.

Table 10. Timber demands of forest product manufacturers (June 2004)

Companies by registered capital	Number of companies	Present annual timber consumption		Maximium processing capacity	
		Per company (m3)	Total (m3)	Per company (m3)	Total (m3)
Up to TUG10 million	279	300	83 700	500	139 500
TUG10 to 50 million	241	1 200	289 200	2 500	602 500
Over TUG50 million	70	3 000	210 000	6 000	402 000
Total	**589**		**582 900**		**1 162 000**

Community-based forest resource management

The main objective of the new Forest Law is to allocate "forest funds" (i.e. areas covered by forests including all species of trees and scrub replanted forests, and saxauls) to local communities. The new law is expected to result in:

- Better forest protection against illegal activities. Involving local communities in forest management and giving them a stake in the forests is expected to ensure better protection against illegal logging and timber collection, illegal hunting, and illegal setting of fires
- Entities and communities that undertake ownership of forest areas working to restore and protect the forests and ensure sound and sustainable use
- Better understanding and new initiatives by local people to protect forest resources and improve the sustainability of usage

Community development

- A "New Community-based natural resource management procedure" was approved by the MNE in May, 2006. It allows allocation of forests and other natural resources to communities
- The community-based natural resource management procedure will be an especial focus for forestry development in Mongolia
- In 2004, 25 communities were leasing about 270,000 ha of forest area. Since that time, significant expansion has occurred.

Forestry community facilitation

Sustainable management of forest and natural resources

A move towards sustainable forest management will be based around three major steps:

1. Develop and implement forest management plans.
2. Implement pasture shifting and rotational grazing schemes.
3. Focus on protection of water, plants and wildlife resources.

4. PROBABLE SCENARIOS FOR DEVELOPMENT

Scenarios for the future of Mongolia's forests can be developed, based around the identified drivers of change and the goals of the Mongolian government's policies and legislation. Four key objectives for 2021 are listed below:

1. National and local structures for management of forest resource will be developed. Communities of local people will lease about 50 percent of the total forest resource by 2015 and about 80 percent of the forests by 2021.
2. Due to climate change and desertification, forest fires and insect infestations have been periodically increasing. Measures taken to arrest the impacts of climate change and desertification will be effective, and the areas of forest fires and insect infestations will be substantially reduced.
3. Illegal logging will reduced. Legal forest harvesting regulated by forest management plans and using a wide range of harvesting technologies will increase harvest volumes two- to three-fold by 2021.
4. The extent and efficiency of reforestation will increase and "Green Wall" construction will be implemented according to plan.

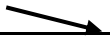
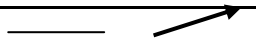
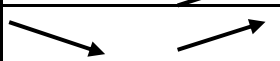
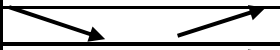
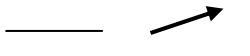
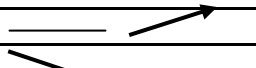
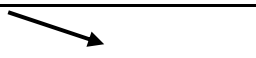
The extent to which these objectives are successfully implemented will be key factors in determining how forests and forestry in Mongolia will evolve to 2020. Scenarios can be developed based on complete or partial achievement of these objectives. Aspects of these are elaborated somewhat in the next chapter.

5. WHAT IS LIKELY TO HAPPEN TO FORESTS AND FORESTRY IN 2020?

Change in forest resources

Table 11 summarizes the direction of change for many of the most important physical variables in Mongolia's forests.

Table 11. Expected changes in forest resource dynamics for 2007-2021

Factors			
Environmental			
1.	Forest cover area	Constant, decrease	
2.	Timber resources	Decrease	
3.	Forest cover rate	Decrease	
4.	Biodiversity	Decrease	
5.	Natural regeneration	Constant, increase	
Climate			
1.	Temperature (hot)	Constant, increase	
2.	Precipitation	Constant, decrease	
3.	Desertification	Increase	
Human			
1.	Harvesting	Increase	
2.	Forest fire	Decrease, increase	
3.	Insects	Decrease, increase	
4.	Mining impact	Increase	
5.	Reforestation	Constant, increase	
6.	Grazing of animals	Increase	
Economic			
1.	Profit margin	Decrease	
2.	Price and value of wood	Constant, increase	
3.	Technology	Old	

Economic factors driven by GDP growth and growth in the mining sector will result in increased harvesting. By devolving forest management responsibilities to communities, it is expected that the overall quality of many forests will increase, as illegal harvesting becomes better controlled and forest management is regulated by formal forest management plans. Forest management activities such as systematic thinning and pruning ("forest cleaning") should enable increased harvests and also help to reduce forest fires and insect infestations (though under some scenarios these might increase). Grazing of animals will increase, but under community forest management, this is likely to be better controlled in forest areas. Community forest management and the "Green Wall" program will both contribute to increased reforestation.

It is envisaged that prices paid for wood will remain constant or increase. Programmes to encourage the use of new technology will result in replacement of some obsolete facilities.

Overall, greater competition from other products such as plastics, concrete and steel is likely to squeeze profits.

The integrated impacts on forests are still likely to see a reduction in many key variables, including biodiversity. Future study estimates that the total forest area (including "non-forest area") will decline by 3.8 percent, while the area of land actually covered by forest area will decline by 6.2 percent. Estimates anticipate 780 000 hectares of forests will be lost between 2007 and 2021. Table 12 summarizes anticipated changes in forest classes.

Table 12. Estimation of forest covered area changes

	2010	2014	2018	2021
Total	**19 108.6**	**18 932.6**	**18 754.2**	**18 557.7**
Natural forest	12 498.2	12 262.7	12 083.2	11 895.9
Others:				
Sparse forest	3 044	3 068.6	3 080.3	3 092.3
Burnt forest	746.2	954	1 116	1 272
Harvested area	215	229	243	258
Area to be reforested	412.7	403.1	393	378
Non-forest area	1 593	1 416.6	1 239.6	1 062.8

Table 13. Estimation of changes of forest use categories

Forest use categories	Forest area (1 000 hectares)				
	1990	2000	2005	2010	2021
Production	784	950	912	918	900
Protection of soil and water	5 065	4 696	4 698	4 698	4 800
Conservation of biodiversity	5 540	4 923	4 933	4 930	4 900
Social services	103	96	92	92	100
Multiple use	0	0	0	0	0
Other (please specify in comments below the table)	0	0	0	0	0
None/unknown	0	0	0	0	0
TOTAL	**11 492**	**10 665**	**10 635**	**10 628**	**10 700**

The assumptions on which these projections of forest resources changes are founded are listed below:

- *Burned area:* Currently the average area burned each year is 58 700 hectares. Calculations here assume an increase of 20 percent resulting from the impacts of climate change, a 10 percent increase in the incidence of fires as a result of climate change, a reduction of 10 percent as a result of management improvements in forests, and an additional 10 percent reduction as a result of improved efficiency and techniques in fire fighting

- *Harvested area:* At present, the average annual harvest area is 25 000 hectares. Reductions in illegal logging are anticipated to reduce this area by 30 percent, while allocations to community management are expected to further reduce harvesting by 10 percent initially, and a further 20 percent once formal management plans are prepared. Substitution by imports from the Russian Federation will result in a further 10 percent reduction in harvested area.
- *Area to be reforested:* The area to be reforested decreases as a result of active reforestation efforts, including the Green Wall construction.

Calculations assume:

  - annual reforestation (excluding Green Wall) of 4 000 hectares/year, but with a mortality rate of 40 percent
  - annual net transfer from "forest land" class to "area to be reforested": 800 hectares
  - net reforested area of 1 600 hectares/year
  - Green Wall: annual average construction of 2 000 hectares/year, with a mortality rate of 20 percent
  - the Green Wall effective annual reforestation rate will be 1 600 hectares
  - Total net reforestation rate of 3 200 hectares/year

- *Sparse forest area:* will increase due to degradation of forests by insect infestations, grazing and various other causes. At present, the area of sparse forest is increasing by an average of 22 400 hectares/year. Improvements in insect pest control are anticipated and will reduce this rate by 30 percent. Increases in animal numbers are expected to increase the rate of conversion to sparse forest by 10 percent
- The area of "non-forest" (areas designated as forest land, but without forest cover) will decrease as non-forest areas are transferred to grassland categories and used for grazing. It is estimated that area transferred to grassland might be as high as 10 percent per annum.

Changes in Selenge *Aimak*

One of the important determinants of overall forest management outcomes for Mongolia is expected changes in forest management in Selenge A*imak*. This northern *Aimak*, which borders the Russian Federation, is currently the source of more than 60 percent of timber harvested in Mongolia. It is an important source of both government-regulated logs and illegally harvested logs.

Table 14 provides forecasts of forest area changes in Selenge *Aimak*, including reforestation efforts, rehabilitation of mining sites, and areas expected to be set aside as protected areas.

Table 14. Estimated changes in forest resources of Selenge *Aimak*

Indicators	2005	2006	2013	2021
Reforested area (ha)	1 380	1 553	2 000	3 500
Rehabilitation of mining area (ha)	275.9	246.5	500	700
Ratio of protected areas to the territory (%)	9.3	9.8	10	12

Source: Ms. Tsengelzaya, 2007.

Forest ownership and employment changes

All forests and land in Mongolia are state-owned. For the period to 2020, state ownership will remain dominant. By 2021, a small amount of forests are expected to have been privatized – around 1-2 percent of forest will likely be under private ownership. A more significant trend is devolution of forest management rights and responsibilities. In 2012, more than 20 percent of forests will allocated to communities and companies under community management contract. By 2021, it is expected that more than 50 percent of forests will be under community management.

Employment in the forestry sector is expected to increase substantially by 2021. The number of people employed in the forest industry is expected to increase from approximately 1 000 to around 5 500, while people employed in forestry, including forest rangers, are expected to increase from 1 000 to 5 200.

Table 15. Number of persons employed in the forestry sector

	2000	2003	2006	2010	2015	2021
Forest industry	1 000	2 500	4 000	5 000	5 200	5 500
Forestry, including rangers	300	500	800	1 200	1 800	2 000
Management & service	28	32	36	140	160	200

Scenarios for forest fires and forest insect increases

Two scenarios have been developed to chart likely developments relating to forest fires and forest insects to 2021. Figure 9 and Figure 10 show smoothed historical data for areas burned in forest fires and areas seriously affected by insect incursions respectively, and future scenarios according to whether institutional capacities to combat these are built to “high” or “medium” levels.

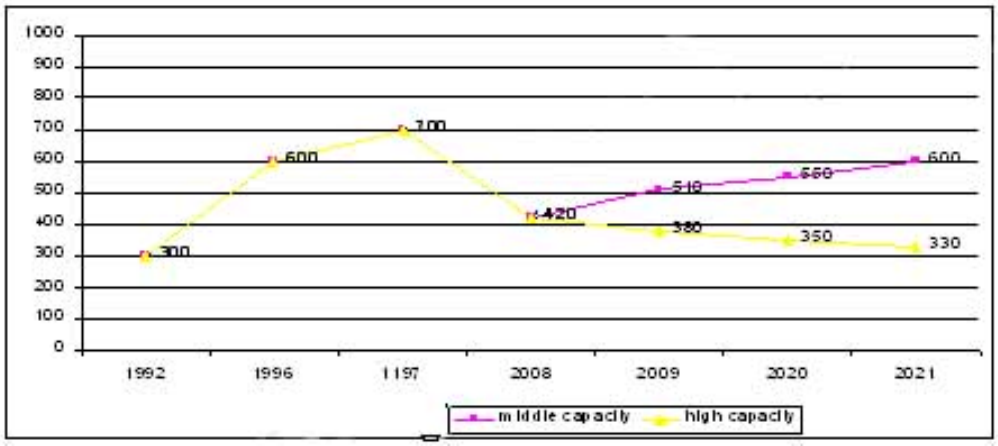


Figure 9. Forest fire projections (thousand ha.) at different institutional capacities

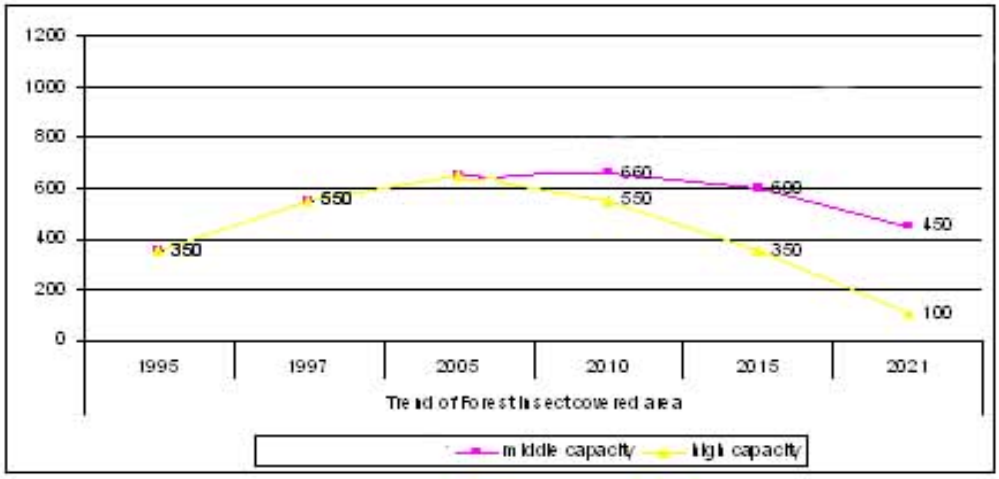


Figure 10. Forest insect coverage (thousand ha.) at different institutional capacities

Timber harvesting

Demand for timber will increase by a factor of 2.0-2.5 by 2121 and will be about 1-1.8 million m^3 in 2021. Most of this demand (50-60 percent) will be met by cleaning (pruning and thinning) of forests carried out in accordance with forest management plans. Approximately 50-80 percent of firewood needs will also be met through forest cleaning operations. It is planned that communities and other entities will carry out forest cleaning operations under co-management contract. A new forest policy envisages:

- A decrease in the number of entities that harvest wood. Those that continue will have strengthened capacities in harvesting techniques and technologies to more efficiently supply wood raw materials to processing industries
- Replacement of wood used in railways and electricity stations
- Imports of wood from other countries (especially the Russian Federation)

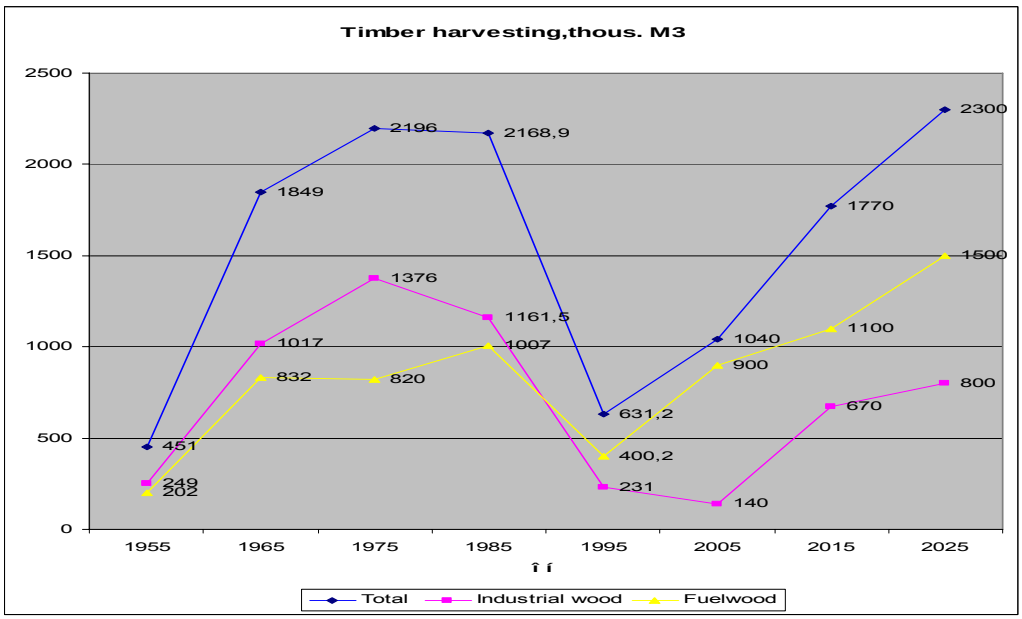


Figure 11. Timber harvesting projections

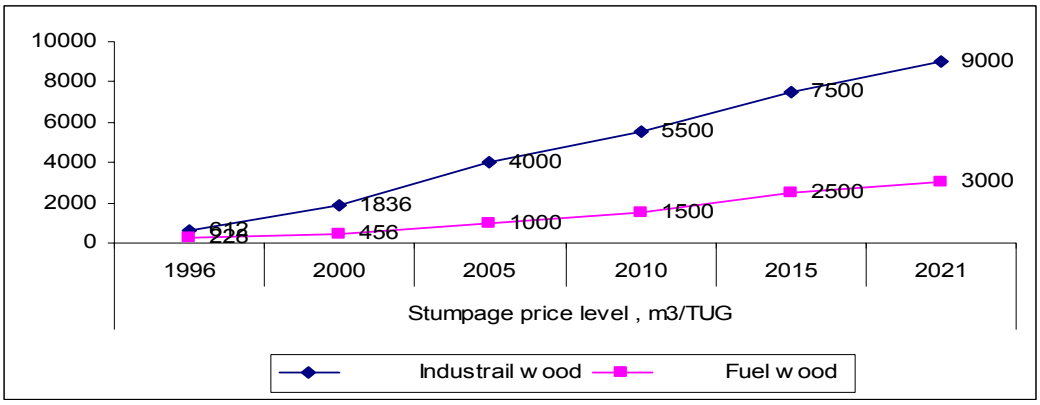


Figure 12. Stumpage price levels, m^3/TUG

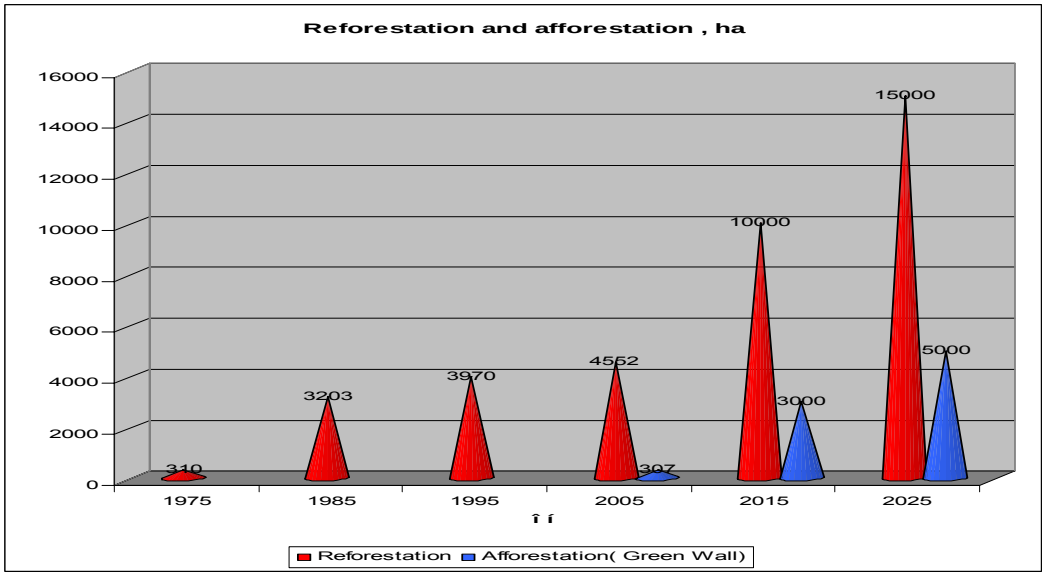


Figure 13. Reforestation and afforestation

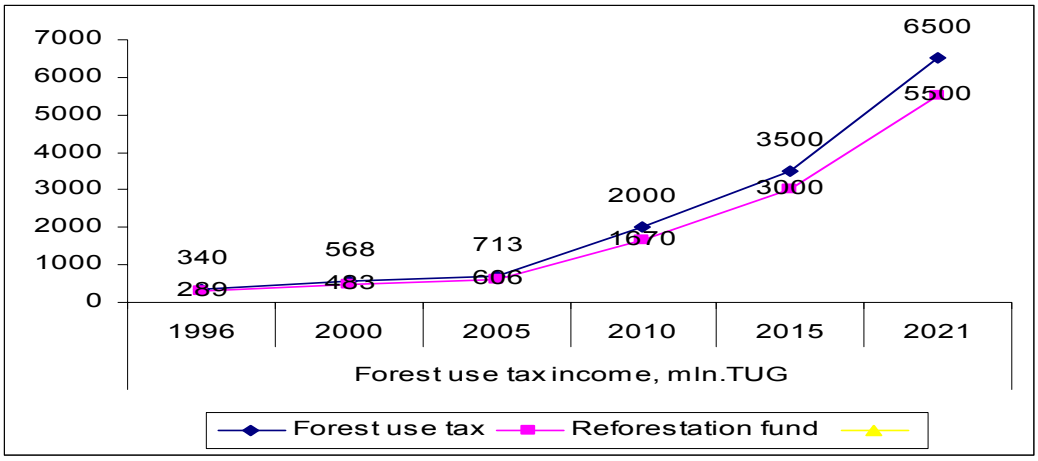


Figure 14. Forest use tax income and reforestation fund

Figure 11 provides projections of expected harvesting of industrial roundwood, fuelwood and total roundwood to 2025.

Figure 12 projects expected stumpage prices for industrial roundwood and fuelwood to 2025.

Figure 13 provides expected areas of reforestation and afforestation under the Green wall programme to 2025.

Figure 14 provides estimates of revenues to government expected from forest use tax, and amounts anticipated to be allocated to the reforestation fund to 2025 (in million TUG).

6. IMPACTS OF CHANGES

The major impacts of change to 2020 will include:

- The forest and wood sectors' contribution to the GDP will increase; the contribution in 2006 was 0.26 percent, in 2008 it is expected to be 1 percent. By 2015 it is expected to be 2 percent
- Stable growth in prices of finished wood products and furniture for both domestic consumption and for export. In 2006, the price was indexed at 78; by 2010 the index price is expected to be 153.8
- All forest managers including local stakeholders, entities, *Sum*, *Aimak* and the capital will have a formal forest management plan and run their activities according to it.

7. PRIORITIES AND STRATEGIES

Protection, sound use and restoration of forest resources

The overall objective is to implement economic policy with ecological orientation in order to protect, ensure sound use of and restore forest resources, reduce processes of desertification and overgrazing, and increase citizens' participation and monitoring to protect forests.

Medium-term objectives (2006-2015)

- *Objective 1:* To build a "Green Wall" by cultivating trees in the Gobi and Steppe regions in order to mitigate the effects of desert climate and protect against desertification, soil deterioration, dust storms and sand encroachment
- *Objective 2:* To prevent natural disasters (forest and steppe fires, harmful forest insect infestations, tree diseases), reduce damage and strengthen capacities to deal with them. Mitigation activities, such as restricting dispersion of harmful forest insects and research on spread and control, will be carried out efficiently
- *Objective 3:* To establish forest and tree databases and mapping capacities based on geographic data systems, forest resource inventories and using remote sensing data from satellites to better define forest spread, structures and components
- *Objective 4:* Implement a series of field management measures including: collection of seeds of trees and shrubs; intensified tree and shrub breeding activities; afforestation of watersheds and river and stream catchments; rehabilitation of areas affected by forest fires, harmful insects and diseases; building a system of forest protection lines, groves and the Green Wall in the steppe, Gobi and desert areas
- *Objective 5:* To improve forest management by reducing the negative impacts of human activities, especially illegal forest activites

Long-term objectives (2011-2021)

Priority objective

In the frame of strategic long-term objectives, a number of activities will be carried out to rehabilitate and improve the quality of forests, to improve management and enhance technology to protect forests and to allocate forest management rights and responsibilities to local communities and citizens (the objective is to allocate more than 50 percent of forest resources).

Objective 1: To establish an extensive system to manage forest protection on the basis of community-based forest resource management and community-based natural resource management approaches (2007-2015). Communities will be expected to protect forests, ensure sound use of and rehabilitate forests. It is anticipated that restoration and natural regeneration of forests will establish more than 15 000 hectares each year between 2015 and 2021)
Objective 2: To establish a connected and complete system of forest management capacity (by 2015-medium, by 2021-higher level) with permanent installed capacities to protect against forest fires, and harmful insects and diseases.
Objective 3: To implement a selection system to identify superior forest trees and use this as a basis for a high-quality tree-breeding programme.

Objectives for developing timber processing industries

Medium-term objective (2007-2015)

Objective: To increase annual average growth of production and sales by building skills and capacities, improving efficiency and raw material recovery rates and improving techniques and technologies used in timber processing industries.

Activities: (i) Transfer new techniques and technologies into timber processing industries. Strengthen management capacities and increase production.
(ii) Training of professionals: establish training centres and build capacities to carry out forestry and wood processing education and training. Organize long- or short-term training.
(iii) In line with national objectives to establish "Industry and Technology Parks", commence establishment in Darkhan city of a "complex of timber-processing industries". The complex should have no negative impacts on nature and environment and should utilize new and progressive techniques and technologies.
(iv) Implement measures to encourage processing industries that will enable import substitution.

Results: Production by the timber processing industry will increase and contribution to GDP will be enhanced. Modern technology and management will be manifested. The skills and capacities of national professionals and personnel will be increased.

Long-term objective (2015-2021)

Objective: To increase and strengthen the production industry sector on the basis of knowledge, science and technology.

Activities: (i) Intensity activities under the "complex of timber processing industries". To establish a "centre of excellence" and meet objectives to have an industrial timber processing park working at full capacity, thereby meeting planned targets.
(ii) Develop a forest chemical industry. Intensity activity for increasing production of forest chemicals such as processed oils and resins for internal or external markets. Final products will be produced using acquired techniques and technologies.

Results: Production will increase and the forestry sector's contribution to the country's economy will reach 2-3 percent of GDP. The quality of products will be closer to world standards.

8. CONCLUSIONS

1. During the past several years, socio-economic development in Mongolia has made significant progress towards economic recovery, stabilization and growth, following its transition from a planned economy to a market economy. In the next 10-15 years a comparatively higher rate of growth in economic development is expected.

2. The total forest area of Mongolia is likely to decrease and impacts of forest fires and insect infestations could substantially worsen this decrease unless interventions are made to encourage sustainable forest management.

3. Structural reform in the forestry sector will bring more participation by local communities in decision making and in forest management, and will reduce the impacts of illegal logging.

4. The current level of timber harvesting is approximately 700 000 m^3 per annum. This can be increased to 0.8-1.2 million m^3 by more intensive forest management systems, by regenerating cut-over and burned areas effectively, by reducing logging wastes and by opening new forest areas for development through building and upgrading roads. However, these responses must be regulated by forest management plans.

5. Forest lands used for grazing – especially buffer zone areas between forest and steppe ecosystems – should mainly be grazed by cattle and horses, which have lower direct impacts on forests than grazing of goats and sheep.

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