Food and Agriculture Organization of the United Nations

Global Forest Resources Assessment 2020

Report

Mongolia

Rome, 2020

FAO has been monitoring the world's forests at 5 to 10 year intervals since 1946. The Global Forest Resources Assessments (FRA) are now produced every five years in an attempt to provide a consistent approach to describing the world's forests and how they are changing. The FRA is a country-driven process and the assessments are based on reports prepared by officially nominated National Correspondents. If a report is not available, the FRA Secretariat prepares a desk study using earlier reports, existing information and/or remote sensing based analysis.

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Introduction

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Introductory text

The country supports two major forest biomes, boreal forests in the north accounting for 14.2 million ha, dominated by larch and birch (CCPIU, 2018 GOM, 2018); and 2.6 million ha of saxaul forests (Bat-Ulzii and Khongor, 2018), a dryland woodland ecosystem in the southern arid regions of Mongolia that is considered under national definitions as 'forest'. The boreal forest comprises deciduous and coniferous forests growing in the forest steppe, boreal forest and mountain zones. Boreal forest is dominated by six main conifer species: larch (*Larix sibirica*), birch (*Betula platyphylla*), Siberian pine (*Pinus sibirica*), Scots pine (*Pinus sylvestris*), aspen (*Populus tremula*) and spruce (*Picea obovata*), with much of the forests being dominated by larch (FRDC, 2017). The broad-leaved trees found here are mainly birch (*Betula platyphylla*), aspen (*Populus tremula*) or poplar (*Populus diversifolia*). Northern boreal forests are part of the transitional zone between the Siberian taiga forest to the north and the grasslands to the south. They typically grow on mountain slopes between 800 m and 2500 m above mean sea level. According to the forest taxation inventories conducted by the Forest Research and Development Center (FRDC), larch, birch and saxaul trees account for more than 60%, 10% and 15% of forest areas, respectively. In terms of growing stock, larch contributes close to 80%, while all other trees are below 10%. The boreal forest average growing stock is estimated 96.3 m^3/ha, excluding saxaul forest (MET, 2019).

Mongolia implemented Multipurpose national forest inventory in 2014-2016 mainly focused to collect stocked forest data (MET, 2016) and additionally to cover some low stocked forests in 2017 (MET, 2019). Also, using dot-grid based sampling approach (Adia et.al, 2015) used to assess Mongolia's land use, land-use change and forestry in 2017 (CCPIU, 2018; FRL, 2018). Similar desktop survey made in 2018 to improve area estimates for the Saxaul forests (Bat-Ulzii and Khongor, 2018).

Information produced from above mentioned studies used for the forest resource assessment report – 2020 of Mongolia. Therefore, previous statistics published in earlier versions of the FRA reports are neglected due to better precision of current data NFI (2014-2017) and LULUCF (1986-2016) used to produce changes in the forests which also consistent with international reporting channels from Mongolia. Those are Forest Reference Level of Mongolia report covering between 2005-2015 (GOM, 2018) and Mongolia is planning to apply LULUCF statistics produced by Forestry land use, land use change assessment report 1986-2016 (CCPIU, 2018) for the second Biennial update report in the next submission (MET, 2017).

References

Adia B., Sanchez-Paus Diaz A., Pekkarinen A., Patriarca C., Maniatis D., Weil D., Mollicone D., Marchi G., Niskala J., Rezende M., and Ricci S. (2015). *Collect Earth User Manual: A guide to monitoring land use change and deforestation with free and open-source software.* Rome, Italy: Open Foris Initiative, Food and Agriculture Organization of the United Nations.

Bat-Ulzii Ch., Khongor Ts., (2018). Dot-grid assessment for Saxaul forest area estimates. UN-REDD Mongolia National Programme.

CCPIU (2018). *Forestry land use, land use change assessment report 1986-2016.* Ulaanbaatar, Mongolia : Climate Change Project Implementing Unit under Environment and Climate Fund of the Ministry of Environment and Tourism.

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GOM (2018). *Mongolia's Forest Reference Level submission to the UNFCCC: Modified submission June 2018. Mongolia: Ministry of Environment and Tourism*

MET (2017). *Mongolia's Initial Biennial update report under the United Nations Framework Convention on Climate Change*. Ulaanbaatar, Mongolia: Ministry of Environment and Tourism.

MET (2016). *Mongolian Multipurpose national Forest Inventory 2014-2016 1st Ed.,* Ulaanbaatar, Mongolia: Ministry of Environment and Tourism.

MET (2019). *Mongolian Multipurpose national Forest Inventory 2014-2018 2nd Ed. Ulaanbaatar, Mongolia: Ministry of Environment and Tourism.*

1 Forest extent, characteristics and changes

1a Extent of forest and other wooded land

National data

Data sources

1990	**References**	Forestry land use, land use change assessment report 1986-2016. Ulaanbaatar, Mongolia : Climate Change Project Implementing Unit under Environment and Climate Fund of the Ministry of Environment and Tourism.
	Methods used	Sample-based remote sensing assessment
	Additional comments	

2000	**References**	Forestry land use, land use change assessment report 1986-2016. Ulaanbaatar, Mongolia : Climate Change Project Implementing Unit under Environment and Climate Fund of the Ministry of Environment and Tourism.
	Methods used	Sample-based remote sensing assessment
	Additional comments	

2010	**References**	Forestry land use, land use change assessment report 1986-2016. Ulaanbaatar, Mongolia : Climate Change Project Implementing Unit under Environment and Climate Fund of the Ministry of Environment and Tourism.
	Methods used	Sample-based remote sensing assessment
	Additional comments	

2015	**References**	Forestry land use, land use change assessment report 1986-2016. Ulaanbaatar, Mongolia : Climate Change Project Implementing Unit under Environment and Climate Fund of the Ministry of Environment and Tourism.
	Methods used	Sample-based remote sensing assessment
	Additional comments	

Classifications and definitions

	National class	**Definition**
1990	Boreal forest	Boreal forest defined as all land spanning of at least 1 ha covered by trees with a height of at least 2 m with a canopy cover of at least 10%.
	Saxaul forest	Saxaul forest defined as all land spanning of at least 1 ha covered by trees with a height of at least 1 m with a canopy cover of at least 4%.

	National class	Definition
2000	Boreal forest	Boreal forest defined as all land spanning of at least 1 ha covered by trees with a height of at least 2 m with a canopy cover of at least 10%.
	Saxaul forest	Saxaul forest defined as all land spanning of at least 1 ha covered by trees with a height of at least 1 m with a canopy cover of at least 4%.

	National class	Definition
2010	Boreal forest	Boreal forest defined as all land spanning of at least 1 ha covered by trees with a height of at least 2 m with a canopy cover of at least 10%.
	Saxaul forest	Saxaul forest defined as all land spanning of at least 1 ha covered by trees with a height of at least 1 m with a canopy cover of at least 4%.

	National class	Definition
2015	Boreal forest	Boreal forest defined as all land spanning of at least 1 ha covered by trees with a height of at least 2 m with a canopy cover of at least 10%.
	Saxaul forest	Saxaul forest defined as all land spanning of at least 1 ha covered by trees with a height of at least 1 m with a canopy cover of at least 4%.

Original data and reclassification

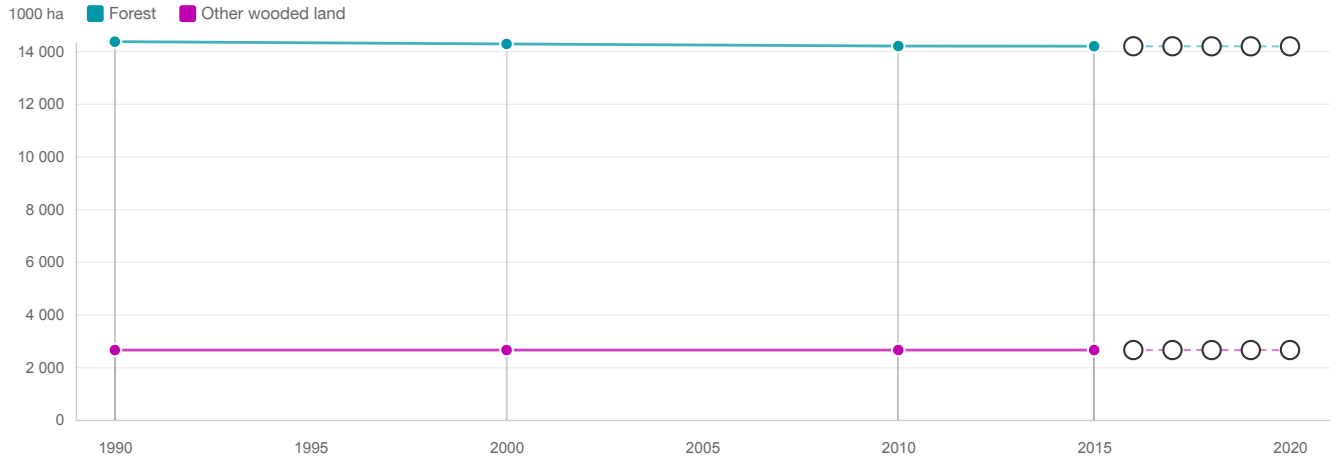
	Classifications and definitions		FRA classes		
	Class	**Area (1000 ha)**	**Forest**	**Other wooded land**	**Other land**
1990	Boreal forest	14 352.00	100.00 %	%	**%**
	Saxaul forest	2 645.00	%	100.00 %	**%**
	Total	**16 997.00**	**14 352.00**	**2 645.00**	**0.00**

	Classifications and definitions		FRA classes		
	Class	**Area (1000 ha)**	**Forest**	**Other wooded land**	**Other land**
2000	Boreal forest	14 263.90	100.00 %	0.00 %	**0.00 %**
	Saxaul forest	2 645.00	0.00 %	100.00 %	**0.00 %**
	Total	**16 908.90**	**14 263.90**	**2 645.00**	**0.00**

2010	Classifications and definitions	FRA classes

	Class	Area (1000 ha)	Forest	Other wooded land	Other land
	Boreal forest	14 183.90	100.00 %	%	%
	Saxaul forest	2 645.00	%	100.00 %	%
	Total	**16 828.90**	**14 183.90**	**2 645.00**	**0.00**

	Classifications and definitions		FRA classes		
	Class	**Area (1000 ha)**	**Forest**	**Other wooded land**	**Other land**
2015	Boreal forest	14 178.33	100.00 %	0.00 %	**0.00 %**
	Saxaul forest	2 645.00	0.00 %	100.00 %	**0.00 %**
	Total	**16 823.33**	**14 178.33**	**2 645.00**	**0.00**


1000 ha
Forest
Other wooded land
14 000
12 000
10 000
8 000
6 000
4 000
2 000
0
1990
1995
2000
2005
2010
2015
2020

FRA categories	Area (1000 ha)								
	1990	2000	2010	2015	2016	2017	2018	2019	2020
Forest (a)	14 352.00	14 263.90	14 183.90	14 178.33	14 177.22	14 176.11	14 175.00	14 173.89	14 172.78
Other wooded land (a)	2 645.00	2 645.00	2 645.00	2 645.00	2 645.00	2 645.00	2 645.00	2 645.00	2 645.00
Other land (c-a-b)	**138 359.00**	**138 447.10**	**138 527.10**	**138 532.67**	**138 533.78**	**138 534.89**	**138 536.00**	**138 537.11**	**138 538.22**
Total land area (c)	**155 356.00**	**155 356.00**	**155 356.00**	**155 356.00**	**155 356.00**	**155 356.00**	**155 356.00**	**155 356.00**	**155 356.00**

The FAOSTAT land area figure for the year 2015 is used for all reference years

Climatic domain	% of forest area 2015	Override value
Boreal	**53.00**	
Temperate	**47.00**	
Sub-tropical	**0.00**	
Tropical	**0.00**	

Comments

The Forest area data 2018, used Mongolian FRL submission report data and Collect Earth Saxaul Forest Remote sensing report, which meets International MRV concepts. The data used for FRA 2020 is better than the previous ones and consistent with FRL report.

1b Forest characteristics

National Data

Data sources + type of data source eg NFI, etc

Country report of Mongolia FRA 2015, http://www.fao.org/3/a-az278e.pdf

Mongolian Forest Reference Level, http://reddplus.mn/eng/wp-content/uploads/2017/11/modul-6-english.pdf

National classification and definitions

According to the "Forest stand assessment" definition, the land area more than 1 hectare, which covered by trees and stand density more than 0.3, defined as Naturally regenerating forest.

According to the Forest Law of Mongolia, the afforested area, defined as planted forest.

However, in the National Forest Inventory, forest defined as all land spanning of at least 1 ha covered by trees with a height of at least 2 m with a canopy cover of at least 10%.

Original data

Forest area data between from 1990 to 2015 used country report of Mongolia FRA 2015.

The forest area data was used from the FRL 2018 report.

Analysis and processing of national data

Estimation and forecasting

The National forest inventory didn't include specific analysis and measurement only in planted forest.

The planted forest information will be available when NFMS operational (currently developing)

Reclassification into FRA 2020 categories

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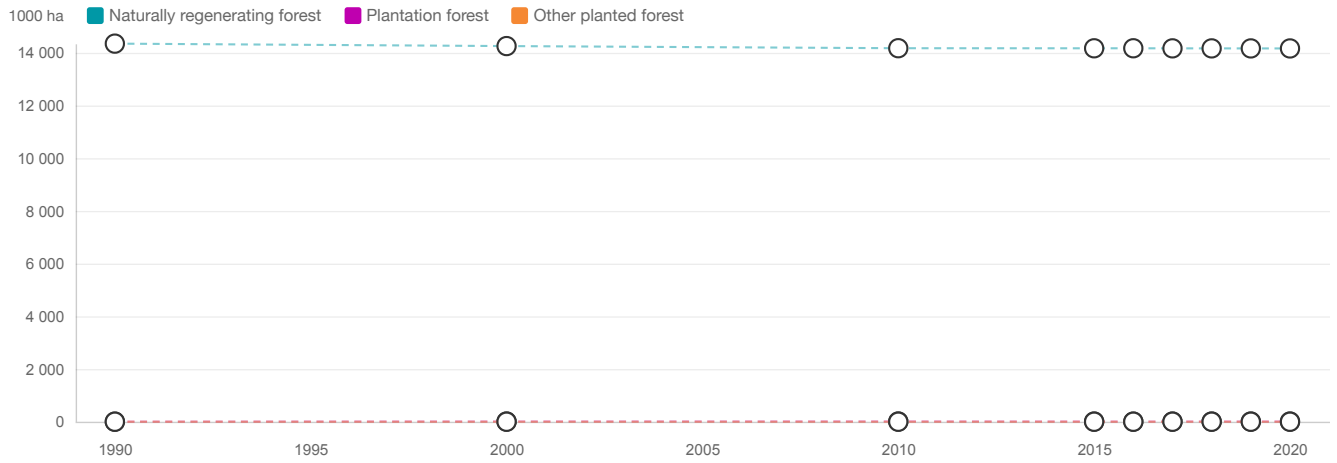
1000 ha
Naturally regenerating forest
Plantation forest
Other planted forest
14 000
12 000
10 000
8 000
6 000
4 000
2 000
0
1990
1995
2000
2005
2010
2015
2020

FRA categories	Forest area (1000 ha)								
	1990	2000	2010	2015	2016	2017	2018	2019	2020
Naturally regenerating forest (a)	14 347.60	14 254.87	14 173.70	14 170.68	14 171.87	14 168.43	14 167.32	14 166.21	14 165.10
Planted forest (b)	**4.40**	**9.03**	**10.12**	**7.65**	**5.35**	**7.68**	**7.68**	**7.68**	**7.68**
Plantation forest	4.40	9.03	10.12	7.65	5.35	7.68	7.68	7.68	7.68
…of which introduced species	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other planted forest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (a+b)	**14 352.00**	**14 263.90**	**14 183.82**	**14 178.33**	**14 177.22**	**14 176.11**	**14 175.00**	**14 173.89**	**14 172.78**
Total forest area	**14 352.00**	**14 263.90**	**14 183.90**	**14 178.33**	**14 177.22**	**14 176.11**	**14 175.00**	**14 173.89**	**14 172.78**

Comments

The Planted forest data were used between 1990 to 2015, based on Forest stand assessment (Known as taxation forest inventory), which is not included spatial supporting data. Start form 2017 till 2020, linear values used to predict planted forest areas which is based on annual planted forest area.

Currently, Mongolia aiming to completely adopt MRV concept into forest sector, were all forest activity data supported by spatial information. Yet, the NFMS is under development. Thus, planted forest information not clear.

1c Primary forest and special forest categories

National Data

Data sources + type of data source eg NFI, etc

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National classification and definitions

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Original data

The data comes from LULUCF Activity data created for Mongolia's GHGi and FRL.

Analysis and processing of national data

Estimation and forecasting

-

Reclassification into FRA 2020 categories

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FRA categories	Area (1000 ha)				
	1990	2000	2010	2015	2020
Primary forest	0.00	0.00	0.00	0.00	0.00
Temporarily unstocked and/or recently regenerated	20.25	10.13	5.06	0.51	0.51
Bamboos	0.00	0.00	0.00	0.00	0.00
Mangroves	0.00	0.00	0.00	0.00	0.00
Rubber wood	0.00	0.00	0.00	0.00	0.00

Comments

We used linear prediction to come up with 2020 estimate for primary forest

1d Annual forest expansion, deforestation and net change

National Data

Data sources + type of data source eg NFI, etc

Mongolian Forest Reference Level, http://reddplus.mn/eng/wp-content/uploads/2017/11/modul-6-english.pdf

National classification and definitions

Categories	Definitions
Forest expansion:	Expansion of forest on land that, until then, was not defined as forest
Afforestation:	Establishment of forest through planting and/or deliberate seeding on land that, until then, was not defined as forest.
Natural expansion:	Expansion of forests through natural succession on land that, until then, was under another land use (e.g. forest succession on land previously used for agriculture).
Deforestation:	Forest areas where tree canopy cover has been reduced to below 10 % by the drivers (fire, pest, logging or mining) are defined as deforestation. The forest areas converted for settlement and agricultural purposes are also considered as deforestation even if the minimum threshold of 10 % canopy cover is reached.

Original data

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Analysis and processing of national data

Estimation and forecasting

-

Reclassification into FRA 2020 categories

-

FRA categories	Area (1000 ha/year)			
	1990-2000	2000-2010	2010-2015	2015-2020
Forest expansion (a)	0.25	0.25	0.41	0.41
…of which afforestation	0.11	0.15	0.30	0.30
…of which natural expansion	0.14	0.10	0.10	0.10
Deforestation (b)	9.06	8.25	1.52	1.52
Forest area net change (a-b)	**-8.81**	**-8.00**	**-1.11**	**-1.11**

Comments

1e Annual reforestation

National Data

Data sources + type of data source eg NFI, etc

-

National classification and definitions

-

Original data

-

Analysis and processing of national data

Estimation and forecasting

-

Reclassification into FRA 2020 categories

-

FRA categories	Area (1000 ha/year)			
	1990-2000	2000-2010	2010-2015	2015-2020
Reforestation	5.02	7.90	9.20	6.50

Comments

1f Other land with tree cover

National Data

Data sources + type of data source eg NFI, etc

-

National classification and definitions

-

Original data

-

Analysis and processing of national data

Estimation and forecasting

-

Reclassification into FRA 2020 categories

-

FRA categories	Area (1000 ha)				
	1990	2000	2010	2015	2020
Palms (a)	0.00	0.00	0.00	0.00	0.00
Tree orchards (b)	0.00	0.00	0.00	0.00	0.00
Agroforestry (c)	0.00	0.00	0.00	0.00	0.00
Trees in urban settings (d)	3.47	3.52	3.93	4.21	4.21
Other (specify in comments) (e)	0.00	0.00	0.00	0.00	0.00
Total (a+b+c+d+e)	**3.47**	**3.52**	**3.93**	**4.21**	**4.21**
Other land area	**138 359.00**	**138 447.10**	**138 527.10**	**138 532.67**	**138 538.22**

Comments

Trees in urban setting is not belong to forest and calculated from Collect Earth assessment result. subir el reporte

http://reddplus.mn/eng/wp-content/uploads/2018/08/FINAL_CE_REPORT_ENG.pdf

2 Forest growing stock, biomass and carbon

2a Growing stock

National Data

Data sources + type of data source eg NFI, etc

Country report of Mongolia FRA 2015, http://www.fao.org/3/a-az278e.pdf

National Forest Inventory report, http://forest-atlas.mn/Documentation.aspx

National classification and definitions

Volume over bark of all living trees with a minimum diameter of 6 cm at breast height. Includes the stem from ground level up to a top diameter of 0 cm, excluding branches.

1. Diameter breast height refers to diameter over bark measured at a height of 1.3 m above ground level.
2. Includes laying living trees.
3. Excludes branches, twigs, foliage, flowers, seeds, and roots

Original data

Growing stock data between from 1990 to 2015 used country report of Mongolia FRA 2015.

Current growing stock data is based on National Forest Inventory report

Analysis and processing of national data

Estimation and forecasting

Growing stock data between from 1990 to 2015 used country report of Mongolia FRA 2015 which is based on forest stand assessment inventory(most work has been done visual estimation and interpretation).

the 2018 data based on National forest inventory which is based on actual field measurement under MRV concept.

Reclassification into FRA 2020 categories

-

FRA categories	Growing stock m³/ha (over bark)								
	1990	2000	2010	2015	2016	2017	2018	2019	2020
Naturally regenerating forest	96.30	96.30	96.30	96.30	96.30	96.30	96.30	96.30	96.30
Planted forest	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
…of which plantation forest	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00
…of which other planted forest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forest	96.30	96.30	96.30	96.30	96.30	96.30	96.30	96.30	96.30
Other wooded land	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69

FRA categories	Total growing stock (million m³ over bark)								
	1990	2000	2010	2015	2016	2017	2018	2019	2020
Naturally regenerating forest	1 381.67	1 372.74	1 364.93	1 364.64	1 364.75	1 364.42	1 364.31	1 364.21	1 364.10
Planted forest	0.11	0.23	0.25	0.19	0.13	0.19	0.19	0.19	0.19
…of which plantation forest	0.11	0.23	0.25	0.19	0.13	0.19	0.19	0.19	0.19
…of which other planted forest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forest	1 382.10	1 373.61	1 365.91	1 365.37	1 365.27	1 365.16	1 365.05	1 364.95	1 364.84
Other wooded land	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.83

Comments

National Forest Inventory conducted only in boreal forest. For that reason, the Saxaul forest (which we classified Other wooded land in FRA) information is missing.

2b Growing stock composition

National Data

Data sources + type of data source eg NFI, etc

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National classification and definitions

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Original data

-

Analysis and processing of national data

Estimation and forecasting

-

Reclassification into FRA 2020 categories

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FRA categories	Scientific name	Common name	Growing stock in forest (million m³ over bark)				
			1990	2000	2010	2015	2020
Native tree species							
#1 Ranked in terms of volume	Larix sibirica	Siberian larch	1 019.19	1 012.60	1 006.84	1 006.71	1 006.23
#2 Ranked in terms of volume	Pinus sibirica	Siberian pine	122.19	121.40	120.71	120.69	120.63
#3 Ranked in terms of volume	Betula platyphylla	Birch	108.99	108.29	107.67	107.66	107.61
#4 Ranked in terms of volume	Pinus sylvestris	Scotch pine	108.68	107.98	107.36	107.35	107.30
#5 Ranked in terms of volume	Picea obovata	Siberian spruce	11.24	11.16	11.10	11.10	11.09
#6 Ranked in terms of volume	Populus tremula	Aspen	7.40	7.35	7.31	7.31	7.31
#7 Ranked in terms of volume	Abies sibirica	Siberian fir	4.55	4.52	4.49	4.49	4.49
#8 Ranked in terms of volume							
#9 Ranked in terms of volume							
#10 Ranked in terms of volume							
Remaining native tree species							
Total volume of native tree species			**1 382.24**	**1 373.30**	**1 365.48**	**1 365.31**	**1 364.66**
Introduced tree species							
#1 Ranked in terms of volume							
#2 Ranked in terms of volume							
#3 Ranked in terms of volume							
#4 Ranked in terms of volume							
#5 Ranked in terms of volume							
Remaining introduced tree species							

FRA categories	Scientific name	Common name	Growing stock in forest (million m³ over bark)				
			1990	2000	2010	2015	2020
Native tree species							
Total volume of introduced tree species			–	–	–	–	–
Total growing stock			**1 382.24**	**1 373.30**	**1 365.48**	**1 365.31**	**1 364.66**

Comments

Data comes from NFI 2014 and same ratios applied for other years.

2c Biomass stock

National Data

Data sources + type of data source eg NFI, etc

National Forest Inventory report, http://forest-atlas.mn/Documentation.aspx

IPCC guideline 2006. https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf

National classification and definitions

The biomass is all living trees volume converted to dry weight.

Above ground biomass: all living trees above ground volume converted to dry weight.

Below ground biomass: all living trees below ground volume converted to dry weight.

Deadwood: all laying, standing deadwood and stumps volume converted to dry weight.

Original data

National forest inventory report

Analysis and processing of national data

Estimation and forecasting

Above-ground biomass (AGB)

The Institute of General and Experimental Biology (IGEB) of the Mongolian Academy of Science (MAS) has carried out a field survey of biomass of main tree species of Mongolia (Dorjsuren, 2017). The field surveys were carried out in most typical forest stands. A total of 23 circular samples of 20 m radius were established. All the plots were inventoried following the NFI (MET, 2016) plot measurement methods.

A total of 192 selected trees were harvested and measured for tree volume and biomass (Table 2-5) following methods of Picard et al. (2012). Tree biomass measurement was organized with seven different operations: site preparation and felling; measurement of felled trees – stem profile; cross-cutting into logs and disks; weighting of logs and brushwood; sampling of branches; and sample weighing. Each model tree was divided into three different sections: trunk wood, crown wood (top, middle, bottom section), and branches and foliage. Standard oven dry methods were used to derive dry biomass of the samples.

The allometric models were derived based on the relationship between AGB and diameter at breast height (DBH) and total height of tree (H_{tot}) measurements.

*(Eq1) AGB=a*DBHb×Htotc*

Where:

AGB = Above-ground live Biomass (tonnes), (= *dry biomass of stem incl. bark, branch and leaves*)

DBH = Tree stem diameter (m) at breast height (1,3m)

Htot = Tree total height/length (m)

a = Species specific factor

b = Species specific DBH exponential factor

c = Species specific H_{tot} exponential factor

The species specific coefficients are provided in Table 1.

Table 1. National species-specific coefficients for biomass models

	Scientific name	Common name	Species specific factors		
			a	b	c
1	*Larix sibirica*	Siberian Larch	0.0534	2.03321	0.5996
2	*Pinus sylvestris*	Scotch Pine	0.037	2.2875	0.4418
3	*Pinus sibirica*	Siberian Pine	0.0677	1.9944	0.5774
4	*Picea obovata*	Siberian Spruce	0.0313	1.5339	1.3435
5	*Abies sibirica*	Siberian Fir	0.1212	0.4343	1.9744
6	*Betula platyphylla*	Asian White Birch	0.0735	2.19502	0.4053
7	*Betula humilis*	Shrubby Birch	0.0735	2.19502	0.4053
8	*Betula rotundifolia / B. nana*	Dwarf Birch	0.0735	2.19502	0.4053
9	*Populus laurifolia*	Laurel poplar	0.1396	2.5168	-0.3862
10	*Populus balsamifera var. Suaveolens*	Mongolian poplar (Siberian poplar)	0.1396	2.5168	-0.3862
11	*Populus tremula*	Aspen	0.0579	2.01676	0.5845
12	*Ulmus pumila*	Siberian Elm	0.0735	2.19502	0.4053
13	*Haloxylon ammodendron*	Saxaul	0.0735	2.19502	0.4053
14	*Populus diversifolia / P. Euphratica*	Desert poplar	0.0735	2.19502	0.4053
15	*Salix berberifolia*	Willow	0.0735	2.19502	0.4053
16	*Salix glauca*	Gray willow	0.0735	2.19502	0.4053
17	*Salix reticulata*	Net-leaved willow	0.0735	2.19502	0.4053
18	*Padus asiatica*	Black Cherry	0.0735	2.19502	0.4053
19	*Sorbus sibirica*	Service Tree	0.0735	2.19502	0.4053
100	not specified	not specified	0.0534	2.03321	0.5996

Below-ground biomass (BGB)

BGB was estimated from IPCC GL (2006) default value of root-shoot ratio for boreal forest (Eq. 2) with a criteria of equal to or above 75 tonnes of dry AGB per ha (Table 2).

(Eq. 2) $BGB=AGB*RSR$

Where:

RSR = Root-Shoot ratio for Boreal forest from IPCC GL (2006)

Table 2. Below-ground living tree biomass as proportion of above-ground living tree biomass

BGB/AGB Root-Shoot ratio for Boreal forest	
AGB<75	AGB≥75
0.39	0.24

Deadwood (DW)

In the NFI (MET, 2016) deadwood organic matter was calculated as the sum of three types of organic matter: standing above-ground deadwood, on-the-ground deadwood (branch ≥ 5cm DBH), and below-ground deadwood (Eq. 3). The three types of deadwood were calculated separately (Eq. 4-6).

(Eq. 3) $DWtotal=DWground+DWstanding+DWBG$

Where:

DWground = Deadwood on-the-ground and stump (based on mid-log diameter, log length and decay)

DWstanding = Standing deadwood (*only stem*)

DWBG = Below-ground deadwood (based on stump/tree DBH and decay)

(Eq. 4) $DWground=Dm2*\pi 4*L*(100-Bd)$

Where:

Dm = Diameter at middle length of a log

L = Log length

Bd = decay as percentage

(Eq. 5) $DWstanding=a*DBHb*Htotc*(100-Bd)/100$

(Eq. 6) $DWBG=AGB*RSR$

Reclassification into FRA 2020 categories

-

FRA categories	Forest biomass (tonnes/ha)								
	1990	2000	2010	2015	2016	2017	2018	2019	2020
Above-ground biomass	54.90	54.90	54.90	54.90	54.90	54.90	54.90	54.90	54.90
Below-ground biomass	16.40	16.40	16.40	16.40	16.40	16.40	16.40	16.40	16.40
Dead wood	15.10	15.10	15.10	15.10	15.10	15.10	15.10	15.10	15.10

Comments

The Forest stand assessment (known as taxation forest inventory) data from 1990 to 2015 didn't consider to estimate biomass. All biomass information between 1990 to 2015 used default value source is unknown.

2d Carbon stock

National Data

Data sources + type of data source eg NFI, etc

Mongolian Forest Reference Level, http://reddplus.mn/eng/wp-content/uploads/2017/11/modul-6-english.pdf

National Forest Inventory report, http://forest-atlas.mn/Documentation.aspx

IPCC guideline 2006. https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_04_Ch4_Forest_Land.pdf

National classification and definitions

Aboveground carbon: All aboveground biomass converted into carbon extraction

belowground carbon: All belowground biomass converted into carbon extraction

deadwood carbon: All deadwood biomass converted into carbon extraction

litter carbon: Carbon in all non-living biomass foliage. excluding branches smaller than 6cm.

soil carbon: Organic carbon in mineral and organic soils

Original data

National Forest Inventory report

Analysis and processing of national data

Estimation and forecasting

The estimation of carbon in living biomass and in dead wood (aboveground, belowground and deadwood biomass) is estimated by converting the corresponding biomass pools to carbon with IPCC 2006 recommended carbon fraction for boreal coniferous trees, 0.51 tonnes carbon per tonne dry biomass.

Above ground carbon calculated by the following equation:

Above-ground carbon=AGB×0.51

Below-ground carbon calculated by the following equation:

Below-ground carbon=BGB×0.51

Deadwood carbon was calculated from deadwood biomass, were included deadwood biomass loss.

Deadwood carbon (DWC) stock

DWC=Bdw*Dc-dw

DWC= Deadwood carbon stock (tonnes of C)

Bdw= Deadwood Biomass (= tonnes of dry dead coarse biomass/ha)

Dc-dw=Carbon density in Bdw (tonnes of C/tonnes of dry biomass); 0.51

DWC=DWCground+DWCstanding+DWCunderground

DWC=Total Deadwood carbon stock (tonnes of C)

DWCground= Above ground lying deadwood carbon stock (tonnes of C)

DWCstanding= Above-ground standing dead wood carbon stock (tonnes of C)

DWCunderground= Below-ground dead wood carbon stock (tonnes of C)

Litter Carbon (LC) stock:

$LC=D_{litter}*Area$

LC= Litter carbon stock (tonnes of C)

D_{litter}= Litter carbon density per hectare (IPPC default factor)

Area= Area of study

Soil organic Carbon (LC) stock:

SOC=Dsoc*Area

SOC= Soil organic carbon stock (tonnes of C)

Dsoc= Soil organic carbon density per hectare (IPPC default factor)

Area= Area of study

Reclassification into FRA 2020 categories

-

FRA categories	Forest carbon (tonnes/ha)								
	1990	2000	2010	2015	2016	2017	2018	2019	2020
Carbon in above-ground biomass	29.10	29.10	29.10	29.10	29.10	29.10	29.10	29.10	29.10
Carbon in below-ground biomass	8.60	8.60	8.60	8.60	8.60	8.60	8.60	8.60	8.60
Carbon in dead wood	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70
Carbon in litter	15.90	15.90	15.90	15.90	15.90	15.90	15.90	15.90	15.90
Soil carbon	83.90	83.90	83.90	83.90	83.90	83.90	83.90	83.90	83.90

Soil depth (cm) used for soil carbon estimates	

Comments

The Forest stand assessment data from 1990 to 2015 (known as taxation forest inventory) didn't include carbon estimation.

3 Forest designation and management

3a Designated management objective

National Data

Data sources + type of data source eg NFI, etc

LAW OF MONGOLIA ON SPECIAL PROTECTED AREA. 1994

Mongolian law on forest Article 5.1. Classifications of Forest Resources and Forest Land.

National classification and definitions

In the forest law it stated that Based upon conservation and utilization regimes and ecological-economic importance, the forest fund shall be classified as follows:
5.1.1. Protected forest zone and
5.1.2. Forest utilization zone

This classifications further detail in Chapter 2 Forest zones and their protection regimes.

In the Law of Mongolia on Special protected area, Article 3. it stated that the protected area classified into four categories.

1) national conservation park;
2) natural complex area;
3) natural reserve;
4) national monument area.

These categories are explained in the chapters 2-5 and national conservation park and natural complex area are further classified to FRA categories of conservation of biodiversity and social services according to allowed activities.

National Conservation Park shall be divided with respect to its natural forms, state, features of soil, water, fauna, flora and its vulnerability to human activities into the following zones:
1) virginal zone;
2) protected zone;
3) limited zone.

The natural complex area shall be divided with respect to its natural state, the location of animals and plants, requirement of conservation of historical and cultural monuments, condition for developing tours and tourisms into following zones:
1) special zone;
2) tourist zone;
3) restricted zone.

Original data

-

Analysis and processing of national data

Estimation and forecasting

-

Reclassification into FRA 2020 categories

-

Primary designated management objective

FRA 2020 categories	Forest area (1000 ha)				
	1990	2000	2010	2015	2020
Production (a)	3 175.52	3 175.52	3 175.52	3 777.00	3 778.00
Protection of soil and water (b)	10 214.02	10 214.02	10 214.02	9 198.63	9 192.08
Conservation of biodiversity (c)	26.31	575.29	578.84	952.77	952.77
Social Services (d)	2.02	197.29	215.52	249.93	249.93
Multiple use (e)			0.00	0.00	0.00
Other (specify in comments) (f)			0.00	0.00	0.00
None/unknown (g)	**934.13**	**101.78**	**0.00**	**0.00**	**0.00**
Total forest area	**14 352.00**	**14 263.90**	**14 183.90**	**14 178.33**	**14 172.78**

Total area with designated management objective

FRA 2020 categories	Forest area (1000 ha)				
	1990	2000	2010	2015	2020
Production					
Protection of soil and water					
Conservation of biodiversity					
Social Services					
Other (specify in comments)					

Comments

According to the forest management planning inventory, Mongolia classifies forest areas into two categories, which are utilization and protection forests. In the table 3a, we put utilization forest area as production forest and protected forest area as protection of soil and water forest.

We used virginal, protected, limited zone of national conservation park and special and restricted zone of a natural complex area to be conservation of biodiversity area. Tourism zone of natural complex area used for social services area. Conservation for biodiversity and social services areas are deducted from the protected forest area of MPFI.

Reviewer edition: 1990 and 2000 estimated equal to 2010 for production and protection

3b Forest area within protected areas and forest area with long-term management plans

National Data

Data sources + type of data source eg NFI, etc

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National classification and definitions

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Original data

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Analysis and processing of national data

Estimation and forecasting

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Reclassification into FRA 2020 categories

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FRA categories	Area (1000 ha)								
	1990	2000	2010	2015	2016	2017	2018	2019	2020
Forest area within protected areas	43.52	2 343.72	2 403.95	2 976.23	2 976.23	2 976.23	2 976.23	2 976.23	2 976.23
Forest area with long-term forest management plan	14 352.00	14 263.90	14 183.90	14 178.33	14 177.22	14 176.11	14 175.00	14 173.89	14 172.78
…of which in protected areas	43.52	2 343.72	2 403.95	2 976.23	2 976.23	2 976.23	2 976.23	2 976.23	2 976.23

Comments

The data source for the protected status of forest comes from spatial file of special protected area which produced by the Minitry of Environment and Tourism.

http://www.eic.mn:8080/geonetwork/srv/eng/main.home

4 Forest ownership and management rights

4a Forest ownership

National Data

Data sources + type of data source eg NFI, etc

-

National classification and definitions

-

Original data

-

Analysis and processing of national data

Estimation and forecasting

-

Reclassification into FRA 2020 categories

-

FRA categories	Forest area (1000 ha)			
	1990	2000	2010	2015
Private ownership (a)	0.00	0.00	0.00	0.00
…of which owned by individuals	0.00	0.00	0.00	0.00
…of which owned by private business entities and institutions	0.00	0.00	0.00	0.00
…of which owned by local, tribal and indigenous communities	0.00	0.00	0.00	0.00
Public ownership (b)	14 352.00	14 263.90	14 183.90	14 178.33
Unknown/other (specify in comments) (c)	**0.00**	**0.00**	**0.00**	**0.00**
Total forest area	**14 352.00**	**14 263.90**	**14 183.90**	**14 178.33**

Comments

4b Holder of management rights of public forests

National Data

Data sources + type of data source eg NFI, etc

Regulation for forest concession 2009

National classification and definitions

Class	Definitions
Forest user group	"Forest user group" means a voluntary association of citizens organizeds pursuant to 481.1 of the Civil Code and Article 3.2.8 of the Law on Environmental Protection and running their joint efforts.
Private enterprise	Forest management rights and responsibilities are transferred from the Public Administration to corporations, other business entities private cooperatives, private nonprofit institutions and associations, etc., through long-term leases or management agreements.

Original data

Data on forest concessions

Analysis and processing of national data

Estimation and forecasting

The public administration leases forest management rights to local communities and/or professional forest enterprises based on Local Citizens Representative Meeting decision. The forest concession area then reported to central government through online database where collected in Forest taxation database.

Reclassification into FRA 2020 categories

-

FRA categories	Forest area (1000 ha)			
	1990	2000	2010	2015
Public Administration (a)	14 352.00	14 263.90	10 507.46	10 139.10
Individuals (b)	0.00	0.00	0.00	0.00
Private business entities and institutions (c)	0.00	0.00	601.70	522.23
Local, tribal and indigenous communities (d)	0.00	0.00	3 074.74	3 517.00
Unknown/other (specify in comments) (e)	**0.00**	**0.00**	**0.00**	**0.00**
Total public ownership	**14 352.00**	**14 263.90**	**14 183.90**	**14 178.33**

Comments

From 2009 a decree approved for forest lease.

5 Forest disturbances

5a Disturbances

National Data

Data sources + type of data source eg NFI, etc

Mongolian Forest Reference Level

CCPIU, (2018). *Forestry land use, land use change assessment report 1986-2016.* Ulaanbaatar, Mongolia : Climate Change Project Implementing Unit under Environment and Climate Fund of the Ministry of Environment and Tourism.

National classification and definitions

Categories	Definitions
Insect damage	Bark beetle, other beetle damaging bark or wood, beetle or larvae removing or damaging leafs or needles
Diseases damage	Any fungus damage affecting wood, bark or leafs
Severe weather events	Snow and ice damage (tree bent, top broken, major branches broken by heavy snow or ice)

Original data

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Analysis and processing of national data

Estimation and forecasting

-

Reclassification into FRA 2020 categories

-

FRA categories	Area (1000 ha)																	
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Insects (a)	10.28	11.38	11.16	18.53	7.23	7.19	10.31	15.06	19.46	18.36	5.21	3.12	14.95	9.74	2.34	5.35	1.28	
Diseases (b)																		
Severe weather events (c)																		
Other (specify in comments) (d)																		
Total (a+b+c+d)	**10.28**	**11.38**	**11.16**	**18.53**	**7.23**	**7.19**	**10.31**	**15.06**	**19.46**	**18.36**	**5.21**	**3.12**	**14.95**	**9.74**	**2.34**	**5.35**	**1.28**	–
Total forest area	**14 263.90**	–	–	–	–	–	–	–	–	–	**14 183.90**	–	–	–	–	**14 178.33**	**14 177.22**	**14 176.11**

Comments

5b Area affected by fire

National Data

Data sources + type of data source eg NFI, etc

Mongolian Forest Reference Level

CCPIU, (2018). *Forestry land use, land use change assessment report 1986-2016.* Ulaanbaatar, Mongolia : Climate Change Project Implementing Unit under Environment and Climate Fund of the Ministry of Environment and Tourism.

National classification and definitions

Categories	Definition
Area affected by forest fire	bark or leaf damaged by fire

Original data

-

Analysis and processing of national data

Estimation and forecasting

-

Reclassification into FRA 2020 categories

-

FRA categories	Area (1000 ha)																	
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total land area affected by fire	1 090.00	380.00	860.00	3 800.00	7 800.00	4 365.00	5 594.00	1 335.00	1 018.00	605.00	302.00	2 100.00	5 000.00	5 600.00	3 100.00	6 600.00	2 917.00	
…of which on forest	660.00	87.00	582.00	320.00	100.00	300.00	300.00	500.00	491.00	161.00	58.00	20.00	300.00	5.00	18.00	45.00	138.00	

Comments

Data comes from National emergency management agency (Unofficial).

Collect Earth study results show different area estimate for forest land but does not give total fire affected areas. Therefore, NEMA data used.

5c Degraded forest

Does your country monitor area of degraded forest		Yes
If "yes"	What is the national definition of "Degraded forest"?	Forest areas with a canopy cover equal to, or above, 10% but in which canopy cover has been reduced due to fire, pest or logging activities were considered as degraded forest.
	Describe the monitoring process and results	The analysis was conducted using high to medium spatial resolution Earth Observation data accessible through Google Earth, Google Earth Engine (GEE), and Bing Maps. A sample plot was determined to be forest land when >=10% tree cover was estimated suing the dot grid within a sample.

Comments

6 Forest policy and legislation

6a Policies, Legislation and national platform for stakeholder participation in forest policy

National Data

Data sources + type of data source eg NFI, etc

State forest policy 2015

Forest clealing programm 2014

Forest management plan guideline 2009

National classification and definitions

Sustainable forest management	Sustainable forest management (SFM) means the stewardship and use of forests and lands in a way, and at a rate, that maintains their biologival diversity, productivity, regeneration capacity, vitality and potential to fulfill, now and in the future, relevant ecological, economic, and social functions al local, national, and global levels, and that does not cause damage to other ecosystems.

Original data

Database on forest utilization, license and violations

Indicate the existence of	Boolean (Yes/No)	
	National	Sub-national
Policies supporting SFM	Yes	Yes
Legislations and regulations supporting SFM	Yes	Yes
Platform that promotes or allows for stakeholder participation in forest policy development	Yes	Yes
Traceability system(s) for wood products	Yes	Yes

Comments

6b Area of permanent forest estate

National Data

Data sources + type of data source eg NFI, etc

-

National classification and definitions

-

Original data

-

FRA 2020 categories	Forest area (1000 ha)					
	Applicable?	1990	2000	2010	2015	2020
Area of permanent forest estate	Yes	14 352.00	14 263.90	14 183.90	14 178.33	14 172.78

Comments

Forest area is expected to be permanent estate by Forest law article 29.1.10. Constructing and placing buildings and facilities in forest land for the purposes other than to serve state special need or implement forestry management.

7 Employment, education and NWFP

7a Employment in forestry and logging

National Data

Data sources + type of data source eg NFI, etc

-

National classification and definitions

-

Original data

-

FRA 2020 categories	Full-time equivalents (1000 FTE)											
	1990			2000			2010			2015		
	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male
Employment in forestry and logging	267.00	93.00	174.00	77.00	27.00	50.00	64.00	29.00	35.00			
…of which silviculture and other forestry activities												
…of which logging												
…of which gathering of non wood forest products												
…of which support services to forestry												

Comments

La referencia

DOI: 10.1080/10549811.2011.548761

7b Graduation of students in forest-related education

National Data

Data sources + type of data source eg NFI, etc

-

National classification and definitions

-

Original data

Number of graduates and employment rate

Year	PhD		Masters		Undergraduate		Diploma	
	No. of Graduation	No. of Employment	No. of Graduation	No. of Employment	No. of Graduation	No. of Employment	No. of Graduation	No. of Employment
2015	2	2	8	8	168	118	21	-
2010	5	5	18	18	81	38	29	-
2005	3	3	6	6	97	40	35	-

Number of students inrolled in forestry programmes in Mongolian universities.

Institution Name	No. of Female Undergraduate Students	No. of Male Undergraduate Students	No. of Female Graduate Students	No. of Male Graduate Students
Department of Environment, Forest Engineering, National University of Mongolia (DEFE, NUM)	21	14	11	4
Department of Ecology, Mongolian University of Life Sciences (DE, MULS)	30	32	1	7
Darkhan branch of Mongolian University of Life Sciences (Darkhan, MULS)	5	16	0	0
Department of Wood processing technology, Mongolian University of Science and Technology (DWPT, MUST)	27	106	5	7
Department of Horticulture, International University of Ulaanbaatar (DH, IUU	18	25	7	8

FRA 2020 categories	Number of graduated students											
	1990			2000			2010			2015		
	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male
Doctoral degree				3.00	1.00	2.00	5.00	2.00	3.00	2.00	1.00	1.00
Master's degree				6.00	3.00	3.00	18.00	9.00	9.00	8.00	4.00	4.00
Bachelor's degree				97.00	33.00	64.00	81.00	28.00	53.00	168.00	57.00	111.00
Technician certificate / diploma				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total				106.00	37.00	69.00	104.00	37.00	65.00	178.00	62.00	116.00

Comments

Number of female and male students calculated 34% and 66% for undergraduates, and 48% and 52% for graduate students. This ratio comes from Table named "Number of students inrolled in forestry programmes in Mongolian universities" in the Original data section. We used 2005 info to fill year 2000 and data presented in the table "Graduation of students in forest-related education (3 year average)" is not 3 years averages.

7c Non wood forest products removals and value 2015

National Data

Data sources + type of data source eg NFI, etc

-

National classification and definitions

-

Original data

-

	Name of NWFP product	Key species	Quantity	Unit	Value (1000 local currency)	NWFP category
#1	Pine nuts	Pinus sibirica	4 811	tonnes	3 851 500	1 Food
#2						
#3						
#4						
#5						
#6						
#7						
#8						
#9						
#10						
All other plant products						
All other animal products						
Total					**3 851 500**	

Name of currency	

Comments

8 Sustainable Development Goal 15

8a Sustainable Development Goal 15

SDG Indicator 15.1.1 Forest area as proportion of total land area 2015

Indicator	Percent							
	2000	2010	2015	2016	2017	2018	2019	2020
Forest area as proportion of total land area 2015	9.18	9.13	9.13	9.13	9.12	9.12	9.12	9.12

Name of agency responsible	

SDG Indicator 15.2.1 Progress towards sustainable forest management

Sub-Indicator 1	Percent						
	2000-2010	2010-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020
Forest area annual net change rate	-0.06	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

Name of agency responsible	

Sub-Indicator 2	Forest biomass (tonnes/ha)							
	2000	2010	2015	2016	2017	2018	2019	2020
Above-ground biomass stock in forest	54.90	54.90	54.90	54.90	54.90	54.90	54.90	54.90

Name of agency responsible	

Sub-Indicator 3	Percent (2015 forest area baseline)							
	2000	2010	2015	2016	2017	2018	2019	2020
Proportion of forest area located within legally established protected areas	16.53	16.96	20.99	20.99	20.99	20.99	20.99	20.99

Name of agency responsible	

Sub-Indicator 4	Percent (2015 forest area baseline)							
	2000	2010	2015	2016	2017	2018	2019	2020
Proportion of forest area under long-term forest management plan	100.00	100.00	100.00	99.99	99.98	99.98	99.97	99.96

Name of agency responsible	

Sub-Indicator 5	Forest area (1000 ha)							
	2000	2010	2015	2016	2017	2018	2019	2020
Forest area under independently verified forest management certification schemes	0.00	0.00	0.00	0.00	0.00	0.00	–	–