UN-REDD PROGRAMME

INFO BRIEF

ASIA-PACIFIC REGION

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Boreal forests in a changing climate

Case study: Mongolia

May 2019

KEY MESSAGES

1. Boreal forests form the world's largest biome and provide important global benefits. They support a diverse range of cold-climate animals and plants, as well as the livelihoods of local people. They also store large amounts of carbon and methane, especially in the soils. Boreal forests can assist northern countries, including Mongolia, to mitigate and adapt to climate change.
2. Forests are important for local livelihoods in Mongolia, including as a source of timber, fuelwood, berries, nuts, and grazing for livestock.
3. Mongolia's boreal forests are on the front line of climate change. The average temperature in the country has warmed 2.1 degrees Celsius since the 1940s – the global average increase is 0.8 degrees Celsius – and the area of permafrost has shrunk significantly. Forests are threatened by fires and insect pests, which are both exacerbated by climate change.
4. Conserving and sustainably managing Mongolia's boreal forests (such as through REDD+) shares some challenges with tropical forestry, but some issues are unique to the north.

SIGNIFICANCE OF BOREAL FORESTS

Boreal forests stretch across the northern reaches of the globe, from Europe to Russia to North America. They are the world's largest biome, and make up 29%[1] of the world's total forest area, as well as 32%[2] of global land-based carbon stocks. Compared with tropical forests, they store twice as much[3] carbon per hectare, much of it in the soil.

The Northern Hemisphere's frozen soils and peatlands hold an estimated 1,700 billion tonnes[4] of carbon – four times more than humans have emitted since the industrial revolution, and twice as much as is currently in the atmosphere.

That means these forests play a key role in mitigating climate change – but at the same time, they are intensely affected by it: boreal forests are warming faster than any other forest biome.

IMPACTS OF CLIMATE CHANGE

The impacts of climate change on boreal forests are cumulative. Fires and insect pests have always been a natural part of the boreal ecosystem, but climate change and human activity are upsetting the balance. Warmer winter temperatures can enable[5] pests like the Siberian silk moth to expand their range, while drought and water stress make trees more susceptible to insects. Where insect infestations kill large numbers of trees, fires burn more easily and intensely – and release more carbon.

Globally, forest fires are causing[6] increasing devastation, and across the boreal region, forest fires are anticipated[7] to increase dramatically as the climate warms, with far-reaching consequences for the environment and people.

But the impacts are also likely to be complex, according to climate change experts. In some parts of the boreal region, warming temperatures, fewer frost-free days, and longer growing seasons could actually make forests grow better. That would allow them to absorb more carbon dioxide from the atmosphere and become better carbon sinks.

In other areas, thawing permafrost, increased fires and pest outbreaks, and land-use change could all release greenhouse gases. On balance, whether the increased growth will outweigh the negative effects – or vice versa – is incredibly hard to predict.

The risks are also asymmetrical. It can take a century for a forest to grow – and a matter of hours for it all to go up in smoke. For boreal forest stands to reach maturity and maximum carbon storage, many decades of survivable growing conditions must prevail – but it only takes a single extreme event to kill trees or whole forest stands.

MONGOLIA'S CHANGING BOREAL FORESTS

Boreal forests stretch across Mongolia's north. They cover 14.2 million hectares – 9 percent[8] of the country – and provide important benefits for this developing nation.

Mongolia's forests are dominated[9] by larch, pine, and birch trees. Wolves, bears, elk, lynx and deer thrive here, alongside hawks, falcons, owls and hooded cranes. These slow-growing forests store large amounts of carbon and methane, prevent erosion on steep mountainsides, and are a natural barrier against the encroaching desert.

They also contribute to the livelihoods of rural people in diverse ways. In Khuvsgul aimag (similar to a province) in the north of the country, families collect berries to sell to jam-making companies, and keep bees on the forest edge. Small-scale enterprises selectively harvest timber, and community-based Forest User Groups gather deadwood for fuel and charcoal production.

Herders – who make up a third[10] of Mongolia's total population – also benefit from grazing their animals near the

1 Kuusela, K. (1990) The Boreal Forests: An Overview. Available at: http://www.fao.org/docrep/u6850e/u6850e03.htm

2 Gauthier, S., Bernier, P., Kuuluvainen, T., Shvidenko, A.Z. & Schepaschenko, D.G. (2015) Boreal forest health and global change. Science 349 (6250), pp. 819-822

3 Pimm, S., Roulet, N. & Weaver, A. (2009) Boreal forests' carbon stores need better management. *Nature* 467, p. 276

4 Schuur, E.A.G. & Abbott, B. (2011) High risk of permafrost thaw. Nature 480, pp. 32-33

5 Pureswaran, D.S., Roques, A. & Battisti, A. (2018) Forest insects and climate change. *Current Forestry Reports* 4 (35). https://doi.org/10.1007/s40725-018-0075-6

6 Hessl, A.E., Brown, P., Byambasuren, O., Cockrell, S., Leland, C., Cook, E. Nachin, B. Pederson, N., Saladyga, T. & Suran, B. (2016) Fire and climate in Mongolia (1532-2010 Common Era). Geophysical Research Letters 43 (12) https://doi.org/10.1002/2016GL069059

7 Ryan Kelly, R., Chipman, M.L., Higuera, P.E., Stefanova, I., Brubaker, L.B. & Hu, F.S. (2013) Recent burning of boreal forests exceeds fire regime limits of the past 10,000 years. PNAS 110 (32), pp. 13055-13060; https://doi.org/10.1073/pnas.1305069110

8 UN-REDD (2018). Mongolia's Forest Reference Level submission to the UNFCCC. UN-REDD Mongolia National Programme, Ministry of Environment and Tourism, Ulaanbaatar, Mongolia.

9 UN-REDD (2018). Mongolia's Forest Reference Level submission to the UNFCCC. UN-REDD Mongolia National Programme, Ministry of Environment and Tourism, Ulaanbaatar, Mongolia.

10 Kingsley, P. (5 January 2017) Nomads no more: Why Mongolian herders are moving to the city. *The Guardian.* Available at: https://www.theguardian.com/world/2017/jan/05/mongolian-herders-moving-to-city-climate-change

forest. The role of forests in supporting grazing was worth an estimated MNT 34.5 billion[11] (US$ 25 million) annually in 2013.

In Mongolia, the effects of climate change are already being felt. Average annual temperatures there warmed 2.1 degrees[12] Celsius between 1940 and 2014 – nearly triple the global increase over the same period (0.8 degrees Celsius). Mongolian tree-ring records indicate[13] that the 20th century was one of the warmest centuries of the last 1200 years, and that the recent series of severe droughts is historically abnormal.

Livestock have been devastated by repeated *'dzuds'*, a local term for a peculiarly Mongolian natural disaster – a dry summer followed by a harsh winter. Less grass means[14] livestock are unable to put on enough weight to survive the winter cold.

The changes are also affecting Mongolia's forests. Pest outbreaks and fires are causing increasing damage, and recent studies[15] have found[16] that the hotter, drier summers inhibit the growth of larch and birch trees.

As temperatures climb, Mongolia's permafrost is shrinking, too. Permafrost[17] is ground, rock or soil that remains frozen for more than two years in a row. It is found across the country's north, over much the same area as the forests. The interactions between the forest and permafrost maintain stable conditions in the ecosystem and increase the moisture available to plants and trees.

Recent studies have found that five percent of Mongolia's permafrost – 13,150 square kilometres – thawed completely between 1971 and 2015. In 1971, temperatures were low enough to support some form of permafrost in 63 percent of the country. By 2015, that had fallen to just 29.3 percent.

In the Khangai mountain range, the southern boundary of the permafrost had migrated north by 94 kilometres, and shifted up 900 metres in altitude.

REDD+ IN MONGOLIA

Mongolia is the first boreal forest country to begin preparing for REDD+, an international climate change mitigation scheme under the UNFCCC that aims to assist developing countries to protect and enhance their forests and the carbon stores within them. Mongolia became a Partner Country in the UN-REDD Programme in 2011 and launched its UN-REDD National Programme in 2015.

Through REDD+ and other forest initiatives the government aims to make Mongolia's forests healthier and more resilient to climate change, while supporting livelihoods and the wood industry. That includes promoting sustainable forest management, finding smarter ways to tackle fire and pest outbreaks, and reducing the area affected by forest fires by 30 percent.

11 Emerton, L. & Bat-ochir, E. (2013) Forest sector financing flows and economic values in Mongolia. UN-REDD Programme. Available at: https://www.undp.org/content/dam/mongolia/Publications/Environment/UNREDD/Mongolia%20Forest%20Sector%20Valuation%20Report%20Final.pdf

12 Intended Nationally Determined Contribution (INDC) Submission by Mongolia to the Ad-Hoc Working Group on the Durban Platform for Enhanced Action (ADP). Date of submission: 2015-09-24. Available at: http://www4.unfccc.int/submissions/INDC/Published%20Documents/Mongolia/1/150924_INDCs%20of%20Mongolia.pdf

13 Hessl, A.E., Brown, P., Byambasuren, O., Cockrell, S., Leland, C., Cook, E. Nachin, B. Pederson, N., Saladyga, T. & Suran, B. (2016) Fire and climate in Mongolia (1532-2010 Common Era). *Geophysical Research Letters* 43 (12) https://doi.org/10.1002/2016GL069059

14 Donahue, M.Z. (27 April 2018) The dangers of dzud, Mongolia's lethal winters. *National Geographic*. Available at: https://www.nationalgeographic.com/photography/proof/2018/04/extreme-winter-mongolia-dzud-environment-science/

15 Khishigjargal, M., Dulamsuren, C., Leuschner, H.H., Leuschner, C., Hauck, M. (2014) Climate effects on inter- and intra-annual larch stemwood anomalies in the Mongolian forest-steppe. *Acta Oecologica* 55, pp. 113-121. https://doi.org/10.1016/j.actao.2013.12.003

16 Gradel, A., Haensch, C., Ganbaatar, B., Dovdondemberel, B., Nadaldorj, O., Günther, B. (2017) Response of white birch (*Betula platyphylla* Sukaczev) to temperature and precipitation in the mountain forest steppe and taiga of northern Mongolia. Dendrochronologica 41, pp. 24-33. https://doi.org/10.1016/j.dendro.2016.03.005

17 International Permafrost Association. What is Permafrost? Available at: https://ipa.arcticportal.org/publications/occasional-publications/what-is-permafrost

More information

Learn more about REDD+ in Mongolia:

http://stories.unep-wcmc.org/borealforestsmongolia/index.html

http://reddplus.mn/eng/

http://www.un-redd.org

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