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**Committee on Forests and the Forest Industry matters  
(Economic Commission for Europe): Update on boreal forest  
work****Food and Agriculture Organization  
European Forestry Commission****Forty-second session**

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**Update on boreal forest work***Summary*

This document provides background information on forests and the forest sector in the boreal biome. It provides comprehensive information about boreal forests, their importance in the environmental social and economic contexts, as well as the threats and challenges they face. The information provided is based on the key findings of the topical study that was prepared as part of the ongoing UNECE project “Strengthening cooperation and national capacities in selected UNECE countries for sustainable forest management”.

The document is submitted to the Committee for review and to facilitate discussions on future work in this area.



## A. Introduction

1. Representing 27% of the world's forests, boreal forests are considered to be the planet's "second lung" after the tropical forests. Encircling the North Pole, they are part of the largest terrestrial biome on earth. They span North America, where they cover most of inland Canada, Alaska (United States of America) and Eurasia, predominantly in Norway, Finland, Sweden and the Russian Federation. Boreal forests can also be found in the Baltic states (Estonia, Latvia and Lithuania), Belarus, Iceland, Kazakhstan, the United Kingdom of Great Britain and Northern Ireland, and also beyond the ECE region, in northern areas of China, Japan and Mongolia.
2. The environmental health of the planet depends very much on boreal forests. They contain approximately 44% of all intact global forest landscapes and are vital for the maintenance of biodiversity and regulating the climate. They are a major component of global carbon storage and fluxes and therefore are key to climate change mitigation.
3. In addition to providing significant ecosystem services, for example the protection of freshwater resources, boreal forests play a substantial role in contributing to the sustainable economic development of countries in the boreal zone and to providing a sustainable wood and energy supply to world markets.
4. Given these multifaceted aspects, boreal forests, like other forest biomes, are important to global goals such as Sustainable Development Goals (SDGs) 8, 12, 13 and 15, the six Global Forest Goals and Targets of the United Nations Strategic Plan for Forests 2030.
5. Yet, boreal forests do not get the same visibility and attention of policy makers and the general public as their tropical forest counterparts. With increasing media attention and calls for action for a sustainable, climate resilient environment, there is an urgent need to increase the understanding of this global treasure trove and its many important contributions.

## B. What are boreal forests?

6. Although there is a general understanding of what boreal forest are, there is no internationally agreed definition of this forest type, except that they are located in the boreal biome. The boreal biome is characterized by seasons divided into short, moist and moderately warm summers and long, cold and dry winters. The indicative length of the growing season in boreal forests is about 130 days (compared to 140-200 days for temperate forests). Soil ranges from thin, nutrient-poor, and acidic to thick organic soils of peatlands. Its flora consists mostly of cold-tolerant evergreen conifer trees, such as pine, fir, spruce and larch with some broadleaf species such as poplar, birch and alder.
7. Boreal forests cover an area of approximately 1.10 billion hectares, which is near 8.5% of the global land area and 27% of the total global area covered by forests.
8. While most boreal forests are characterized by a low diversity of tree species, they also have the highest tree densities in forest areas on earth. They are estimated to contain over 24% of the world's individual trees or about 0.74 trillion trees.
9. The world's boreal regions are among the least-densely populated on earth, with densities ranging from 0.5 people (Alaska, United States) to 20 people (Sweden) per km<sup>2</sup>.

## C. The importance of boreal forests

### 1. Boreal forests and the environment

10. **Boreal forests are an unrecognized hotspot of global biodiversity.** One of the boreal forest's greatest features is that they contain large areas of the remaining unmanaged wilderness in the world. Intact boreal forests are a global refuge for many species. Although they are generally poorer in species, genera and families compared to temperate and tropical ecosystems, the world's boreal forests contain an estimated 100 000 species, 95% of which

are arthropods and microorganisms, with only some 20% of these taxa identified taxonomically. They shelter more than 85 species of mammals, 130 species of fish, 300 species of birds, 20 tree species, numerous shrubs and other plant species.

11. Owing to their remoteness and limited landscape alteration, boreal forests have no species listed as extinct on the International Union for Conservation of Nature (IUCN) Red List, while eight species (representing only 0.14% of the world's 5,704 threatened forest-related species) were listed as threatened.

12. **Boreal forests and their wetlands provide a multitude of ecosystem benefits.** The boreal zone is characterized by large rivers, lakes, and wetlands, **with more surface freshwater than any other biome on earth.** Furthermore, boreal forests are the source of a high number of rivers that provide fresh water for human and industrial use as well as for hydroelectric power dams to transmit electricity over long distances to southern regions. By regulating the world's most extensive surface freshwater system, boreal forests are likewise of great importance to nearby and downstream agricultural areas.

13. **They constitute a large carbon sink**—on a level comparable to tropical forests— with about 32% of global terrestrial carbon stocks, mostly in climate-sensitive peat, soils and permafrost deposits. The amount of carbon stored in boreal soils corresponds to no less than 75% of the current atmospheric carbon stock. This means relatively small changes in the boreal soil carbon stocks significantly affect the atmospheric carbon levels. Globally, boreal forests sequester about 20% of the total carbon sink that is generated annually in the world's forests.

## 2. Boreal forests and the economy

14. Beyond their importance for the environment, boreal forests substantially contribute to sustainable livelihoods and economic growth. By providing products and services, the boreal biome's forests are a critical driver of sustainable economic development. They constitute approximately 45% of the world's stock of growing timber. Today, with the use of sustainable forest management practices, their growth and yield are larger than ever before. They provide about 17% of the total annual global harvest of industrial roundwood. Relative to forest products exports globally, the importance of boreal forests is significant; they contribute 33% of the lumber, 16% of the wood-based panels, 26% of the paper and paperboard and 21% of the pulp volumes exported.

15. In addition, it has been estimated that the value of the **environmental and socioeconomic benefits** of boreal forests exceeds the combined market values derived from the timber, oil and gas, mining and hydroelectric energy sectors. These ecosystem services include carbon storage, flood control and water filtering. However, most of these ecosystem services are not monetized.

16. Furthermore, non-wood forest product related activities such as berry or mushroom picking, hunting or recreation are economically very valuable in many parts of the boreal zone, particularly for livelihoods of local populations.

## 3. Ownership and management of boreal forests

17. **Forest ownership patterns** in the boreal zone are diverse. Most boreal forest lands are publicly owned in the Russian Federation, United States and Canada. In contrast, about 70% of the forests in Finland, 76% in Sweden, and 80% in Norway are under private and corporate ownership.

18. In countries with a large share of private ownership (predominantly in Norway, Finland and Sweden), a substantial part of the forest is owned by small forest holders. Small-scale forest farms are an important economic model that often combines forestry with agricultural farming activities.

19. **Forest management** is widely implemented in boreal forests; nearly two thirds of them are considered to be managed, largely for industrial wood production (35 to 40% in

Canada, 58% in the Russian Federation and 90% in Norway, Finland and Sweden). Across the boreal zone the intensity of forest management activities varies greatly. It ranges from timber logging followed by a natural forest regeneration, through extensive management with simple silvicultural approaches, to very intensive management practices with frequent interventions. As a result of intensive forest management, the growing stock volume contained in the forests of Norway, Finland and Sweden has increased by 23% during the past 40 years and is expected to increase further.

20. Despite the fact that boreal forests contain some of the highest proportions of intact, primary forests on earth, areas under protection represent a relatively small share of the biome: between 8 and 11%, below the Convention on Biodiversity Target 11 goal to protect 17% of each nation's land area.

21. Overall, while serving as a key global source of timber, the boreal region is characterized by a net gain in growing forest stock, despite timber losses caused by forest disturbances. This so-far positive development would support the overall assessment that boreal forests are sustainably managed for timber and other wood-based production.

22. Nevertheless, in the face of climate change and its threats, forest managers continue to explore an array of approaches to maintain ecosystem services of boreal forests that aim at preserving the forests' health and vitality. The forest ecosystem-based management concept aims to bridge the gap between natural and managed forests to maintain the ecological integrity and biodiversity of ecosystems. Similarly, a continuous cover forestry approach, which maintains a forest canopy at all times and excludes clear cutting, receives considerable attention for application in boreal and temperate forests.

## **D. Threats, trends and climate change**

23. Boreal forests are under threat and their resilience remains at risk. Natural and human-caused disturbances are increasingly deteriorating forest health and vitality. Multifactor events of forest damage and disturbance have cumulative effects and are impacting the environmental, cultural, social and economic values derived from forested areas.

24. Natural and human-caused disturbance events in boreal forests include wildland fires and forest pest infestations, both exacerbated by climate change; resource extraction (e.g. minerals, oil and gas, timber, food); infrastructure development (e.g. roads, pipelines, seismic-exploration lines); recreation; and urban expansion.

25. Forest fires in boreal forests regularly make headlines owing to their wide extent. Forest fires are the main cause of disturbance in boreal forest areas. In 2015, about 0.5 % of the total boreal forest, or 6.03 million hectares, were affected by wildfires. Yet, wildfires are a natural part of this forest ecosystem, which has evolved over a few thousand years, and are important for their biological succession. However, short-interval fires, at the multidecadal scale are increasing, driven by climate change influences. These fires are predominantly occurring in coniferous forest landscapes and are inducing conversion from coniferous to broadleaves forests.

26. Similarly, with the expected rising temperatures, outbreaks of insect pests may be more frequent, which can have large-scale consequences for forest ecosystems and may therefore negatively affect the forestry sector and its economy.

## **E. Boreal forests and climate change**

27. The Arctic and the boreal region are warming twice as fast as other parts of the world. Under a globally averaged projection of a 4°C warming by the end of this century, boreal regions could experience temperature increases from 4° to 11°C. This might be accompanied by an expected reduction in precipitation.

28. From 30%–40% of boreal forests have underlying permafrost. The permafrost region of the boreal zone contains twice as much carbon as is currently found in the atmosphere. Conversion of just a fraction of this frozen carbon pool into greenhouse gases and their

release into the atmosphere could significantly increase the pace and impact of future climate change.

29. On one hand, higher temperatures and increasing atmospheric carbon dioxide levels may enhance the growth of vegetation and the resulting carbon sequestration. On the other hand, higher temperatures can also favour the decomposition of soil carbon and the thawing of permafrost, effects that will increase the release of carbon and the emission of carbon dioxide from the soil. It is yet unclear how these changes will affect the overall carbon balance of boreal forests.

30. The future state of the boreal soil carbon stock will depend on the balance between these two opposing effects.

31. Given the global importance of boreal forests and the current and anticipated disturbances that are threatening them, there is an urgent need for better monitoring and risk mitigation to the largest extent possible.

## **F. Addressing the knowledge gaps**

32. To balance the resilience of boreal forests against the uncertainties of climate change and the growing extraction of forest resources, major knowledge gaps on how to achieve this remain and need to be addressed.

33. Among others and in particular, a better understanding of the dynamic of the boreal soil carbon stocks under climate change is required, considering their importance. For example, it is not known which of these soils will gain carbon in response to climate change and which will lose it and for what reasons.

## **G. Increasing the understanding and visibility of boreal forests**

34. Although boreal forests have not yet been on top of the agenda of global climate change policies and forest governance discussions, they constitute one of the most critical ecosystems in terms of sustainable economic development and the environment. Therefore, the comparatively good conditions of boreal forests and their mostly sustainable use should not be taken for granted.

35. Many researchers and scientists have been expressing concern about the fate of the boreal forest biome and its fragile ecosystem. So far, the impact of their warnings falls short of triggering the much-needed policy awareness and changes.

36. A commonly agreed definition of boreal forests would help to delineate the area they are occupying as a precondition for a consistent monitoring of the boreal forest biome. This effort can be coupled with the identification of a set of criteria and indicators that would help to comprehensively monitor the changes that are occurring in boreal forests as a result of forest management activities and climate change. Such assessment instruments, resulting from the joint efforts of boreal countries, would have the potential to generate evidence of the current state and to gain the focus that is needed for this critical biome.

37. Global discussions on sustainable development, biodiversity conservation, calibration of indicators of ecological sustainability and climate change mitigation need to place a greater focus on this vast biome to support critical and timely action across the boreal forest.