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## FORESTERY

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### ANALYSIS OF WOOD RESOURCES IN THE REGIONS OF THE FAR NORTH

Research article

#### Abstract

The article considers the possibilities of logging operations in the regions of the Far North of the Russian Federation. The authors investigate the peculiarities of climatic conditions and give an assessment of the volume and characteristics of available wood resources in various regions of the Far North. They also study the transport infrastructure of the proposed areas for timber harvesting. As a result, the article substantiates the prospect of development of the regions of the Far North due to the development of wood resources.

**Keywords:** negative temperature, permafrost, wood, logging, cutting area, Far North.

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### АНАЛИЗ ДРЕВЕСНЫХ РЕСУРСОВ РАЙОНОВ КРАЙНЕГО СЕВЕРА

Научная статья

#### Аннотация

В статье рассмотрены возможности лесозаготовительных работ в районах Крайнего Севера Российской Федерации. Исследованы особенности климатических условий. Дана оценка объему и характеристике имеющихся древесных ресурсов в различных районах Крайнего Севера. Исследована транспортная инфраструктура предполагаемых районов для заготовки древесины. Обоснована перспектива развития районов Крайнего Севера за счет освоения древесных ресурсов.

**Ключевые слова:** отрицательная температура, мерзлота, древесина, лесозаготовки, лесосека, Крайний север.

#### 1. Introduction

The Far North is a part of the Earth territory located mostly to the north of the Arctic Circle. Here there is the Arctic zone, tundra, forest tundra and regions of the northern taiga. The climate in some areas is extremely severe. It is characterized by long frosty winters and short cold summers [1], [2]. Today some territories of the Russian Federation with a harsh climate are considered equivalent to the conditions of the Far North.

Figure 1 shows a map of the Russian Federation regions of the Far North and areas equated to them. Marked in orange on the map are the subjects of the Russian Federation which territory is fully assigned to the regions of the Far North and areas equated to them. Marked in blue on the map are the subjects of the Russian Federation, the territory of which is partially assigned to the regions of the Far North and areas equated to them.

According to the decree issued by the Government of the Russian Federation on November 16, 2021. N 1946, the regions of the Far North of the Russian Federation include all the islands of the Arctic Ocean and its seas, as well as the islands of the Bering and Okhotsk Seas, the Republic of Karelia, the Republic of Komi, the Republic of Sakha (Yakutia), the Republic of Tyva, Kamchatka Krai, Krasnoyarsk Krai, Khabarovsk Krai, Arkhangelsk Oblast, Irkutsk Oblast, Magadan Oblast, Sakhalin Oblast, Nenets Autonomous Okrug, Chukotka Autonomous Okrug, Yamalo-Nenets Autonomous Okrug, Khanty-Mansi Autonomous Okrug - Yugra. All of them are shown in Figure 1.



Fig. 1 – Map of the regions of the Far North and areas equated to them in the Russian Federation:

- 1 – Murmansk Oblast; 2 – Republic of Karelia; 3 – Arkhangelsk Oblast; 4 – Nenets Autonomous Okrug;
- 5 – Komi Republic; 6 – Yamalo-Nenets Autonomous Okrug; 7 – Khanty-Mansi Autonomous Okrug – Yugra;
- 8 – Krasnoyarsk Krai; 9 – Sakha (Yakutia) Republic; 10 – Chukotka Autonomous Okrug; 11 – Magadan Oblast;
- 12 – Sakhalin Oblast; 13 – Kamchatka Krai; 14 – Tuva Republic; 15 – Tyumen Oblast; 16 – Tomsk Oblast;
- 17 – Altai Republic; 18 – Perm Krai; 19 – Irkutsk Oblast; 20 – Republic of Buryatia; 21 – Chita Oblast;
- 22 – Amur Oblast; 23 – Khabarovsk Krai; 24 – Primorsky Krai

These areas are characterized by the following natural and climatic features:

- winter period lasting from 185 to 305 days with negative temperatures below  $-40^{\circ}\text{C}$ ;
- a large annual temperature difference, reaching  $100^{\circ}\text{C}$  in some places;
- strong winds exceeding 30 m/s;
- high relative air humidity in the coastal areas of the seas and oceans, reaching 90%;
- long polar day and night, causing low natural illumination of the territory in autumn and winter;
- sharp dynamics of atmospheric pressure;
- strongly pronounced geomagnetic and heliophysical disturbances [3].

Despite the harsh climatic conditions, the regions of the Far North attract not only with their riches such as oil, natural gas, coal, but also with significant reserves of wood resources.

Today, the regions of the Far North have a huge raw material base of wood resources. Due to this, it is necessary to carry out logging in these areas, which will allow to develop transport accessibility and increase the exploitation of forests. Having a huge potential for the development of forest resources, the regions of the Far North are significantly inferior to other subjects of the Russian Federation in terms of timber harvesting. Currently, no more than 3% of the volume of wood from the potentially possible volume of its use is being developed.

## 2. Methods

The decree of the Government of the Russian Federation dated November 16, 2021, N 1946 and the data of the "Unified Interdepartmental Information and Statistical System" on the total annual stock of wood of the Far North were studied in order to identify potential territories with significant reserves of wood resources.

## 3. Results

Studies have shown that mainly shrubs grow in the tundra and the Arctic desert. Forests suitable for logging work begin to the south, in the forest-tundra (a natural zone at the junction of the tundra and taiga). It stretches along the Arctic Circle in a rather narrow strip from 20 to 250 km wide.

The diagram of the tundra soil structure (Figure 2) shows that this soil is highly swampy. It happens due to waterlogging, which is facilitated by waterproof permafrost and low evaporation at low temperatures.

In the Far North, there are territories where the soil is cold and has a thin layer due to permafrost. Such conditions lead to the fact that trees rarely grow and are pressed tightly to the ground. The root system of these trees does not go deep but stretches along the surface of the earth. And there are areas with dense taiga forests [4].

The regions of the Far North, such as the Irkutsk Oblast, the Komi Republic, the Arkhangelsk Oblast, are rich in wood species like Siberian and Dahurian birch, larch, spruce, and pine. At the same time, they are very short in the forest-tundra compared to the taiga of the Far North, as the wind reduces their height, bending the trunks and pressing them to the ground. The lower tier of the northern forest is mainly occupied by polar willow, dwarf birch, wild rosemary. They have a small height and are sometimes completely lost in a thick layer of mosses and lichens.

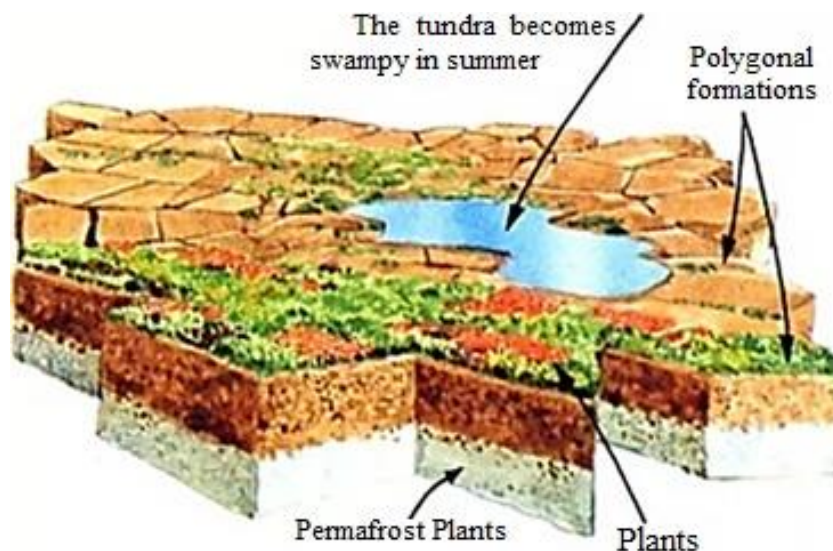


Fig. 2 – Scheme of tundra soil layers in the Far North

In the Arctic zone of Russia there are the northernmost forest areas of the planet. Two of them are located on the polar Taimyr Peninsula - the tract "Lukunskoye" and "Ary-Mas".

Light-coniferous and dark-coniferous types of taiga forests are common in the regions of Yakutia and the Krasnoyarsk Krai. They are both suitable for logging. Their location depends on the climate, rainfall and topography. The dark-coniferous type of taiga is predominant in places with high humidity. Spruce is common on the East European Plain. To the south, there are also fir, pine and deciduous trees. The slopes of the northern and middle Urals are covered with spruce, fir and cedar thickets, which are occasionally interrupted by mountain grassy meadows [5], [6], [7].

The West Siberian Plain is characterized by mixed spruce, cedar, fir, pine and birch thickets.

The light-coniferous type of taiga consists mainly of larch and pine forests. Larch forests are common in the regions of the Republic of Karelia, the Komi Republic, and the Arkhangelsk Oblast. Larch is a tree that is undemanding to heat and humidity. So, the dry, sharply continental climate of the East Siberian mountains and plains is perfect for this plant.

Pine forests located along the Angara River are very different from the larch forest. There are few branches on the pines, and the openwork crowns let the rays of the sun pass well, so it is light and spacious here.

Within the permafrost zone, the state forest fund is concentrated mainly on the territory of the Yamalo-Nenets, Taimyr, Evenk Autonomous Okrugs, the Republic of Sakha (Yakutia), the Magadan Oblast and the Chukotka Autonomous Okrug. The northern forests of the European part of Russia are distributed south of the area of continuous permafrost.

In the conditions of the north of Western Siberia, the formation composition of forests and the peculiarity of the forest fund can be studied using the example of the Yamalo-Nenets Autonomous Okrug. Here the main massifs of near-tundra woodlands and northern taiga forests are concentrated. These massifs are formed primarily by Siberian larch, Scotch pine and Siberian spruce. The area of all lands of the state forest fund in this territory is 31.5 million hectares. Forested lands occupy an area of about 15.7 million hectares. The share of natural clearings and unforested lands in total accounts is about 1.4 million hectares, and the share of non-forest lands is less than 14.4 million hectares. The latter are mainly represented by swamps, tundra communities, and biological or natural sparse areas [8], [9].

Forests and light forests of the permafrost zone of Central Siberia can be characterized by the example of the Taimyr and Evenk Autonomous Okrugs. Within the administrative boundaries of the Taimyr Autonomous Okrug, the area of state forest fund lands is only 10.6 million hectares. Forest-covered lands occupy about 1.3 million hectares. Natural clearings and unforested lands make 2.2 million hectares, and non-forest lands cover 7.1 million hectares. The latter are represented mainly by zonal shrub and shrub tundra, which is the predominant type of vegetation in the North Siberian (Taimyr) lowland. For this reason, the forest cover of the district is the lowest of all subjects of the Russian Federation and is only 3.7%. The state forest fund is more than 12 million hectares here and most of its lands have been transferred for long-term use as reindeer pastures of agricultural enterprises and tribal hunting grounds assigned to the indigenous peoples of the Far North.

The largest forest region in the Far North is the Republic of Sakha (Yakutia). Its total area of the forest fund lands is almost 264.7 million hectares or 26.7% of the area of the forest fund lands of Russia. Forested lands slightly exceed 134 million hectares, while natural sparse and unforested lands occupy a total of more than 37.7 million hectares. About 36.3 million hectares of forest land have been transferred for long-term use [10].

Non-forest lands are represented, by zonal and mountain tundra, natural and pyrogenic open spaces, lakes and wetlands. In the structure of the state forest fund, they make up 48.7 million hectares. The forest cover index is 47.4%, which is slightly higher than the average for the Russian Federation (46.4%). Therefore, the regions of the Far North, such as the Republic of Komi, the Republic of Sakha (Yakutia), the Krasnoyarsk Krai, the Khabarovsk Krai, the Arkhangelsk Oblast, the Kamchatka Krai and the Irkutsk Oblast are priority areas for logging.

Table 1 presents the data of the "Unified Interdepartmental Information and Statistical System" on the total annual timber stock of the Far North for 2019-2021.

Table 1 – The total stock of wood in the forest plantations on the forest fund lands and lands of forest categories

Regions of the Far North	2019, million m <sup>3</sup>	2020, million m <sup>3</sup>	2021, million m <sup>3</sup>
Republic of Karelia	1025,9	1025,34	1034,66
Komi Republic	3070,7	3037,34	3030,42
The Republic of Sakha (Yakutia)	8899,3	8890,4	8874,46
Tyva Republic	1170,6	1170,53	1169,26
Kamchatka Krai	1222,7	1221,53	1217,9
Krasnoyarsk Krai	11577,3	11555,46	11523,77
Khabarovsk Krai	5137,4	5138,17	5115,42
Arkhangelsk Oblast	2675,6	2671,74	2677,76
Irkutsk Oblast	8810,2	8769,74	8741,68
Magadan Oblast	475,1	4751,04	474,95
Murmansk Oblast	237,2	238,13	238,05
Sakhalin Oblast	663,9	663,12	662,77
Nenets Autonomous Okrug	18,2	18,21	18,21
Chukotka Autonomous Okrug	84,4	84,36	84,35
Yamalo-Nenets Autonomous Okrug	1123,1	1119,3	1116,98
Khanty-Mansi Autonomous Okrug - Yugra	3263,1	3258,4	3253,04
Altai Republic	762,5	762,11	761,68
The Republic of Buryatia	2248,2	2246,34	2243,17
Zabaikalsky Krai	2678,6	2676,27	2675,43
Perm Krai	1608,4	1601,05	1593,01
Primorsky Krai	1881,7	1888,43	1884,87
Amur Oblast	2050,8	2049,27	2047,79
Tomsk Oblast	2840,4	2829,95	2816,42
Tyumen Oblast	975,7	975,16	974,21

Table 1 shows that some regions of the Far North have large timber reserves. They are the Krasnoyarsk Krai – 11.5 billion tons. m<sup>3</sup>, the Republic of Sakha (Yakutia) – 8.8 billion. m<sup>3</sup>, Irkutsk Oblast – 8.7 billion. m<sup>3</sup>, Khabarovsk Krai – 5.1 billion. m<sup>3</sup>.

The presented data show that despite the harsh climate of the Far North, they have huge reserves of timber for logging. Due to this, there is a large raw material base for obtaining various types of wood material.

#### 4. Discussion

The regions of the Far North have vast territory, which is thousands of kilometers away from the major industrial centers of Russia. Socio-economic development and life of these regions are largely determined by the state and efficiency of the transport system.

The main feature of this transport system is the poor development of land communications. More than 85% of districts have seasonal transport accessibility. The main volume of cargo is transported in a short navigation period by river and sea transport, the share of which in the cargo turnover is 43.7%. About 88% of the production of goods and services is located in areas served seasonally. Only 16% of the population lives in the zone of year-round transportation. Only part of the settlements is connected with the regional centers by a road network with a solid type of surface. Some areas do not have a reliable transport connection with nearby areas. The most serious problems are in the transport service for the population living in the Arctic zone, where communication with remote areas has traditionally been carried out by air transport and all-terrain vehicles. The high cost of transportation by planes and helicopters, the lack of off-road transport is today a real limiting factor in ensuring the freedom of movement of the population, cargo and solving vital social problems [11].

#### 5. Conclusion

Having a huge potential for the development of forest resources, the regions of the Far North are significantly inferior to other regions of the Russian Federation in terms of timber harvesting. Currently, no more than 3% of the volume of wood from the potential volume of its use is being developed.

Poor exploitation of forests is the reason for the predominance of mature and overmature plantations and are mainly used only by domestic consumption. Forest areas suitable for felling are located extremely unevenly and have low transport accessibility, which predetermines different intensity of timber harvesting in forest areas.

As a result, in our opinion, the development of the logging complex in the regions of the Far North is one of the priority areas for the formation of the Far North. Given the climatic and geographical conditions, this can become one of the budget-forming sectors of the economy. Through intersectoral cooperation, it is possible to give impetus to the development of related industries - transport, housing construction, alternative bioenergy and significantly increase its export potential.

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**Conflict of Interest**

None declared.

**Конфликт интересов**

Не указан.

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