



Forestry in the Republic of Belarus: Current State and Development Prospects

Sergey A. Golyakevich^{a,*}, Mikhail T. Naskovets^a, Sergey P. Mokhov^a, Andrey R. Goronovsky^a

^a Belarusian State Technical University, Faculty of Forest Engineering, Materials Science and Design, Sverdlova Str. 13a, Minsk 220006, Belarus, gsa@belstu.by (S.A.G), naskovets@belstu.by (M.T.N.), mokhov@belstu.by (S.P.M), arg@belstu.by (A.R.G).

HIGHLIGHTS

- The Republic of Belarus is one of the ten largest forest-covered countries in Europe.
- The country has its own forest machinery industry, which covers most of the domestic needs of forestry.
- Scientific research in the field of forestry and forest industry is financed within the framework of state programs and privately by enterprises and interested private companies.

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ABSTRACT

This article presents data on the current state and prospects of development of forestry and forest industry in the Republic of Belarus. Issues related to the forest structure, species, age, and composition, as well as the degree of their involvement in the country's economy are considered. Ownership and management of the forest resources is noted, and the study considers the issues of mechanization of forest operations and describes the used technologies. Directions for further improvement of the fleet of forest machines are indicated. A special attention was paid to the analysis of informatization in forest production processes. The structure of forest road network and its influence on the efficiency of production was considered. The problems faced by the forestry in Belarus are discussed in the study, then solutions are proposed to overcome the current challenges. Data about the existing programs and projects of scientific research aimed at solving these problems are given.

* Corresponding author. Tel.: +375-29-506-34-80; fax: +375 17 363-86-91.
E-mail address: gsa@belstu.by

1. INTRODUCTION

Being one of the main renewable natural resources, forests represent the most important national treasure of the Republic of Belarus. Forests and forest resources are of great importance for the sustainable socio-economic development of the country, ensuring its economic, energy, environmental and food security. This article is intended as a technical communication and it analyzes the current state and prospects of development of the forestry in the Republic of Belarus, particularly in the following areas: structure and general state of the forests, forest technology, availability of machines and equipment, forest roads and logistics of timber products.

2. CHARACTERIZATION OF FOREST RESOURCES AND THEIR CONTRIBUTION TO THE ECONOMY

According to the specific indicators of the forest area (0.88 ha/person), the growing stock of wood (194.7 m³/pers.) and the forest cover (39.9%), the Republic of Belarus is among the top ten forested states in Europe. In absolute figures, the current indicators of the country's forest resources are as follows: a forested area of 8,280.3 thousand ha, a total standing stock of 1,831.8 million m³, an average stock of timber per unit area of 221 m³/ha, a stock of mature and over-mature stands of 272 m³/ha, and an average age of the forest stands of 56 years.

Table 1. Dynamics of the indicators of the forest in the Republic of Belarus over the last 26 years

Name of the indicator	Measurement unit	1994	2001	2010	2020
1. Total area of the forest lands	thousand ha	8,676.1	9,247.5	9,416.6	9,620.9
1.1. Forest lands	thousand ha	7,775.9	8,275.7	8,598.2	8,799.1
	%	89.6	89.4	91.3	91.5
1.2. Forest covered lands	thousand ha	7,371.7	7,850.6	8,002.4	8,280.3
	%	85	85.0	85.0	86.1
1.3. Mature and over-mature forest lands	thousand ha	350.1	623	804.4	1,379.1
	%	4.7	7.9	10.1	16.7
2. Forest cover	%	35.5	37.8	38.5	39.9
3. Total plantation stock	million m ³	1,093.2	1,339.9	1,566.1	1,831.8
4. Total average stock change	million m ³	24.9	28.2	30.2	33.4
5. Average growing stock	m ³ /ha	148	171	196	221
5.1. Mature and over-mature stands	m ³ /ha	213	220	244	283
6. Average age	years	44	48	52	53

The dynamics of the forest indicators of Belarus over the last 26 years (**Table 1**) shows that the introduction of the principles of sustainable and non-depleting use of forests had a positive impact on the overall structure of the forests and on the quality of economic activity developed in them [1].

3. DESCRIPTION OF FOREST MANAGEMENT AND OF THE USE OF FOREST RESOURCES

In contrast to many European countries, all the forests from the Republic of Belarus are the exclusive property of the state, which determines the order of forest management and timber production. In the structure of the state forest management there are 7 forest owners. The general distribution of the forests in the Republic of Belarus [2] by ministries and departments as of 01.01.2020 is given in **Table 2**.

Table 2. Distribution of forest land by department

Name of ministries, organizations	Area, thousand hectares	Percentage of total area	Number of legal entities engaged in forestry
The Ministry of Forestry	8,461.3	87.9	98
The Ministry of Defence	90.1	0.9	2
The Ministry of Emergency Situations	216.9	2.3	1
The Ministry of Education	27.8	0.3	2
The Office of the President of the Republic of Belarus	767.8	8.0	7
The National Academy of Sciences of Belarus	41.6	0.4	3
Local executive and administrative bodies	15.4	0.2	6
Total	9,620.9	100.0	119

Open statistical information regarding a number of forest owners presented in **Table 2** is either absent or statistically insignificant, so the further analysis is done mainly for the largest of them - the Ministry of Forestry.

4. CHARACTERIZATION OF MECHANIZATION IN OPERATIONS

In recent years, the number of forestry machines by enterprises of the Ministry of Forestry of the Republic of Belarus has not changed significantly. As at July 2020, 2,788 units of harvesting and timber transporting machines were operated by the enterprises of the Ministry of Forestry. Among them are 305 harvesters, 353 forwarders, 823 trucks and 1307 towed loader-transporters. Since 2010, the implementation of the program of technical equipment of enterprises of the industry has increased the total number of machines by 1,385 units [3]. In comparison with the same period of the previous year, the total number of harvesters increased by 2 units, forwarders - by 3 units, trucks - by 6 units, and trailed loader-transporters - by 22 units. The slight increase in the number of machines in general and by relevant types indicates the current structure of the machine fleet.

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During the first half of 2020, enterprises of the Ministry of Forestry of the Republic of Belarus harvested 10.757 million m³ of wood. For instance, 3.445 million m³ were harvested by their own harvesters and 1.8 million m³ by harvesters of external organizations providing logging services. The share of mechanized timber harvesting operations was 48.8%. Data on the volume of timber harvesting production [4] by state production forestry associations (SPFA) is given in **Table 3**.

Table 3. Volume of timber harvested by the Ministry of Forestry enterprises

Name of the state production forestry association	Total harvested volume, thousands m ³	Volume harvested by the Ministry of Forestry, thousands m ³	Volume harvested by contractors, thousands m ³	Share of fully mechanized timber harvesting operations ^a
Brest	1,420.0	386.7	212.1	42.2
Vitebsk	1,470.2	474.8	148.1	42.4
Gomel	2,601.5	625.7	424.8	40.4
Grodno	1,326.5	458.9	295.8	56.9
Minsk	2,160.5	852.9	337.1	55.1
Mogilev	1,718.4	645.9	381.8	57.8
Total	10,757.1	3,444.9	1,799.7	48.8

Notes: ^a – in the total volume harvested by the Ministry of Forestry

The provision of timber harvesting services by contracting has developed significantly. On average, such contractors harvest about 52% of all the timber harvested in Belarus by the use multifunctional machines. For the enterprises operating under the Ministry of Forestry, the fleet used to harvest timber is mainly composed of the machines manufactured by JSC Amkodor. Harvesters produced by JSC Amkodor are shown by four of the most used models in **Figure 1**.

The enterprises of the Mogilev State Production Forestry Association are equipped with the most modern harvesters. With a total number of 55 units, the number of harvesters older than 5 years does not exceed 25%. The largest number of harvesters in use is that of the Minsk State Production Forestry Association - 77 units, of which 45 are older than 3 years. The majority of the machines are currently working in a 2-shift mode. As a rule, older machines work in single-shift mode. The oldest harvester fleet is located in the Vitebsk State Production Forestry Association, which holds only 9 units having less than 3 years of operation (**Table 4**).

The harvesters of Vitebsk State Production Forestry Association have been repaired for the longest time, averaging 5,5 days of maintenance and repairing per month per one harvester. The harvesters of the State Forestry Institution "Rossonsky Forestry" spent 82 days in repairs (as of 2012), with a harvested volume of 8.55 thousand m³, achieved in a single-shift mode of operation. Low indicators of work and long downtime are not only due to the physical deterioration of the machines [5], but also due to much more difficult conditions of operation in this area. For comparison purposes, the oldest machine of this type has been working since 2010 in the State Forestry Institution "Minsk Forestry" and in the first half of 2020 it harvested 14.4 thousand m³, working in one shift and being repaired in this period only for 12 days.



Figure 1: A description of the commonly used harvester and forwarder models produced by Amkodor

In general, the fleet of harvesters held by the Ministry of Forestry needs to be updated by 17 - 35%, figures which depend on the affiliation of the machines to a particular State Production Forestry Association.

Table 4. Main indicators characterizing the fleet of harvesters used in the Republic of Belarus

Name of the state production forestry association	Total number of harvesters	Number of harvesters under 3 years of operation	Number of harvesters from 3 to 5 years of operation	Number of harvesters over 5 years of operation	Number of harvesters under repair, days per month for 1 unit
Brest	41	23	3	15	2.9
Vitebsk	37	9	7	21	5.5
Gomel	51	14	16	21	2.9
Grodno	44	22	5	17	2.3
Minsk	77	32	11	34	3.0
Mogilev	55	33	8	14	2.7
Total	305	134	48	123	3.1

In comparison with the harvesters, the forwarder fleet [5-6] of the Ministry of Forestry enterprises is older (Table 5). 57.8% of forwarders hold more than 5 years of operation. This can be explained by the fact that the use of forwarders in timber harvesting operations began earlier than that of harvesters. Before the large-scale introduction of the harvesters in the 2010s, the technology of logging operations was based on the use of gasoline-powered saws and log transportation by

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forwarders (in the most difficult operational conditions) and trailer loading and transportation machines (in easier operational conditions).

Table 5. Main indicators characterizing the fleet of forwarders used in the Republic of Belarus

Name of the state production forestry association	Total number of forwarders	Number of forwarders under 3 years of operation	Number of forwarders from 3 to 5 years of operation	Number of forwarders over 5 years of operation	Number of forwarders under repair, days per month for 1 unit
Brest	47	20	1	26	2.9
Vitebsk	70	14	9	47	6.5
Gomel	51	8	16	27	3.5
Grodno	43	12	7	24	4.2
Minsk	88	32	6	50	4.1
Mogilev	54	18	6	30	3.1
Total	353	104	45	204	4.2

In the Vitebsk State Production Forestry Association (SPFA), which holds the most worn-out forwarder fleet, the monthly downtime is about 6.5 days/unit. The downtime of such machines during half a year is 10 - 36 days. Average productivity of the most worn forwarders is in the range of 13.6 - 32.7 m³ per shift, which is much lower than the industry average of 56.7 m³. However, in what concerns the harvesters, low productivities are often the result of harsh operating conditions.

The average output of trailed loaders compared with forwarders is 21.8 m³ lower and stands at 34.9 m³. At the same time, the specific monthly downtime averages 3.1 days (Table 6). It should be noted that the operation of loading and transporting machines is less intensive and occurs mainly in the conditions of the I and II types of forests (group I of forests includes forests whose main purpose is to ensure water protection, protective, sanitary-hygienic, health-improving, and other functions, as well as forests of protected natural areas; group II of forests includes production forests). This explains the average monthly downtime of tractor trailers, which is comparable to that of forwarders, despite their older fleet (in 44% of cases the age of tractor trailers is more than 7 years). More than 500 tractor trailers will need to be replaced with new ones in the near future. The process of transition to the use of new-type tractor trailers should take into account a number of industry specifics [7-8].

At present, the domestic practice of using tractors and forest machines in forestry production differs from the foreign practice by the delineated use of machines: universal tractors (agricultural) for forestry work, and specialized forest machines in timber harvesting operations. Moreover, the fleet of forestry farm tractors consists mainly of tractors produced by OJSC "Minsk Tractor Works": MTZ-82 and MTZ-1221, which are used to perform most of the forestry work [8]. At the same time, the design of these universal tractors has some flaws that prevent their more effective use in timber harvesting operations. On the contrary, JSC "Amkodor" produces and releases machines for the use in timber harvesting operations such as loaders, harvesters, skidders and chippers [9-11].

Table 6. Main indicators characterizing the fleet of tractor trailers used in the Republic of Belarus

Name of the state production forestry association	Total number of tractor trailers	Number of tractor trailers over 7 years of operation	Number of tractor trailers under repair, days per month for 1 unit	Average volume transported per shift, m ³
Brest	216	110	3.1	34.9
Vitebsk	210	89	4.6	31.0
Gomel	323	111	3.0	34.1
Grodno	117	57	2.0	34.9
Minsk	268	121	2.7	36.7
Mogilev	173	90	2.8	38.7
Total	1307	578	3.1	34.9

Taking into account the growth in the amount of the performed forest operations, exploring the possibilities of using modern tillage and forest planting machines, to reduce the number of personnel, to develop a multifunctional forestry tractor, needs to be approached to be able to perform a wide range of operations, including forest transportation operations on I and II types of terrain. According to preliminary calculations, the total technological need of forestry organizations in what regards the tractors with an engine power of over 120 kW does not exceed 5-8%, while the share of forestry tractors with an engine power of 80 - 120 kW can reach 60-70%. The specified numbers reflect the difference in mechanization of the forest operations compared to the agricultural ones, where the use of high-power tractors allows reducing the cost of work.

Vimek AB harvesters and forwarders (**Figure 2**) are widely used for clearing and felling operations. The most used models are the Vimek 404 harvester and Vimek 610.2 forwarder.



Figure 2: Machines models produced by Vimek AB which are used in timber harvesting operations

The structure of the Ministry of Forestry operates 79 units of Vimek harvesters and 78 units of Vimek forwarders. The average daily output per each harvester of this brand in the first half of 2020

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was 25.8 m³ (from 17.7 to 30.8 m³, for different SPFA), while the average daily productivity of forwarders from this brand was of 31.5 m³ (25.5 - 40.8 m³). It should be noted that Vimek forwarders were used on relatively long extraction distances, averaging 933 m. The highest timber extraction distances - 1250 m - are noted in the forests of Vitebsk and Gomel SPFA. In most cases, this is due to the underdeveloped network of forest roads in these areas, which are characterized by ages of the forest stands of 20-40 years.

The harvested wood is transported mainly by log trucks of trailed and semi-trailed type. The total number of machines in use is of 823 units, of which 242 units (29%) are more than 7 years old and will soon require replacement. Each vehicle has an average monthly idle time of 3.8 days. The average output per machine is of 67.3 m³ per shift (**Table 7**).

Table 7. Main indicators characterizing the fleet of log trucks used in the Republic of Belarus

Name of the state production forestry association	Total number of log trucks	Number of log trucks over 7 years of operation	Number of log trucks under repair, days per month for 1 unit	Average volume transported per shift, m ³
Brest	118	39	2.9	70.4
Vitebsk	139	47	5.0	62.7
Gomel	185	53	3.9	69.2
Grodno	92	32	2.6	60.7
Minsk	163	47	3.9	71.4
Mogilev	126	24	3.8	69.4
Total	823	242	3.8	67.3

The average distance for hauling wood assortments by trucks exceeds 40 km in 75% of the cases. Most of the log trucks are not all-wheel-drive and hold a 6 x 4-wheel arrangement. All-wheel-drive log trucks account for less than 20% of the total number.

Besides the production of timber assortments, the enterprises of the Ministry of Forestry implement technologies for obtaining woodchips. For this purpose, mobile chippers of their own production made in the form of semi-trailers (MTZ MR-40, MR-100), on specialized forest chassis (Amkodor 2904) [9-10], and also truck-mounted (MAZ 6944C9) are used. It should be noted that tracked machinery is not used in the logging industry of Belarus. At the same time, conditions for its rational use exist in a number of regions; these are found in the areas of Gomel and Vitebsk SPFA, where the forests are often located on poorly boggy soils, which make difficult the movement of wheeled machinery, and in some cases not possible. In this regard, an important area of research should be framed around the study of the machines' compatibility with the forest environment in terms of using different wheeled, combined and tracked locomotion systems, and their compliance with the requirements of regulatory and legal acts and forest certification systems.

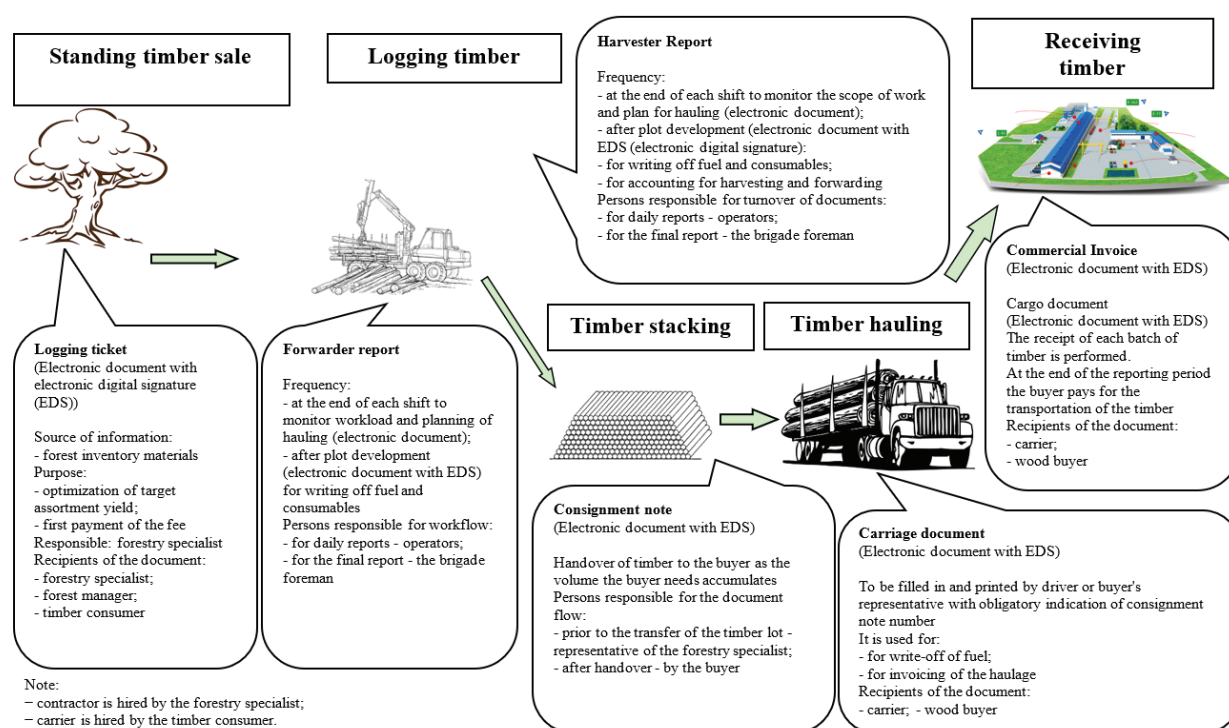


Figure 3: The main concept behind the unified state automated information system (USAIS)

The control over the operation of machines used in timber harvesting operations is carried out by installing navigation systems that can transmit data through mobile operators' networks. Such systems are installed on 75% of harvesters, 79% of forwarders, 95% of log trucks, 90% of forestry tractor trailers, as well as on a number of service cars and other equipment involved in the production. Wide dissemination of the navigation equipment will make it possible to switch to the unified state automated information system (USAIS) by the end of 2021. Its general structure is shown in Figure 3.

5. CHARACTERIZATION OF THE FOREST ROAD NETWORK

For the transportation of round timber in the Republic of Belarus, public roads and departmental (forestry) roads are used. The total length of the network of public roads in the country is 86,967 km. Among them, 15,929 km are republican roads and 7,038 km are local roads. At the same time, all republican roads hold an improved pavement system. The density of the public road network is of 418 km × 1000 km⁻². The ability to move heavy timber trucks on a number of republican roads is limited by their carrying capacity. Thus, 1,884 km of national roads have a carrying capacity of 6 tons per axle, 11,954 km - 10 tons per axle, and 2,091 km - 11.5 tons per axle.

In addition to general-purpose roads, forest roads are constructed and operated in the country. The density of forest roads should be 0.5 km × km⁻² in order to ensure the efficient development of the forestry. Currently, this indicator is of 0.27 km × km⁻². For the purposes of developing the road and transportation network in forested areas, in the period of 2011-2015, a state program for their

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construction was in effect. As a result, 570.1 km of forest roads were commissioned in 5 years. In 2016-2020, the subprogram "Construction of forest roads" of the State program "Belarusian forest" was in effect, which allowed the commissioning of 997 kilometers of forest roads in the forests managed by the Ministry of Forestry from 2010 to 2019. In 2019, 17 forest roads with a total length of 102.5 kilometers were put into operation, and in 2020 about 105 kilometers of roads were constructed. Therefore, there is an increase in the rate of forest road construction.

The average construction cost of 1 kilometer of forest road is of 69.19 thousand euros, therefore 69.19 euros per meter of constructed road. It should be taken into account that many roads are built in the forest areas dominated by soils with a low bearing capacity. Geosynthetic materials are used in the constructions of such roads, which leads to a significant increase in the strength of the constructed road systems. In general, the procedure for the construction of forest roads in the country is determined by technical code of practice (TCP) 500-2016 (33090) "Forest roads. Design standards and rules of construction".

6. CURRENT AND CRITICAL CHALLENGES IN THE FORESTRY AND FOREST ENGINEERING OF BELARUS

Despite the systematic development of the forestry in the Republic of Belarus, to date, several problems have arisen, the solutions of which have either already begun or will be implemented in the near future. The most important challenges are the following:

- **Uneven age and species composition of the forests.** As a result of the World War II, the amount of mature forests in the country declined significantly (in 1945, the forest cover was not more than 21.5% of the total country area). Only now we have managed to bring the share of mature and overmature forests up to 0.16-0.18% of total forest cover (forest cover of about 40%). At the same time, 30.7% of the species composition of such forests is made up by soft broadleaved species, such as birch and alder. Improvement of the age and species structure of forests is a rather long process. Scientists of the Belarusian State Technological University, the Forest Institute of the National Academy of Sciences of Belarus, the Kuprevich Institute of Experimental Botany, the Institute of Microorganisms of the National Academy of Sciences of Belarus, and the Institute of Microorganisms of the National Academy of Sciences of Belarus are working on ways to accelerate it;

- **Drying and mortality of the coniferous forests.** This problem is typical not only for Belarus, but also for the neighboring countries. Shrinkage of areas covered by spruce and pine occurs as a consequence of climate change and the spread of insect pests. For these factors, the limits of country territories are very conditional, so the solution of these issues must be intergovernmental. The ways to combat this problem are being developed within the framework of projects of the state scientific and technical program "Forests of Belarus";

- **The ageing of the forestry machinery fleet.** Due to the fact that the Ministry of Forestry is the main logging company and forest owner in the country, the aging of the machine fleet is more noticeable than in the case of private ownership of forests and machines. In the coming years, the country will have to seriously reequip and replace its logging machinery. For this purpose the

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country has several forest machinery enterprises of its own: OJSC Amkodor - managing company of the holding company" (specialized forest machinery and equipment: harvesters, forwarders, skidders, mulchers, forest chassis, trailed carts, choppers), OJSC Minsk Tractor Plant (harvesters, forwarders, trailed carts, forest modifications of tractors manipulators, technological equipment for forestry work), OJSC Minsk Automobile Plant (sorting trucks, chip carriers, trailers and semi-trailers, choppers). New models of multifunctional machines have been already developed;

- **High costs of logging in conditions of low access forest areas.** As noted earlier, about a quarter of the country's forests are on soils with low bearing capacity. Increasing the efficiency of logging in such conditions is a complex task. It is mainly solved by increasing the transport accessibility of such forests (construction of roads), improving harvesting technologies, development of new means of mechanization (including: the use of rope units, the use of light multi-support machines with low ground pressure indicators, a general increase in machine efficiency), increasing the training of engineers and workers in the field of timber harvesting operations;

- **Underdevelopment of information systems of timber accounting and transactions with it.** To date, the Unified State Automated Information System is at the stage of industrial testing and has not been introduced everywhere. However, its advantages are already in demand on the market of wood raw materials. The main problem in the near future will be the integration of accounting systems for timber harvested by harvesters into it. There are at least 5 different timber accounting systems installed on harvesters in the country. The practice of verification and calibration of such systems has not been widely implemented so far.

7. RESEARCH AND TECHNOLOGICAL DEVELOPMENT – STATE OF THE ART IN RELATION TO BELARUSIAN FORESTRY AND FOREST INDUSTRY

The effort of providing efficient solutions to the above problems is carried out at different levels. In the scientific direction, it takes place within the framework of state scientific and technical programs: "Forests of Belarus", "Machine building and machine building technologies", "Resource saving, new materials and technologies", a number of regional programs within the framework of the EAU, as well as with the financial support of the World Bank. A considerable amount of attention is paid to the use of wood raw materials as a local fuel and energy source and the impact of logging on the environment. These studies have found a significant reflection in the formation of sustainable development goals of countries.

In addition, we should note a number of scientific and practical problems and tasks of paramount importance for the development of forestry-related production at the sawmills, as part of the forestry industry. For the authors of the article, this problem is the closest and constitutes the immediate area of scientific research.

8. CONCLUSIONS

- 1) The depreciation of the fleet used in timber harvesting and transportation puts the forest industry and forestry enterprises under the task of its modernization. Old and technically worn-out machines should be replaced only by the new ones, more advanced machines with improved characteristics. The domestic enterprises of forest machine building are those facing the task of creating such machines. Both tasks should be solved jointly, which requires appropriate scientific and technical support. Within its framework, it is important to consider the following issues:
 - a. The operating efficiency of the harvester-forwarder systems, taking into account the type of harvesting operations, operating conditions, energy and layout characteristics of the machines;
 - b. Methods and techniques of the harvester and forwarder operators, taking into account the need to increase the work pace of the harvester-forwarder system, and the variability of the subsequent use of harvesting residues;
 - c. Ecological compatibility of machines with the forest environment in terms of the use of different wheeled systems, the use of combined and tracked systems, as well as the compliance with the requirements of regulations and forest certification systems.
- 2) It is advisable to develop guiding documents or instructions on existing and prospective systems of machines, to implement various logging and forestry technologies based on the principles of sustainable forest management, to create sets of technological schemes for different types of harvesting operations and methods used, to develop recommendations for amendments to existing regulations in the field of timber harvesting operations or, if necessary, to create new regulations;
- 3) Based on the analysis of the collected data on the volume of harvested timber it was found that the level of timber harvested by multifunctional machines in the forests owned by the enterprises of the Ministry of Forestry exceeded 50%. At the same time, most of the timber harvested by machines is obtained with the involvement of third-party organizations. The structure of the harvesting machines fleet in the enterprises of the Ministry of Forestry could be considered as well established. Its further change has a weak tendency for a proportional increase of each type of machines. Significant structural changes are possible in the area of mechanization of forest operations, especially for thinning and clearing, where the existing machinery does not meet the requirements adequately or it is purchased from foreign manufacturers. National enterprises that are developing and releasing forestry machines have formed and are updating the assembly lines of harvesting machines designed and built for felling and processing as a primary use. A significant disadvantage is the lack of domestic small-sized machines capable of working in thinning operations;
- 4) It is also noteworthy that there is a significant trend of increasing installation of navigation and information equipment on logging machines, which in general

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contributes to a more uniform transition to the unified state automated information system;

- 5) The analysis of the technical condition of the machine fleet for a number of GPLHF has established a trend of reducing the volume of harvesting with increasing age of the machines. In general, significant changes were observed in the age of machines: more than 3 years for harvesters and more than 5 years for forwarders. However, when comparing the volumes harvested by machines of different ages in the country as a whole, there is no such a clear correlation between these indicators. There are not isolated cases in which machines of significantly older age harvest larger volumes of timber. The reasons for this are the significant differences in operating conditions of machines in the regions of the country and the difference in the experience of operators. In this regard, there is a need for scientific and practical research into the operating conditions of machines in different regions of the country. For such an attempt, the most influential factors should be noted: soil and ground driving conditions, forest type, type of harvested assortments by species, size and quality, thickness of the forest floor etc.;
- 6) Along with the noted directions of development of the machine fleet, special attention should be paid to the study of forestry machinery ownership costs and its impact on the cost of production.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

EXTENDED ABSTRACT – REZUMAT EXTINS

Titlu în română: *Silvicultura în Republica Belarus: Starea actuală și direcții de dezvoltare*

Rezumat: *Lucrarea prezintă date cu privire la starea actuală și prospectele de viitor legate de dezvoltarea silviculturii și industriei forestiere în Republica Belarus. Sunt tratate aspecte legate de structura pădurilor, specii, vârste și compoziții, precum și aspecte legate de contribuția pădurilor în economia țării. Se trec în revistă tipul de management și proprietate a pădurilor, lucrarea tratând la un nivel mai adâncit aspecte legate de mecanizarea operațiilor forestiere, prin descrierea tehnologiilor utilizate în sectorul forestier. Pe baza rezultatelor prezentate se indică direcții de îmbunătățire a flotei de utilaje. O atenție sporită s-a acordat analizei nivelului de informatizare a proceselor de producție forestieră precum și structurii rețelei de drumuri forestiere și influenței acesteia asupra eficienței producției. La final, lucrarea caracterizează principalele provocări ale sectorului forestier din Republica Belarus și creionează principalele soluții pentru rezolvarea problemelor curente, inclusiv prin descrierea principalelor programe și proiecte științifice relaționate cu astfel de probleme.*

Cuvinte cheie: *Belarus, tehnologie, harvester, forwarder, mașină de tocat.*

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