

*Original Research*

# Socio-Economic Aspects of Strategic Development of the Forest Complex in the Bashkir Region

Milyausha Lukyanova<sup>1\*</sup>, Rida Sultanova<sup>2,3</sup>, Zariya Zalilova<sup>1</sup>,  
Rasul Gusmanov<sup>1</sup>, Aigul Selezneva<sup>1</sup>

<sup>1</sup>Department of Economics and Management, Federal State Budgetary Educational Establishment of Higher Education “Bashkir State Agrarian University”, 50-letia Octyabrya str., 34, 450001 Ufa, Russian Federation

<sup>2</sup>Department of Forestry and Landscape Design, Federal State Budgetary Educational Establishment of Higher Education “Bashkir State Agrarian University”, 50-letia Octyabrya str., 34, 450001 Ufa, Russian Federation

<sup>3</sup>Laboratory for Monitoring Climate Change and Carbon Balance of Ecosystems, Federal State Budgetary Educational Establishment of Higher Education “Ufa State Oil Technological University”, Ufa, Russian Federation

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## Abstract

The purpose of the research is a socio-economic assessment of the effective integrated use of forest resources in the region. The methodology of socio-economic assessment of the effective integrated use of forest resources of the region is proposed, which is based on: an assessment of the number of contributions to the regional trust fund, based on the differentiation of minimum rates of payment for the use of forest resources; calculation of an integral coefficient reflecting the effectiveness of the mechanism of financial regulation according to economic, social and environmental criteria. The conceptual novelty of the research is determined by the creation of a Regional Trust Fund to support projects for the development of the forest complex in the region, which makes it possible: to level the conditions of forest resources management in the republic by differentiating minimum rates of payment for the use of forest resources; to assess the effectiveness of various measures up to time and allocate more funds for reforestation; minimize personnel risk in the industry and obtain information necessary to adapt the proposed mechanism to changes in the economy.

**Keywords:** conomic and social efficiency, financial system of the forest sector, forest complex, regional trust fund, strategic planning

## Introduction

In conditions of limited forest resources, the duration of forest-growing processes, the complexity and specificity of the combination of natural and

economic factors, the improvement of the mechanism of financial regulation of the reproduction of forest resources is becoming increasingly relevant. Moreover, the issue of forming a financial base for the purposes of reforestation comes to the fore.

One of the principles of the state forest policy is the responsibility of state authorities and local self-government bodies for the exercise of powers in the field of forest relations in the relevant territories.

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\*e-mail: millukyanova7@rambler.ru

The economic efficiency of expanded reforestation is determined by the interest of both the state and specific forest users. Present-day sustainable forest management means stable, continuous and sustainable forest management for present and future generations without prejudice to other ecological, economic, social and other systems. Compliance with this principle is inextricably linked with sustainable economic development, a rational balance of economic and environmental approaches to forest management. The economic subsystem of sustainable forest management implies an increase in profitability from forest management, a rational economic and ecological balance of forest resources use, expanded reproduction of forests and increasing their productivity, a rational breed and age structure, ensuring economic security of forestry and sustainable forest management [1].

It should be noted that the scale of forest reserves and possible volumes of forest use in Russia can both fully satisfy all domestic demands for products and successfully integrate into the world economy without any harm to the environment and forestry [2, 3].

### Literature Review

At the present stage of the development of economic science, there is an increased interest of the scientific community in considering the issues of socio-economic aspects of the strategic development of the forest complex [4]. It should be noted that the Data Envelope Analysis (DEA) method is widely used in the international practice to analyze the effectiveness of regional forest complexes. The essence of this methodology is that the relationship between forest ecosystems and the forest industry requires a balance between the needs of forestry development and the development of natural ecosystems, which is a key issue of sustainable development of the international economy. Analysis from a systemic point of view is carried out using quantitative methods.

DEA is actively used to study forest management effectiveness and the logging sector for complex wood processing enterprises (from harvesting to the production of highly processed products) [5, 6]. The DEA method is applicable to assess the performance of forestry contractors in the mountainous and lowland regions of Slovakia, which requires urgent measures to improve logging management efficiency [7]. The combination of the DEA method with the Tobit econometric model made it possible to compare forestry efficiency in lowland and high-altitude forests in Poland. In addition, the analysis showed that the financial efficiency of lowland forestry is significantly influenced by population density, which negatively affects economic indicators [8]. The forestry service effectiveness study regarding small and medium-sized enterprises revealed a reliable correlation between performance efficiency and business duration [9].

At the same time, Bulgarian and Slovak researchers using the Data Coverage Analysis (DEA) approach and the Malmquist Productivity Index (MPI) have revealed that long-term sustainability and increased economic efficiency of forest enterprises in both countries can be achieved through improved forest management and investment in research [10]. In addition, an assessment of forest sector relative efficiency in 28 EU countries by three non-discretionary factors (number of employees; forest available for wood production; initial stock of plantings) using DEA allowed identifying the countries with the lowest efficiency indicators: Greece, Bulgaria and Italy [11].

The research of forest complex ecological basis is also worth noting. The studies covered regions with intensive industrial production as well [12], Atkins et al. [13], Zhu and Lo [14]. Some researchers have presented an accounting model of forest resource environmental benefits based on "green" development using accounting and data coverage analysis (DEA) models. The model aims to increase the environmental benefits of China's forest resources [15].

American scientists, such as Lister et al. [16], emphasize the managerial aspect of the problem. Lister and Leites [17] have proposed models of correlations between the sampling efficiency during forest inventory and the configuration variables of group areas. The models determine the decisions of inventory planners [16,17]. In addition, an important contribution was made by works aimed at studying the public-private partnership mechanism in the forest complex, including concession relations [18-20].

Thus, as the analysis of theoretical sources has shown, there is a growing interest of academic researchers in the problems of the forest complex strategic development at the regional level. Nevertheless, socio-economic aspects of strategic development, as a rule, remain outside the research field of available scientific publications. The main motivation of this study was the increasing social demand for the sustainable development of the forest complex, and the lack of research on socio-economic aspects of the forest complex strategic development in modern scientific literature.

### Methods and Materials

During the research, a methodology was formulated to assess the effectiveness of the mechanism of integrated use of forest resources in the region (Fig. 1).

The formation of criteria and a system of indicators for assessing the mechanism of complex use of forest resources is carried out by means of a correlation analysis of the most significant factors that have a priority impact on the amount of costs for the reproduction of forest resources (regression equations of group 1 ( $Y_1$ ) – indicators characterizing the breed-

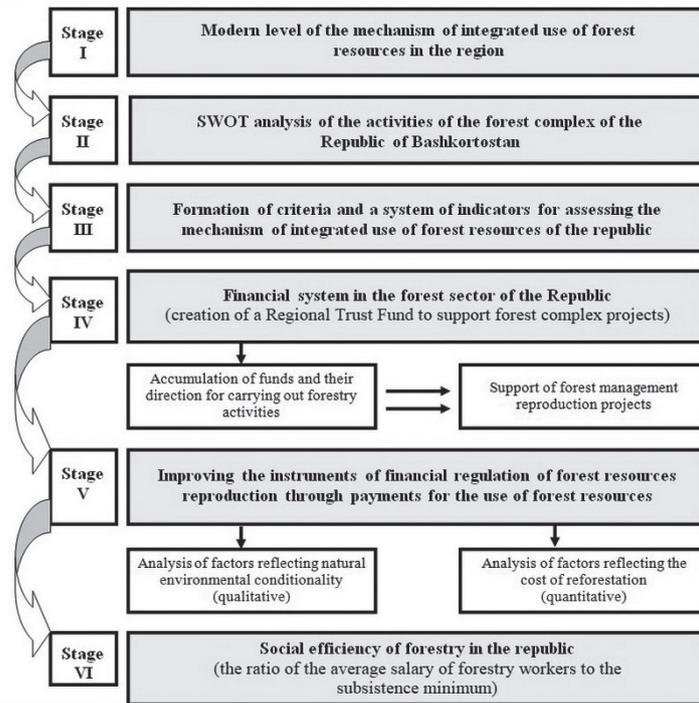


Fig. 1 Methodology of socio-economic assessment of effective integrated use of forest resources of the region. Source: Compiled by the authors

qualitative and geographical features of the territory; regression equations of group 2 ( $Y_2$  – indicators characterizing financial and economic features of forest users’ management) [1].

Correction coefficients to the minimum rates of payment for the use of forest resources:

$$K_1 = \frac{Y_1}{Y_0} \tag{1}$$

$$K_2 = \frac{Y_2}{Y_0} \tag{2}$$

$Y_1$  is the estimated costs of expenses on the reproduction of forest resources according to equation 1 of the group of factors;

$Y_2$  is the estimated costs of expenses on the reproduction of forest resources according to equation 2 of the group of factors;

$Y_0$  is the actual cost of the expenses.

Contributions to the regional trust fund:

$$S = V * (T_{min} * K_1 * K_2 - T_{min}) \tag{3}$$

where

$V$  – volume of forest resources;

$S$  – the number of contributions to the regional trust fund;

$K_1$  – correction coefficients of the 1st group of the most significant factors;

$K_2$  – correction coefficients of the 2 groups of the most significant factors;

$T_{min}$  – is the minimum rate of payment per unit volume of forest resources.

Economic efficiency is characterized by the ratio of the costs of reproduction of forest resources to the economically justified amount of received financial resources.

$$F_i = \frac{930.3 \text{ thousand rubles}}{503.6 \text{ thousand rubles}} = 1.85 \tag{4}$$

Social efficiency characterizes how the wages of forestry workers correlate with the value of the subsistence minimum, determined based on the average annual growth rates of wages, indexation of household incomes and inflationary processes in the economy of the region:

$$F_j = \frac{P_j}{PM_j} \tag{5}$$

where:  $P_j$  is the average salary registered in the j-th forestry of the republic:

$$P_j = \frac{\sum_{i=1}^m p_j n_j}{\sum_{i=1}^m n_j} \tag{6}$$

where:

$P_j$  – average salary in the j forestry of the republic;

$n_j$  – the average population in the j forestry of the republic;

$n_j$  – the number of forestry units included in the interdistrict territorial department;

$PM_j$  – is the value of the subsistence minimum registered in the  $j$  forestry of the republic.

$$F_j = \frac{32.3 \text{ thousand rubles}}{11.3 \text{ thousand rubles}} = 2.86 \quad (7)$$

or

$$F_j = \frac{2.39+2.74+3.11+3.3+2.84+3.06+2.71+2.70}{8} = 2.86 \quad (8)$$

One of the unfavourable factors is illegal logging of forest plantations, where there is a violation of legal requirements (lack of necessary documents, the breed or age composition is violated, logging is more than the permitted amount, etc.). According to the Ministry of Forestry in the Republic of Bashkortostan [21], the illegal logging rate in the republic in 2020 decreased by 3,688.1 m<sup>3</sup> or 32% compared to 2019. However, illegal logging caused damage in 2020 for 91.9 million rubles [21]. The increase in illegal logging continues

in the Abzelilovsky, Belebeysky, Birsy, Zilairsky districts of the republic. In general, in the Republic of Bashkortostan, taking into account the amounts for violations of previous years, more than 8 million rubles were collected for illegal logging, which is 38% more than in 2019 [21].

## Results and Discussion

The presence of a strategy for the sustainable development of the timber industry encourages enterprises to further effective development. The analysis of factors based on the construction of the SWOT analysis matrix of the forest complex of the Republic of Bashkortostan was the basis for identifying the strongest and weakest sides (Table 1), as well as opportunities and risks (threats) of further development.

The data in Table 1 show that the forestry complex of the Republic of Bashkortostan has many strengths in its market and production activities (significant

Table 1. SWOT analysis of the activity of the forestry complex in the Republic of Bashkortostan\*

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>– significant forest resource potential of the republic;</li> <li>– good quality indicators of products;</li> <li>– availability of a reserve of the estimated cutting area;</li> <li>– successful experience in implementing priority investment projects;</li> <li>– updating of equipment for logging;</li> <li>– the presence of an extensive network of railways;</li> <li>– the use of new technology of sawmilling and woodworking;</li> <li>– availability of specialized educational institutions;</li> <li>– a wide range of products;</li> <li>– the presence of large timber processors focused on the use of low-grade wood raw materials;</li> <li>– the popularity of the enterprises of the timber industry of the republic at the market of timber production of the Russian Federation and abroad.</li> </ul>	<ul style="list-style-type: none"> <li>– outdated forest management materials, lack of cadastral registration of forest plots;</li> <li>– depletion of operational forest reserves in transport accessibility zones;</li> <li>– low level of development of the estimated cutting area;</li> <li>– the presence of illegal logging;</li> <li>– the absence of forest lands on which voluntary forest certification has been carried out;</li> <li>– lack of effective technologies for harvesting wood in hard-to-reach areas;</li> <li>– insufficient development of transport infrastructure on forest lands;</li> <li>– lack of qualified personnel;</li> <li>– a long time from the bidding process to the start of wood harvesting;</li> <li>– inadequately high railway tariffs and unreasonable weight control standards for the transportation of industrial goods;</li> <li>– low level of cooperation in the industry.</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>– availability for deep processing of low-grade wood;</li> <li>– the existing shortage of foreign competitors for forest resources;</li> <li>– stable trends in the growth of world prices for products of deep processing in the medium and long term;</li> <li>– increase in domestic consumption of wood products;</li> <li>– increasing the transport accessibility of forest resources on the terms of public-private partnership and the development of new modes of transport;</li> <li>– development of intraregional intersectoral integration;</li> <li>– growing demand for wood biofuels, wood-polymer composite materials, high-grade pulp and paper construction;</li> <li>– availability of regional support measures for timber producers;</li> <li>– formation of the timber industry cluster of the Republic of Belarus.</li> </ul>	<ul style="list-style-type: none"> <li>– force majeure of a natural nature (forest fires, floods, hurricanes);</li> <li>– instability of legislation in the field of federal forest management;</li> <li>– unfair fulfilment by forest users of the terms of lease agreements;</li> <li>– the negative impact of international instability on the development of timber exports;</li> <li>– «Freezing» of investment and innovation projects, reduction of innovation activity, reduction of availability of credit resources for enterprises of the forest sector of the economy;</li> <li>– deterioration of the quality of forest resources while maintaining a low level of development of the estimated cutting area;</li> <li>– increased competition from neighbouring regions.</li> </ul>

\*Source: Compiled by the authors

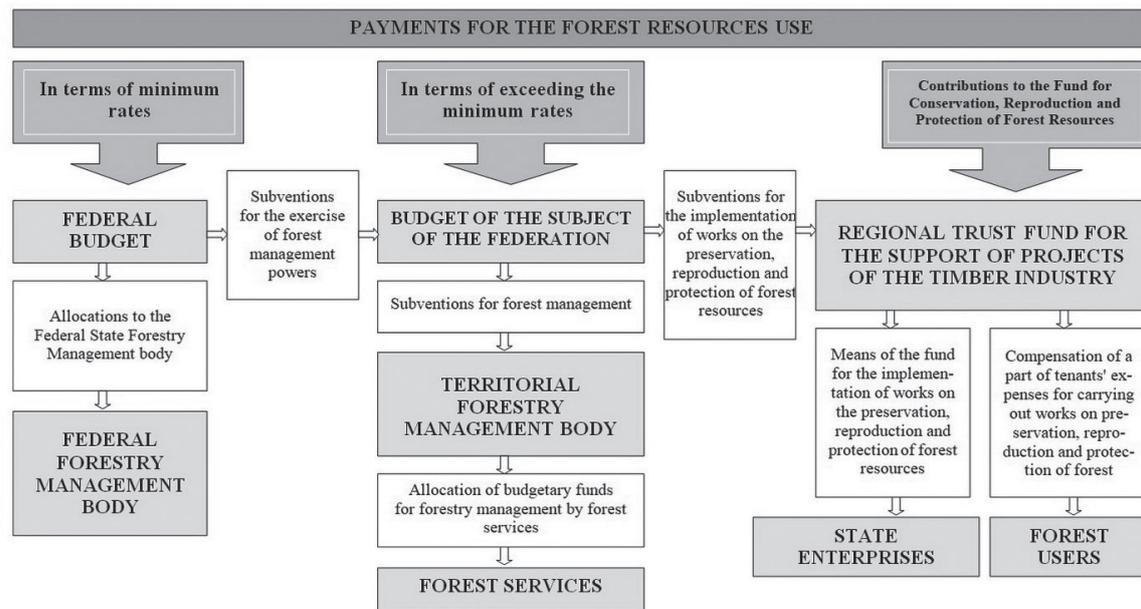


Fig. 2. Financial system in the forestry sector of the Republic\*  
Source: Compiled by the authors

forest resource potential of the republic, good quality indicators of products, the presence of large timber processors focused on the use of low-grade wood raw materials, the popularity of enterprises of the forestry complex of the republic in the market of forest products of the Russian Federation and abroad, but is not devoid of significant drawbacks (depletion of operational forest reserves in transport accessibility zones, the absence of forest lands on which voluntary forest certification has been carried out, the lack of effective technologies for harvesting wood in hard-to-reach areas, a high level of depreciation of fixed assets).

The sustainable forest complex development requires creating a specialized trust fund. In this case, funding should be directed strictly to specific measures for the conservation, protection, and restoration of the forest fund. The amount of money spent should be distributed proportionally to the responsibility assigned to the regional authorities and forest users to carry out forestry work [22-24]. Fig. 2 shows the scheme of interaction of subjects of regulation of financial relations, as well as their responsibilities in the formation, distribution and use of financial resources.

The analysis of statistical observations and forecast values [23] showed that the average annual growth rate of deforestation in interdistrict territorial forestry departments is approximately 2.6% and reforestation is 13%. Such forestry areas as Askinskoye, Uchalinsky, Karaidelskoye, Yanaulskoye, and Baymaks koye demonstrate the highest value. There is an increase in the reforestation dynamics, but the reforestation growth rate is significantly lower than the deforestation growth rate (by approximately 60%). In dynamics, there is an increase in the share of reforestation, however, the

growth rate of reforestation is significantly lower than the growth rate of deforestation (by about 60%). At the same time, the economic efficiency coefficient increased from 1.31 in 2018 to 1.85 in 2022.

We analyze the relationship between qualitative (natural and climatic conditions of vegetation, qualitative parameters of the forest at the root and the degree of development of the territory) and quantitative (financial and economic condition of users of forest resources) factors and minimum rates of payment for forest use (Fig. 3).

With the help of correlation analysis, we will reveal the relationship between the minimum rates of payment for the release of wood on the root ( $Y$ ) and factors reflecting the natural environment ( $X1 - X8$ ) and the cost of reforestation ( $X9 - X16$ ) in 31 forestry districts of the republic included in 8 interdistrict territorial departments of the Federal State Forestry and Forest Supervision of the Ministry of Forestry (Table 2).

According to Table 2, the conclusion is a close relationship only between the effective parameter and factors reflecting the natural conditionality (forest cover of the territory). The obtained values reflect the lack of correlation of the effective indicator with the group II factors. In this regard, the conclusion is the current minimum wage rates do not reflect the financial features of forest management.

To verify the reliability of the obtained results, we present the calculation of the Student's t-criterion (Table 3).

Table 3 shows a relationship only with the indicator of forest cover of the territory (2.651~2.045). According to other factors, there is an excess of the tabular values of the Student's t-criterion over the actual ones. Таким

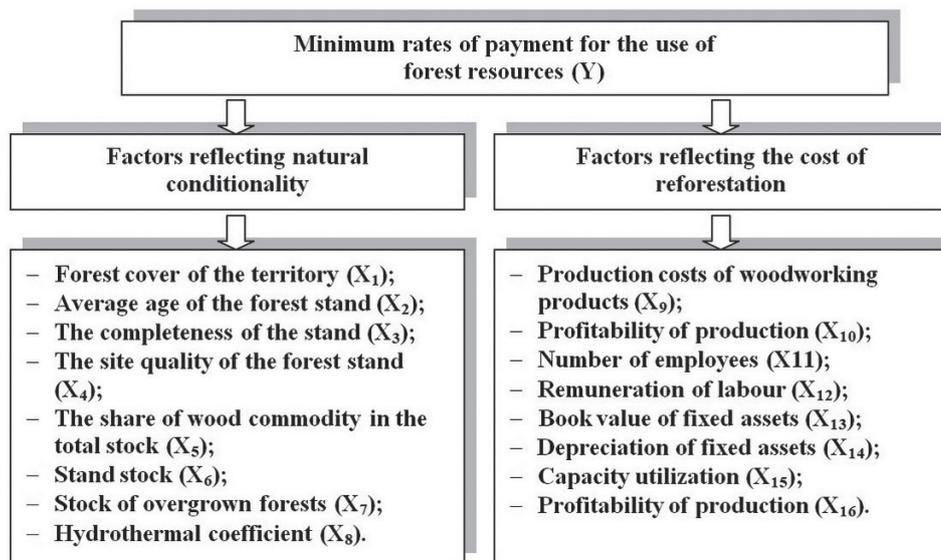


Fig. 3. Factors and rates of payment for the use of forest resources.  
Source: Compiled by the authors

Table 2. Correlation matrix of minimum rates of payment for the use of forest resources and factors\*

Group I factors									
	Y	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$
Y	1.000								
$X_1$	0.504	1.000							
$X_2$	-0.079	0.233	1.000						
$X_3$	-0.029	0.025	0.000	1.000					
$X_4$	0.210	-0.206	-0.159	0.033	1.000				
$X_5$	0.326	-0.190	0.030	0.090	0.074	1.000			
$X_6$	0.225	0.420	0.124	-0.010	-0.228	-0.304	1.000		
$X_7$	0.342	0.587	0.530	-0.087	-0.312	-0.197	0.790	1.000	
$X_8$	0.140	0.387	0.040	0.043	-0.089	-0.234	0.224	0.190	1.000
Group II factors									
	Y	$X_9$	$X_{10}$	$X_{11}$	$X_{12}$	$X_{13}$	$X_{14}$	$X_{15}$	$X_{16}$
Y	1.000								
$X_9$	-0.310	1.000							
$X_{10}$	0.490	-0.026	1.000						
$X_{11}$	0.205	-0.234	0.090	1.000					
$X_{12}$	0.111	0.410	-0.136	0.044	1.000				
$X_{13}$	0.163	0.480	0.100	-0.157	0.060	1.000			
$X_{14}$	-0.167	-0.300	-0.199	0.024	-0.147	-0.052	1.000		
$X_{15}$	0.411	0.100	0.093	-0.100	0.400	0.120	-0.140	1.000	
$X_{16}$	0.315	0.160	0.085	-0.164	0.205	-0.020	-0.051	0.608	1.000

\* Source: Compiled by the authors

Table 3. Values of the t-criterion indicator (t-table = 2.045)\*

Indicators	Index	t-factor	Indicators	Index	t-factor
Group I factors			Group II factors		
Forest cover of the territory, %	X <sub>1</sub>	2.651	Production costs, thousand rubles	X <sub>9</sub>	0.388
Average age, years	X <sub>2</sub>	-3.114	Production income, thousand rubles	X <sub>10</sub>	-2.222
Completeness of the forest stand	X <sub>3</sub>	-0.236	Number of employees, people	X <sub>11</sub>	1.654
Tree stand site quality class	X <sub>4</sub>	-3.012	Remuneration of labour, thousand rubles	X <sub>12</sub>	1.034
The share of wood commodity in the total stock of the forest stand, %	X <sub>5</sub>	1.802	Book value of fixed assets, thousand rubles	X <sub>13</sub>	0.581
Forest stand stock, total, thousand m <sup>3</sup>	X <sub>6</sub>	1.329	Depreciation of fixed assets, %	X <sub>14</sub>	1.843
Stock of over-standing forests, thousand, m <sup>3</sup>	X <sub>7</sub>	1.610	Capacity utilization, %	X <sub>15</sub>	-0.863
Hydrothermal coefficient	X <sub>8</sub>	0.450	Profitability of production, %	X <sub>16</sub>	0.701

\* Source: Compiled by the authors

образом, The use of correlation analysis and calculation of the Student's t-criterion showed that the current minimum rates of payment for the forest resources use do not contribute to the work of an effective mechanism for paid forest management.

The issues concerning the targeted management of the effectiveness of forest complexes based on an objective systematic integrated assessment remain not fully studied. However, the formation of an integrated system, the creation of the regional trust fund proposed by us made it possible to develop coordinated solutions that contribute to the timely assessment of the effectiveness of various measures, increase the economic efficiency of the use of forest resources and social efficiency in the industry.

### Conclusions

Using the developed methodological support, the effectiveness of the implementation of the financial regulation mechanism was assessed, the economically justified amount of necessary financial resources and its impact on improving social efficiency in forestry were determined.

According to this study's results, it is proposed to create a Regional Trust Fund to support projects for the development of the forest complex in the region. The purpose of creating a Regional Trust Fund is to preserve and make better use of the existing raw material base of the forest complex of the region, as well as to delineate the areas of responsibility of subjects of financial relations in the forest complex.

Revenues and expenses for forest management are determined taking into account the projected cost of reforestation up to 13% and adjusted for correction factors and additional funding from the Regional Trust Fund. Taking into account the creation of a Regional Trust Fund to support timber industry projects, the

economic efficiency coefficient is increasing from 1.31 in 2018 to 1.85 in 2022.

With the help of qualitative and quantitative factors, the work revealed that the current minimum rates of payment for the use of forest resources do not form an effective mechanism for paid forest management. To minimize personnel risk in the industry, it is advisable to determine the planned values of the amount of remuneration according to the forecast indicators of the adopted Resolution of the Government of the Republic of Bashkortostan "On approval of the Strategy for the development of the timber industry complex of the Republic of Bashkortostan for the period up to 2030" dated 13.11.2018 No. 535. At the same time, the annual increase in wages will be 10-14%. Based on the forecast values of the exact minimum, it is possible to increase the coefficient of social efficiency of the forestry sector of the republic by 2022. by 0.82, and will amount to 2.86, with the implementation of all planned measures for the conservation, protection and reproduction of forest resources, with the allocation of subventions from budgets of all levels and extra-budgetary sources of financing, their rational distribution.

The vector of further research on the issue under consideration is aimed at calculating differentiated minimum rates of payment for the use of forest resources for each specific forestry of the republic and calculating economic efficiency.

Nevertheless, the study has the following limitation: the forecast values for calculating economic and social efficiency were determined according to the data of the Ministry of Forestry of the Republic of Belarus. These data do not fully reflect logging and reforestation by tenants-loggers of the Republic's forestry enterprises. Therefore, all calculations covered only a short period. In this case, it was possible to study and adjust the planned indicators in connection with the changing economic environment.

### Conflict of Interest

Authors declare that they have no conflict of interests.

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### Data Availability

Data will be available on request.

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