Sustainable forest management is one of Russia's economic problems

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Abstract. The world community is increasingly expressing its concern about the rational and cost-effective use of available natural resources. There is a threat of degradation of a large area of the world's forests, the loss of unique biological systems and biological diversity, and environmental degradation. This is mainly due to insufficient funding. Therefore, new approaches to financing of reforestation are required. This, in turn, requires a different approach to determining the cost of standing timber. When determining the cost of standing timber, one should take into account not only the species composition, but also the quality of tree stands (i.e. assortment composition), road infrastructure (remoteness from public roads and the availability of forest roads for hauling timber and by-products), soils and other factors affecting the cost of transport of forest products. Funds received from the sale of wood resources should be directed to reforestation, the creation of forest infrastructure and the solution of other social and environmental problems.

1. Introduction

Vast natural plant resources of Russia have an immense value to the nation. In addition to wood, forests are also rich in other types of forest resources, such as berries, mushrooms, nuts, and medicinal herbs. Forests form the ecological basis of the territories, and the basis of the ecological security of the country and the planet as a whole. Forests are characterized by their natural diversity due to climatic, soil and other geographic features, as well as socio-economic differences between regions. Forests perform a variety of functions, among them water regulation, climate control and support of biological diversity [1].

In modern conditions, the problems of preserving and using forests are becoming increasingly relevant and complex. Forest management must meet international, social, environmental and economic requirements. Fires, pests and diseases, other adverse factors increase the threat of forest degradation. The forest sector is increasingly confronted with the need for a quick response to the development of technologies and the tightening of environmental requirements [2].
That is why it is essential to have a long-term forest policy followed by the state in the interests of both the participants of forest relations and all citizens of the country. Therefore, modern society should pay considerable attention to the use and renewal of natural resources [3].

The authors of the study believe that the topic chosen for the study is one of the most relevant today. The objective of the present study is to examine the issue of forest management in Russia, the existing problems and the ways forward. In this article, problems of forest management are considered in terms of the implementation of the principle of continuous, sustainable forest use in the context of reforestation and its linkage with payments for the resources used. The scientific and practical significance of the present study is expressed in the proposed recommendations, the use of which will allow for the most efficient management of the available forest resources in the Russian Federation; it will also allow observing the interests of both the resource owner, i.e. the state (in terms of receiving larger payments from the resources used), and business.

Forest use in Russia is characterized by low profitability, as evidenced by the ratio of forest income to the costs of forest management (Figure 1).

![Figure 1](image)

**Figure 1.** Ratio of income from the use of forests to the cost of forest management by year, billion rubles.

The Figure shows that the funds spent on forest management exceed the income from the use of forests.

In Russia, the main source of income is logging. In the budget of the Russian Federation, logging currently makes up about 60% of the total amount of income from forest use.

The structure of the annual income by type of forest use for 2017 shows that the main source of income is logging (Figure 2).
Figure 2. Structure of the annual income from the use of forests by type of forest use in 2017, billion rubles.

The issues of profitability of forest uses in Russia began to be dealt with in 1883, when the Manual of the Forest Department on determining the price of wood was issued. For many years, exploitation of the state forests allowed Russia not only to cover the costs of forest management, but also to substantially replenish the state budget. Payments for timber harvesting accounted for about 90% of the total income received from the use of forests. This was due to the competent establishment of payments for standing timber. Over the years, the approach to setting fees for harvested timber has changed. This approach was not always effective. And the current approach has also proved to be ineffective.

Since the middle of the twentieth century, such Russian scientists as Vasilyev P V, Voronkov P T, Lazarev A S [4-6] and others have been involved in the discussion on stumpage prices. These scientists considered different approaches to establishing payments. So far, no consensus has been found.

Of particular relevance are issues related to the financing of environmental protection measures, the allocation of funds for the restoration, reforestation and protection of forests. The funds allocated for these purposes in the state budget of the Russian Federation are insufficient. The revenue budgets are much lower than the costs of carrying out all the necessary forest management activities. It is necessary to reconsider, as soon as possible, the issues related to the possibility of increasing revenue budgets of the forest sector, because insufficient financing of forestry can only end in disaster. And one of these sources of income is payments for timber harvesting and other types of forest use.

2. Material and methods

The need to measure income from the use of forests and the costs of their maintenance and reproduction.

The condition that all participants of forest relations should observe the principle of sustainable forest use forms the basis for the preservation of the ecological and resource potential of forests. At the same time, the reproduction of forest resources occurs when they are used within the limits that make it possible to replenish resources while maintaining the sustainability of forests as an ecological system, of which forest is an element.
Therefore, the entire forest management system should be built on the principle of sustainable development, while ensuring the effective development of forestry [7].

The basic principle of modern economics in the use of forest resources, which is the most important condition for sustainable forest management, should be the principle of measuring the income derived from the use of forests by the costs of their maintenance and reproduction [8].

The main type of forest use in Russia is logging. Wood resources are renewable. The cost of their reproduction should include the cost of reforestation, forest protection and management. At the same time, in a market economy, it is necessary to match these costs with the payments received for their use. Payments for the use of wood are included in the cost of its harvesting and, accordingly, in the price of wood products. Considering that under market conditions, the price is formed under the influence of supply and demand, the price level for wood products can have a direct impact on the possible level of payments for wood resources [9].

Establishment of forest payments based on market prices for standing timber is used in the main forest provinces of Canada [10].

The balance of interests between the forest owner and the forest user can be achieved by establishing the offer price, built on the cost-based method of reproduction of forest resources and the price of demand, determined on the basis of the rental approach. The problem of establishing fees for forest use is still one of the most pressing in the forest sector of Russia. Forest economists still argue about the method of establishing fees for the use of standing timber. Some are supporters of the establishment of a calculation method based on the costs of reforestation (in Russia, it is called the cost approach), others are satisfied with the current approach (prices are set according to the price list), and the rest of economists suggest using the approach based on rent (rental approach) [11].

2.1. The method of calculating the fee for the use of standing timber
According to its economic nature, the payment for wood is a rent, that is, an income from a natural resource formed after the sale of a product made from this wood at market prices.

The main determinant of the amount of rent should be the market prices of final products.

When calculating the rent, the final product is defined as sawn timber, plywood, plates, paper, building structures, furniture, etc. Only on the market for final products where supply and demand are met can market prices be formed, taking into account the quality and properties of forest products, and the quality of forest resources (species, yield class, tree-length volume, age of forest stands, etc.) on the one hand, and consumer demand for these products on the other hand.

As mentioned above, the establishment of forest payments on the basis of market prices for standing timber is applied in the main provinces of Canada.

The market price for timber assortments in Russia should be established on the basis of the interests of private business and the state. In particular, it should have two values: a maximum value that reflects the interests of entrepreneurship, and a minimum value that reflects the interests of the state. At the same time, the upper limit of the price should be the residual value of wood products formed when the standard costs of their manufacturing including harvesting, transportation costs for the delivery of raw materials from the place of harvesting to the places of wood processing, as well as the standard profit in production on procurement and processing of raw materials have been taken into account. The lower limit of the market price will be calculated based on the standard costs of forest management, reforestation and protection of forests, and forest inventory. The lower price limit, as opposed to the upper one, can be assumed to be the same for all assortments. To carry out such calculations, it is necessary to consider separately for each enterprise the process-based methods of recording information [12, 13].
Having established the role of an entrepreneurial structure in the creation of the value of the final product, the rent \((1)\), which takes the form of payments for standing timber, can be defined as follows \([1]\):

\[
P = MP - C_c - PRI - C_{tr} - PR_t
\]  

(1)

where, \(P\) is payments for standing timber, \(MP\) is the market price of roundwood, \(C_c\) is the costs timber harvesting, \(PRI\) is the profit from timber harvesting, \(C_{tr}\) - transportation costs, \(PR_t\) - profit of transport.

Payments for standing timber \((2)\) should be linked to the costs of reforestation and forest protection.

\[
P \geq Z
\]  

(2)

where \(Z\) is the cost of forest protection and reforestation.

Market prices of wood products are based on an analysis of market prices in the Russian and international markets. They depend on the average diameter of a forest stand and the species composition.

An entrepreneur in Russia who have rented a forest plot, should establish for himself the extent to which it is possible to harvest wood of various species, of various sizes and with different quality characteristics.

In the process of establishing the payment for standing timber, it is necessary to take into account factors affecting both the cost of logging and the income from the use of harvested timber. These factors will affect the amount of this payment. These factors are: the mean volume of a tree-length, distance of timber transportation, growing stock per 1 ha, and species composition. The influence of these factors can be taken into account through the cost structure and prices (Table 1).

**Table 1.** The influence of various factors on income and costs of logging of round timber.

| Factor                     | Income (price of round wood) | Logging cost |
|----------------------------|------------------------------|--------------|
| The volume of a tree-length| +                            | +            |
| Distance of transportation  | -                            | +            |
| Growing stock per 1 hectare| -                            | +            |
| Species composition        | +                            | +            |

When calculating fees for standing timber, we examined in more detail the costs of harvesting roundwood, which are included in formula 1. We found the relationship between the change in costs and the factors presented in Table 1.

We know that with an increase in the volume of a tree-length, some elements of the cost of harvesting roundwood (for example, wages and fuel costs) decrease and lead to a decrease in the total amount of costs of timber harvesting. To prove this, we carried out a study using the method of project layouts.

**3. Results and discussion**

In our study, we calculated the coefficients characterizing the change in the cost of harvesting wood depending on the volume of a tree-length (Table 2).
Table 2. Coefficients characterizing the change in costs of procurement of 1 m$^3$ of wood depending on the volume of a tree-length.

| The volume of a tree-length (m$^3$) | Coefficient |
|-----------------------------------|-------------|
| 0.14-0.17                        | 1.0         |
| 0.18-0.21                        | 0.94        |
| 0.22-0.29                        | 0.80        |
| 0.3-0.39                         | 0.73        |
| 0.4-0.49                         | 0.67        |
| 0.5-0.75                         | 0.62        |
| 0.76-1.10                        | 0.60        |

Based on the obtained coefficients, it can be concluded that the cost of harvesting 1 m$^3$ of wood with a tree-length size of 0.82 m$^3$ is 60% lower than the cost of harvesting 1 m$^3$ of wood with a tree-length size of 0.16 m$^3$. Consequently, the cost of harvesting 1 m$^3$ of wood is reduced when cutting larger trees.

The volume of the growing stock per 1 hectare also affects the cost of logging. In our study, we obtained the following coefficients reflecting this effect (Table 3).

Table 3. Coefficients to account for the volume of the growing stock.

| Growing stock per 1 ha (m$^3$) | Coefficient |
|---------------------------------|-------------|
| 51-75                           | 1.0         |
| 76-100                          | 0.92        |
| 101-125                         | 0.86        |
| 126-150                         | 0.83        |
| 151-175                         | 0.81        |
| 176-200                         | 0.78        |
| 201-250                         | 0.77        |

Table 4 presents the coefficients that show the relationship between the distance of transportation of harvested timber and the cost of harvesting.

Table 4. Ratios taking into account the distance of removal.

| Average distance of timber transportation (km) | Coefficient |
|-----------------------------------------------|-------------|
| 20                                            | 1.0         |
| 30                                            | 1.24        |
| 40                                            | 1.49        |
| 50                                            | 1.70        |
| 60                                            | 1.89        |
| 70                                            | 2.11        |
| 80                                            | 2.27        |
| 90                                            | 2.51        |
| 100                                           | 2.70        |

Using the obtained coefficients, we can calculate the costs of timber harvesting and the payments for the harvested timber.

The results of assessing the value of forest resources can provide a basis for making economic and administrative decisions to improve the efficiency of forest management in the Russian Federation.

4. Conclusion
In Russia, revenues from the use of forests currently do not cover the costs of their reproduction. Therefore, we can talk about the inefficient use of forests. In order to make it effective, it is necessary to revise the method of determining the payment for standing timber. The method is rental by nature.
Sustainable forest management can guarantee continuous reproduction of forest resources, preservation and enhancement of forest potential for future generations.

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