Favourites from the Russian experience in assessing forest plots and resources

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Abstract. Consider in this article, interesting in our opinion, the results of the study and the proposals of scientists in terms of determining the value of land and forest resources using the assessment options for these purposes. When conducting research on the chosen topic, we completely agreed with the opinion of many Russian scientists, said about the need to assess the value of forest lands and forest resources, which is carried out for different purposes. The most relevant for our country are: determination of fees for the use of forest resources; setting fees for obtaining the right to lease or concession of forest fund plots; determination of the effectiveness of forest land use projects and the effectiveness of forest management systems; assessment of environmental damage and the effectiveness of environmental projects, etc. In this article we have shown only part of the proposals, in our opinion, of important assessment factors and their calculations for determining the value of the forest resource in a certain territory of the country's forest fund. They presented for your consideration a brief algorithm for the integrated assessment of forest resources and sites, compiled from research and analysis of various scientific Russian schools.

1 Introduction

The simplest way is to estimate a natural resource based on the gross income received from its operation. This approach is biased due to the fact that the income received in the vast majority of cases is the result not only of the productive forces of nature, but also of significant expenditures of living and social labor.

This disadvantage is not present in the estimation of a natural resource based on its net income. But since the amount of this income depends on the subjective factor — the level of organization of economic activity, then as an estimated indicator began to use the standard net income, which is determined not as actually received by the enterprise, but as possible under the normal organization of activity.

The most objective is the rent concept, in which rent is determined by the difference between the cost of production obtained during the operation of a given resource, and the cost of its production when using this natural resource.

Advantages of this method:

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- the best resources have a higher cost;

- resource development costs are focused on the average level and are more objective;

- for the occurrence of rental payments, it is considered appropriate to separate the owner of the resource and its user;

- rental estimations take into account the resource's limitations, which is the initial prerequisite for its economic evaluation in the rental approach [1,2].

The rent concept is based on calculating the difference between the social and individual cost of a natural resource.

When determining the forest income received by the owner of the forest fund for the use of forest resources, the rental concept is the most acceptable. If the owner presents the forest fund plots for lease, he receives forest income in the form of payments collected from the lessee, if he uses forest resources independently, then the forest income becomes part of the total business income (profit).

The main reasons for the unsatisfactory use of forest resources are the imperfection of the legal base and economic mechanism of forest management, the general low level of state land management in the country and, as a result, weak solutions to issues related to the creation of market infrastructure, the organization of rational forest management, the regulation of forest markets and financial flows in the forest sector. Forest land as an object of use in the economic sense is not valuable in itself, but commercial forest resources, products of secondary use, recreation.

Forest rent belongs to the owner of the forest fund. If the state owns the forest fund, the forest rent is currently taxed. Any payments for forest use are essentially a rent tax. To date, the withdrawal of forest rent by tax ways and methods leads to a negative trend: a decrease in the profitability of logging and wages of industry employees [3-5].

2 Methods

There are several specific approaches to the procedure for determining (calculating) the amount of forest rent, taking into account certain factors.

We consider it interesting that N. N. Pankratova proposed a method for calculating forest rent, which is as follows. When evaluating wood resources, the value of total forest rent is determined by two components: the assessment of the plot at basic rates; and the assessment of the rental advantage.

In the first case, the estimate includes the minimum and regional rates. Based on the basic rates, the entire stock of liquid wood available on the plot and transferred to the cutting is estimated. A special feature of the rent premium in the forestry sector is that it is calculated only for those forest resources whose products are in stable solvent demand on the external and domestic markets.

To determine the value of the rent premium, we can use the method of determining forest rent, as the difference between the prices of forest products and the cost of their production, taking into account the rate of profit, which is widely used in the world practice.

Forest rental income will be a total estimate of the total forest rent for each plot of the forest fund transferred for use on the territory of a subject of the Russian Federation or an administrative district.

In many respects, the proposals of the scientist N. M. Bolshakov [4,5] coincide with the approach outlined above. In his opinion, the basis for calculating the forest rent should be a technical and economic assessment of the project of the cutting area. The method of practical determination of forest rent and, accordingly, the amount of estimated payment

should be based on estimates of investment and production and financial activities of logging enterprises.

In general, the value of a forest resource is estimated by the amount of income (or rent) (for example, during the year). This indicator is calculated using formula 1:

$$Vi = NVi * Q_i \tag{1}$$

where: Vi -income from resource operation during year t; Qi — resource extraction volume per year; NVi - net cost of resource units in year t, which is calculated using formula 2:

$$NVi = Pi - Ci \tag{2}$$

where: Pi - the selling price of a resource unit in year t; Ci - the cost of extracting of resource unit in year t.

Market (rent) assessment of renewable forest resources is based on the determination of income (rent) from operation, determined using market data. It can be performed at constant and changing rates of resource operation.

In this case, the following options are possible.

1)   Rent assessment with constant indicators of forest resources operation. The value of natural resource reserves in the case of sustainable operation of the resource and non-changing volumes of extraction and incomes over time is calculated using the following formula (3):

$$P_V = Vi / S \tag{3}$$

where: P_V — cost of resource reserves; Vi - net income from resource operation in t year; S - discount rate;

2)   Rent estimation for resource operation indicators that change over time. The value of resource reserves with changing extraction and income volumes over time and sustainable operation of the resource is calculated using the following formula (4):

$$P_V = \sum_{i=1}^{T} Vi / (t + S)^t \tag{4}$$

where: Vi— the amount of income from resource extraction in year t, determined by the formula (1); T— the estimated term of the resource operation.

Russian scientists Medvedeva O. E., Kasyanov P. V., Petrov A. P. suggest calculating the cost of the first group of forest land plots using the converted Faustmann's formula (5):

$$V_L = [r_r * Qr - C_F / (1+e)^r - 1] - C_F - m/e \tag{5}$$

where: QT - the operating stock of wood on the root at the age of the main cutting, rT - the forest rent formed during the implementation of main use felling in the plantation of age T, CF - the cost of forest restoration, m - the annual cost of management, security and protection of forests, established by the federal forestry management authority, e - the discount rate.

For the second group of forest plots, the calculation can be performed using the following formula (6):

$$V_L = [r_r * Qr - C_F / (1+e)^{T-t}] + [r_r * Qr - C_F / (1+e)^r] * [(1+e)^T - 1] - m/e \tag{6}$$

where: (T-t) - the period of time that separates the time of the assessment and the time of the first cutting of the main use.

For the third group of forest land plots, the calculation is made using the formula (7):

$$V_L = r_r * Qr - C_F - m/e + [r_r * Qr - C_F / (1 + e^r - 1)] \quad (7)$$

The cost of a land plot of the forest fund, provided that only non-wood resources are used, without using wood, is determined by the formula (8):

$$V_{LN} = (P - C - i * K - Ci) / e \quad (8)$$

where: VLN - the cost of forest land plots provided that only non-wood resources are used; P - annual gross income from the use of non-wood resources (recreation, harvesting pine nuts, etc.); C - annual operating costs for the harvesting (production) production of non-wood forest resources or their use in any other way; K - specific capital investments in the organization of use of non-wood forest resources; i - rate of return on capital through the use of non-wood forest products (or the capitalization ratio for improvements, if there are buildings and structures); e - the capitalization coefficient for land; Cf-the cost of restoring, maintaining and protecting non-wood forest resources (in addition to those costs that are taken into account in the formulas).

If the complementary use of wood and non-wood forest resources is possible on the land plot of the forest fund, the cost of 1 hectare of plot is determined by the capitalized amount of rental income from logging and from the use of non-wood forest resources (9)

$$V_L \Sigma = V_L F + V_L N \quad (9)$$

where: $V_L \Sigma$ - the cost of a land plot of the forest fund, where complex multi-resource use of forest resources is possible; $V_L F$ - the cost of a land plot for wood harvesting; $V_L N$ - the cost of a land plot if only non-wood resources are used.

In turn, the cost of a forest plot is equal to (10):

$$V_L = [V_T/(1+e)^T] + [V_T/(1+e)^{2\,T}] + [V_T/(1+e)^\infty] \quad (10)$$

where: T - the turnover of logging; V_L - the cost of forest land; V_T - the cost of the forest reserve received every T years; e - the discount rate.

Mathematical simplification of this expression leads to the formula (11):

$$V_L = V_T/(1+e)^T - 1 \quad (11)$$

This formula is used to calculate the real value of successive forest incomes that have the value of V_T and occur at the end of each felling turnover.

3) Rent assessment of environmental resources by closing costs. This method is based on determining the cost savings of resource extraction, for example, resulting from the harvesting of high-quality wood (or better location) compared to a resource of lower quality (closing). Such savings can be considered as a differential rent calculated by the formula (12):

$$R = (Zn - Zi) * Qp \quad (12)$$

where: R — the differential rent for the resource; Zn - the cost of wood harvesting with the lowest quality (closing resource); Zi – the individual cost of wood harvesting ; Qp–the individual volume of wood harvesting.

This method is simple and quite visual, but it also has drawbacks:

-the optimal capacity for each enterprise is taken without linking with the capacity of other enterprises;

-the geographical location of the resource is not taken into account enough;

-ranking indicators are set without taking into account the time factor and market conditions.

Forest rent is determined per unit of used forest resources (ha, m^3, kg, etc.) at the time of operation for the purpose of reproduction, since forest resources belong to reproducible ecosystems.

At constant values of prices for capital and labor resources the forest rent is determined by the formula 13:

$$r = R - MC - K * i - W * q , \qquad (13)$$

where: r - forest rent; R - gross income from the use of resources; MC - material costs of production; K - the amount of investment; W - the standard of payment of employee labor; i - the rate of return on capital; q - the amount of labor.

If rent is calculated using this formula, it can serve as a criterion for the efficiency of forest resources use.

3 Results, Study Discussion, Suggestions

Thus, in any case, the valuation of forest resources is carried out only on the basis of forest rent. Normative costs for forest reproduction, without determining the price of forest resources, are used only to establish their economic availability.

This is the principle of the rent approach to forest resource assessment, which differs from other resource assessments.

However, the practical application of the rent-based approach to the assessment of forest resources is hindered by state intervention in the sphere of economic forest relations due to:

-making payments for the use of the forest fund taxable;

- prescriptive establishment of minimum rates of payment for wood that do not reflect either the forest rent or the standard costs of forest reproduction.

Many scientists and authors see the following mechanism for distributing rental income [6,7,8,9,10].

The main value of forest resources can be expressed by discounting the present value of future rents. Let's assume that a specific resource is used at a rate of X units per year. The cost of the resource sold at the time of operation is P, and the cost of its unit is C, then the rent cost in the first period is R = P-C. If the resource is used sustainably, X units can be extracted per year. Then the cost of the forest plot will be equal to (14):

$$V = \sum_{t=0}^{T} Xt \, (Pt - Ct)(1+r)^t \qquad (14)$$

where r - is the discount coefficient.

With proper operation, forest land can serve indefinitely. Therefore, the assessment of forest land should take into account the total effect obtained in the course of their unlimited use (15):

$$Pr = Pr_1 * [Re/(1+R)^T] + \sum_{j=1}^{m} Ppi * rj \qquad (15)$$

where: Pr_1 - estimate of 1 m^3 of wood stock of the reference stand at the age of cutting, rub/ m^3; Re - stock of the reference stand at the age of cutting, m^3

We consider it necessary to present the opinion of Ural scientists, including the authors, on the need to introduce additional factors of a comprehensive assessment of forest lands

and forest resources for effective and efficient use of the forest fund of the country and regions.

The operational value within the territory is determined by the formula (16):

$$Vo = Rh + Rs.u. + Rhu + Ro.p., \qquad (16)$$

where Rh, Rs.u., Rhu, Ro. p., - income from using forest resource.

Secondary forest use includes: harvesting of wood juices, oleoresin, wild fruits, berries, mushrooms, medicinal plants, technical raw materials, hay, as well as the placement of apiaries, pastures, etc.

For a full version of the assessment of biodiversity in woodlands, a comprehensive, complete assessment of forest land also requires the inclusion of costs for the study of the values of the environment-forming functions of forests [6,7].

a) functions of the forest in maintaining the air composition of the atmosphere (17)

$$E_{atм} = \sum_{i=1}^{n} (q_i * I_j (1 + K_{1i} * B_{1i} + K_{2i} * B_{2i}) * t_i * d_i) * (I_c * E_c + I_o * E_o), \text{rub/ha} \quad (17)$$

where: qi - current average periodical growth of stem wood in the i - th age group, m^3/ha;
Pj - weight of 1 m^3 of absolutely dry wood of the j-th breed;
K_1i, K_2i - coefficients of wood volume co-measurement in the i-th age group;
B_1i, B_2i - coefficients of co-measurement of phytomass growth of individual components of forest stands for different age groups; ti - duration of the i-th age group, years; di - discount coefficient for the i-th age group; n - number of groups of age of forest stands;
I_C, Io - the intensity of carbon dioxide absorption and oxygen release during the formation of 1 ton of completely dry wood, t / t;
E_C, E_O - the value of "replacement costs" for the carbon dioxide-absorbing and oxygen-producing functions of the forest.
b) The economic assessment in the form of the long-term effect of the water protection and water regulation function of the forest for the period of one turnover of logging is determined in stages.

First, annual increases in fluvial flow R due to the presence of forests are calculated.

Then the total economic effect EE is determined using the formula 18:

$$E_E = \sum_{i=1}^{n} (R_i * K_1 + R_o(K_1 - K_2)) * t_i * d_i * E, \quad \text{rub/ ha.} \qquad (18)$$

where: R - annual increase in fluvial flow due to the presence of forests;
K_1, K_2 - coefficients of the underground component of fluvial flow for a given wooded area and uncovered by wood territory; Ro - the total amount of fluvial flow in this territory, m^3/ha per year.
c) The cost of the climate-forming function of the Pk forest for the period of one turnover of logging is determined by the formula 19:

$$Pk = \sum_{i=1}^{n} (E * (1 + K_1 + Rn)) * AI * di K_2, \, rub/ha \qquad (19)$$

where: K_1 - coefficient taking into account the cost of conservation and protection of forests; Rn - the ratio of profitability in forestry; a_1 - the coefficient characterizing the fraction of the cost of forestry related to climate function of forests; K_2, K_3 - coefficients differentiating the value of the climate-forming function of forest depending on the characteristics of forest vegetation zone, forest types; n - number of measures for reproduction of forests.

d) The cost of the soil-forming function of the forest Ep for the period of turnover of logging is determined by the formula 20:

$$E_P = Q * \sum^{ni=1} Li \ (1 - 1/ \ Ki \ Ki_1) \text{ , rub/ha} \qquad (20)$$

where: Q - wood stock per 1 ha in a mature modal plantation, m^3/ha; Li - weighted average value of payments for wood of the i-th breed, $rub.m^3$; Ki - coefficient that characterizes the decrease in the stock of wood of the i-th breed in the plantation when assessing the soil-forming function of the forest.

e) The cost of the forest water treatment function is determined by the formula 21:

$$Evo = \sum^{ni} = 1 \ (Ri * K_1 + Ro * (K_1 - K_2)) \ ti * di * E, \qquad (21)$$

where: Ri, K_1, R_0, K_2, ti, di - are defined similarly to the one described above.

f) The cost of the forest's soil protection function Epz for the period of logging (100 years) is determined by the formula 22:

$$E \ pz = Ep * \sum E * K, \text{ rub / ha.} \qquad (22)$$

where: $\sum E$ - is the sum of the values of the forest's environment-forming functions; K - is the coefficient that differentiates the value of the forest's soil-protecting function in relation to the functions listed above.

g) The air-purifying function of the forest is determined by the formula 23:

$$Apf = \sum^{ni=1}(P_1i * Z_1 + P_2i * P_1i * Z_2 + P3i * Z_3)* ti * di \text{ , rub/ha;} \qquad (23)$$

where: P_1i, P_2i, P_3i - the ability of forest vegetation in the period of the i-th age group to absorb pollution from the atmosphere, t/ha;

h) The protective function of the forest is to secure and protect plots of the most valuable tree species and other plant species, as well as forest fauna. The calculation formula has the form (24):

$$Epr = K \ (\sum E) - (\sum Pr + C) \text{ thousand rub/ha} \qquad (24)$$

where: K – the coefficient of expert assessment, which determines the increase in the significance of the environment-forming functions of forests in certain plots that perform a protective function; C - the cost of forest protection.

A number of scientists and authors of the paper rightly believe that when conducting a comprehensive assessment of forest lands, it is also necessary to take into account the social functions of forests [6,7,9].

a) assessment of the recreational function of the forest (formula 25)

$$Er = \sum^n_{i=1}(8760 * A_d * P_p - C \ ) * t_i * d_i, \quad \text{rub/ha} \qquad (25)$$

where: Ad - the average annual allowable or actual P_p -recreational load; C - the annual cost of forest management in recreational forests, rubles/ha;

b) the cost of the forest health function (formula 26)

$$Ez = Er * Ko * (K_1 + K_2) \qquad (26)$$

where: Er-cost of the forest's recreational function;
Ko - coefficient of forest health effect assessment (as a percentage of the price of "free time");

K_1, K_2 – coefficients for assessing the degree of oxygen ionization and volatility of forests of various species composition

c) the cost of the educational function of the forest (*Ev*) is determined by formula 27:

$$Ev = K_V * (Er + Ez), \text{ rub/ha} \qquad (27)$$

where: K_V - coefficient, estimates of the educational function of the forest to the recreational and health functions of the forest.

d) the cost of the aesthetic function of individual plots of forest landscapes is determined by formula 28:

$$Eaest = Ka \cdot (Er + Ez) * (Pr_{i=1}{}^4 * K_i), \text{ rub/ha} \qquad (28)$$

where: Ka - coefficient that evaluates the aesthetic function of the forest in relation to the recreational and health function of the forest;

$(Pr_{i=1}{}^4 * K_i)$ - the multiplication of the coefficients of aesthetic attractiveness of forest landscapes depending on the relief, size, etc.

As a result of using the above methods of assessment, the authors carried out through the calculation of comprehensive environmental and economic assessment of phytorecreational potential of the Sverdlovsk region, which showed the following results: the average cost of biodiversity in the region is 10.3 thousand rubles/ha, evaluation of ecological-forming functions of forests is equal to 55.6 thousand rubles/ha, the cost of social functions of forests - 63.1 thousand rubles/ha. Thus, the specific value of the phytorecreational potential of a typical forest plot in the Sverdlovsk region is 128.9 thousand rubles/ha. Also, the authors of the study have repeatedly used calculations using these methods to challenge in court the cost of damage caused by the seizure of forest land plots for industrial construction purposes.

4 Conclusions

The use of the above proposed methods for determining the value of forest resources is reflected in the project for determining the cadastral value of forest land in Russia, which is the basis for taxation of land and lease payments, but currently there is no approved method for determining the cadastral value of forest land. Many economists suggest that market valuation should only be applied to land intended for forest management (wood harvesting and processing). And for other land plots, specific indicators of cadastral value should be calculated based on the values of specific indicators of cadastral value of the category of land plots and (or) the type of use that is closest in functional purpose to the estimated land plots within one administrative district (subject of the Russian Federation).

There may be some logic in this, but from the point of view of nature management, the cost of forest resources, in our opinion, should include an assessment of biodiversity (the cost of environment-forming factors) and indicators of social functions of forests.

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