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რეგიონულ დონეზე სათვით მართვების ეკოლოგიური და ეკონომიკური ფუნქციების განხილვის მეთოდები

ნაშრომში შემუშავებულია ტყის მიწების ეკოლოგიური და ეკონომიკური შეფასების ალგორითმი. ალგორითმის გამოყენებით განისაზღვრა ტყის მიწების ეკოლოგიური და ეკონომიკური შეფასების მეთოდოლოგიური მიდგომა. განხილულია ტყის გამოყენების ინდიკატორები ადგილობრივ დონეზე (მიწის ნაკვეთი). განისაზღვრა 1 ჰექტარი ტყის მიწის ეკოლოგიური და ეკონომიკური შეფასების შედეგები, აგრეთვე ტყის მიწის შეფასება ფერმერული მეურნეობების დონეზე. დადგენილია, რომ მიწების ეკოლოგიური და ეკონომიკური შეფასების რაოდენობრივ გამოხატვაზე გავლენას ახდენს ისეთი მაჩვენებლები, როგორცაა ხის სახეობები, ჭრის რეალური ასაკი, ხეების პოტენციური მარაგი ჭრის ასაკში, ფულადი ღირებულება და ძირითადი ჭრის ასაკი, ტყის ხარჯი ძირითადი ჭრის წინ, სატყეო საქმიანობის ტიპი. გარკვეულმა გარემომ, ეკონომიკურმა და სოციალურმა ეფექტებმა, რომლებიც მჭიდრო კავშირშია, შეიძლება შეავსონ და გარდაქმნან ერთმანეთი, ამიტომ საჭიროა მათი განხილვა ურთიერთქმედებასა და ურთიერთდამოკიდებულებაში. გარემოს მდგომარეობის გაუმჯობესების საჭიროება მოითხოვს ტყის რესურსების გამრავლების, სატყეო მეურნეობის, ტყის მენეჯმენტისა და ტყის რესურსების დამუშავების არეების ანალიტიკურ შეფასებას.

ტყის მიწების ეკოლოგიური და ეკონომიკური შეფასების შემოთავაზებული მეთოდი ითვალისწინებს ტყის რესურსების თვისებებს, მიწის ნაკვეთების რაციონალურსტრუქტურას, ტყის მიწების გამოყენებიდან გამომდინარე ტყის მიწის ერთ ფართობზე მიღებულ ეკონომიკურ ეფექტს.

დადგენილია, რომ მიწის ნაკვეთის ეკოლოგიური და ეკონომიკური შეფასების რაოდენობრივ გამოხატვაზე

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METHODS OF CALCULATION OF ECOLOGICAL AND ECONOMIC FUNCTIONS OF LAND FOREST ASSIGNMENT AT LEVEL OF REGION

An algorithm for conducting ecological and economic assessment of forestry lands has been developed. The methodological approach of ecological and economic assessment of forest lands is determined with the help of the algorithm. Indicators of forest use at the local level (land plot) are analyzed. The results of ecological and economic assessment of 1 ha of forest lands, as well as assessment of forest lands at the farm level are determined. It is established that the quantitative expression of ecological and economic assessment of lands is influenced by such indicators as wood species, actual age of felling, potential stock of trees at the age of felling, monetary valuation of stands at the age of main felling, cost of growing stands before the main felling, type of forestry measures. Certain environmental, economic and social effects, which are closely linked, are able to complement and transform each other, so they need to be considered in interaction and interconnection. The need to improve the state of the environment requires an analytical assessment of the field of reproduction of forest resources, forestry, forest use and areas of processing of forest resources.

The proposed method of ecological and economic assessment of forest lands takes into account the properties of forest resources, rational structure of land areas, economic effect obtained per unit area of forest lands due to the use of forest lands, and takes into account the fact that land on which forest vegetation grows is operational. for the establishment and growth of forest plantations and the fact that the land together with the available forest vegetation and other natural resources is a single natural complex - the forest. Based on the obtained data on the state of use of forest lands, it becomes possible to develop and implement measures for the balanced use of forest resources.

It is established that the quantitative expression of ecological and economic assessment of the land plot is influenced by such indicators as the species of timber, the actual age of the felling, the potential tree stock of planting at the age of the felling, the

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monetary value of the stand at the age of the main felling, the cost of growing the stand up to the age of the main felling, the type of forest management.

According to the results of the ecological and economic evaluation at the economic level, it is established that according to the assessment of the area of the operational forests of SE «Mirgorod Forestry» occupies the first place, according to the assessment of the areas of protected forests the leaders are SE «Mirgorodsky Forestry», SE «Poltavaoblagrosy forestry», According to the assessment of the area of recreational forests – SE «Kremenchug forestry», SE «Poltava forestry», SE «Hadyatsky forestry », by the assessment of areas of forests of nature conservation, scientific, historical and cultural purpose – SE «Kremenchug forestry» Children’s Forestry Enterprise, State Enterprise «Novosanzharsky Forestry». It has been found out that land valuation according to one or another variant allows to substantiate the most optimal scenario of development of forestry activity in accordance with the chosen strategy.

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***Key words:** ecological and economic assessment, land of forestry destination, natural resources, rent, economic effect, methodology.*

1. INTRODUCTION

One of the dominant tasks of the state policy in the field of nature management has been the development of forestry with increasing social, economic and environmental importance of forests [1, p. 9].

Today forest lands occupy an important place among the categories of lands of Ukraine and have a special legal regime. The grounds for the allocation of forest land to a separate category are the following features: germination on their territory of forest vegetation, forest management, including through the implementation of forest reproduction, improving their productivity, quality composition and conservation of biodiversity [2, p. 10].

But an important element is the implemented intensive forest management model, which is based on the principles of sustainable management and provides a sufficient level of reforestation. In this case, one of the main problems is to increase the efficiency of economic indicators without compromising the integrity of the forest and its environmental functions.

One of important factor of balanced forest management is the ecological and economic assessment of not only the results of the use of forest resources, but also the useful functions of the forest. A prerequisite for such an assessment should be an environmentally forest management system that takes into account the natural patterns of forest ecosystems development. Such an assessment should be used to reflect the value of forests in the national wealth of the country; analysis of forestry activities of enterprises and forest users; substantiation of efficiency of all forestry measures; maintaining the state forest inventory; determining the amount of damage to forests; does the job ting payment for forest management [3].

The purpose of the article is to enable the development theoretical and methodological provisions for the calculation of estimates of ecological and economic functions of the land plot for forestry purposes at the regional level.

2. MATERIALS AND METHODS

Today there is no clear methodology for ecological and economic assessment of forest land for which you can assess the state of use of land and natural resources.

In a general sense, methodology is the doctrine of the principles of building scientific knowledge, in the field of forest ecosystem assessment - is the doctrine of the principles of building a set of natural benefits of the assessed objects in the dynamics of their natural process; forms of presentation of economic characteristics of different types of natural resources (indicators, criteria, effects) of the assessed areas of forestry lands, taking into account their spatio-temporal dynamics; ways to determine the total value of forestry plots depending on their environmental, social and economic significance of TV legal status. In accordance with this methodology were formulated the following basic principles (basic principles of the theory) of land valuation of forestry [5; 6; 7; 8]:

- clear idea of the land plot as an object of ecological and economic assessment;
- formation of a set of evaluation indicators (resources or functions);
- substantiation of evaluation indicators;
- construction of a criterion for a comprehensive assessment of the forest area.

The methodological approach of ecological and economic evaluation of forest land has the following algorithm:

1) Determining the economic assessment of forest resources (we have formed) the formula:

$$EAFR = F * TF * S * PA \quad (1)$$

where EAFR - economic assessment of forest resources;

F - forest rent;

TF – is a factor that takes into account the time factor;

S - estimated land area of plantations i- th species of the j- th type forest, ha;

PA * is a potential tree plantation age in the felling age (determined by the tables of the modal plant growth course for the i- th species of the j- th type of forest), m 3 / ha.

Note: * is only taken into account when determining the economic value of timber resources.

2) Economic effect (by Kislova T., Tunytsya J., Koval Y, Synyakevych I.):

$$EF = MAS - CFG \quad (2)$$

where EF is the economic effect of forestry;

MAS - monetary assessment of the stand in the age of the main felling;

CFG - the cost of growing the stand up to the age of the main felling.

3) Economic assessment of social and ecological functions of forest resources (by O. Balatsky):

$$E_i = W_i * (\sum_{j=1}^n k_{ij}) * S_i \quad (3)$$

where E_i is the current economic assessment of the socio-ecological functions of the forest on the i- th area;

k_{ij} - coefficient of economically estimating socio-ecological functions of the forest of j- th relative value (estimation) of wood stock on the i- th area in annual dimension;

W_i - economic assessment of the stock of wood per unit of the i- th plot;

S_i - is the area of the i- th area of reforestation.

4) Ecosystem services will be calculated by the already known formula:

$$ES = E_i + E_{ef} + E_{ec} \quad (4)$$

E_i – current economic assessment of the socio-ecological functions of the forest on the i- th area;

E_{ef} – coefficient of economic efficiency of forestry measure;

E_{ec} – the economic effect of cultivation.

5) Ecological and economic efficiency measures proposed to (by Y. Koval) [9]:

$$Eef = \frac{\sum C_{ni} * B_{Cpi} - \sum_i C_{pi} * B_{pi}}{\sum_i B_{pi} * C_{pi} + E_n + C_i} \quad (5)$$

where Eef is the coefficient of economic efficiency of the forestry measure;

C_{ni} - the cost of manufactured products by the results of the i- th forestry event, UAH / ha;

C_{pi} - cost of works and the 1st forestry event, UAH / ha;

B_{ni} , B_{pi} - coefficients of discounting of the effects and costs associated with holding the i- th forestry event;

E_n is the normative capital ratio;

C_i - specific capital investment for holding the i- th forestry event, UAH / ha.

According to the characteristics and features, which are characteristic of forest resources, land evaluation system for forestry purposes can be done by different options. The first option is to assess the protective functions of the forest, namely to determine the economic effectiveness of forestry measures. The second

option is to evaluate the recreational and health functions through the assessment of ecosystem services. The third option covers the assessment of environmental and aesthetic functions by determining the economic effectiveness of forestry activities, the characteristics of socio-ecological functions and ecosystem services. The fourth option consists of successive stages of resource function assessment by determining the economic assessment of the natural resource, the economic effect of forestry and socio-environmental functions.

3. RESULTS AND DISCUSSIONS

Existing approaches to the economic assessment of forest resources practically do not take into account the features of forest lands [11]. As a result, the value of both forests and forest land is low. Only individual economic evaluation attempts are made and, therefore, only individual components of forests and their products. It is known that a qualitative and complete assessment of forest resources is included in the economic assets of the country, thanks to it, the real and potential wealth of forest areas is determined, the costs of forest reproduction, the real efficiency of investment projects of forestry is estimated, a strategy of environmental activity is developed, the financial system in the forest sector is created.

In the broad sense, forest resources are structurally represented by two components: forest material resources, which include forest resources of operational forests (berries, mushrooms, wood, etc.) and partly forest resources performing protective, recreational and environmental functions. For environmental

and economic assessment it is important to take into account the following features of forest resources:

- 1) the natural reproducibility of forest resources and their role in the continuous production of natural complexes;
- 2) the ability to meet the various (economic and environmental) needs of society.

Because the potential resource that creates an environment, there is always a function of ecosystems. And only the need arises to satisfy ecological needs and their economic reproduction translates the forest ecosystem into the rank of ecological forest resource. The economic expression of an ecological forest resource may be different: from constraints on economic growth to alternative uses in order to preserve the quality of the environment required [12].

At present most reasonable theory of the existing methods is an approach that focuses on rental valuation takes into account the totality of the factors and conditions that determine the efficiency of resource use. Therefore, the rent concept is based on the assumption that in today's conditions there are such types of rental income - natural rent and environmental rent [13].

1. Quantitative expression of monetary valuation of forest resources (rent) determined by the difference between the market price of timber and regulatory costs of production, including entrepreneurial activity income to support business activity. Forest rents should be based on the principles and requirements of the rational use, conservation and enhanced reproduction of forest resources [14].

In theory, rental income is regarded as a

surplus or a surplus that is generated by the use of relatively persistent limited factors of production - natural, environmental, technological, intellectual, financial, etc. the most well-known rent is the natural rent, which is received as an additional product as a result of using the best quality and location of resources and which is determined on the basis of the difference between the market price of the product and the cost of its production, taking into account the normal return on capital [15].

Environmental rent is a relatively new economic category, although with the emergence of the rent itself, but the identification of this category, its essence began with the aggravation of environmental problems, there are two sources of obtaining this surplus: exhausting, selective development of the best, most productive resources and extra-regulatory use natural environment without their restoration and elimination of harmful emissions, discharges. Recognition of the fact that rent arises not only when the resource is consumed but also when it is contaminated, requires a change in the valuation method [16].

However, the methodology for calculating the rent for many natural resources, including forest resources, has not been developed, which complicates the implementation of rent estimates and, accordingly, payments. In modern conditions, a monopoly-departmental approach has become a practical application, which is a kind of cost approach. With regard to environmental rent, the methods of accounting for it in the form of pollution charges, the rates of which should be determined based on the magnitude of the marginal damage to the environment, also have many problems. This is due not only to the

difficulty of detecting these contaminants, but also to the difficulty of monetary assessment of the loss.

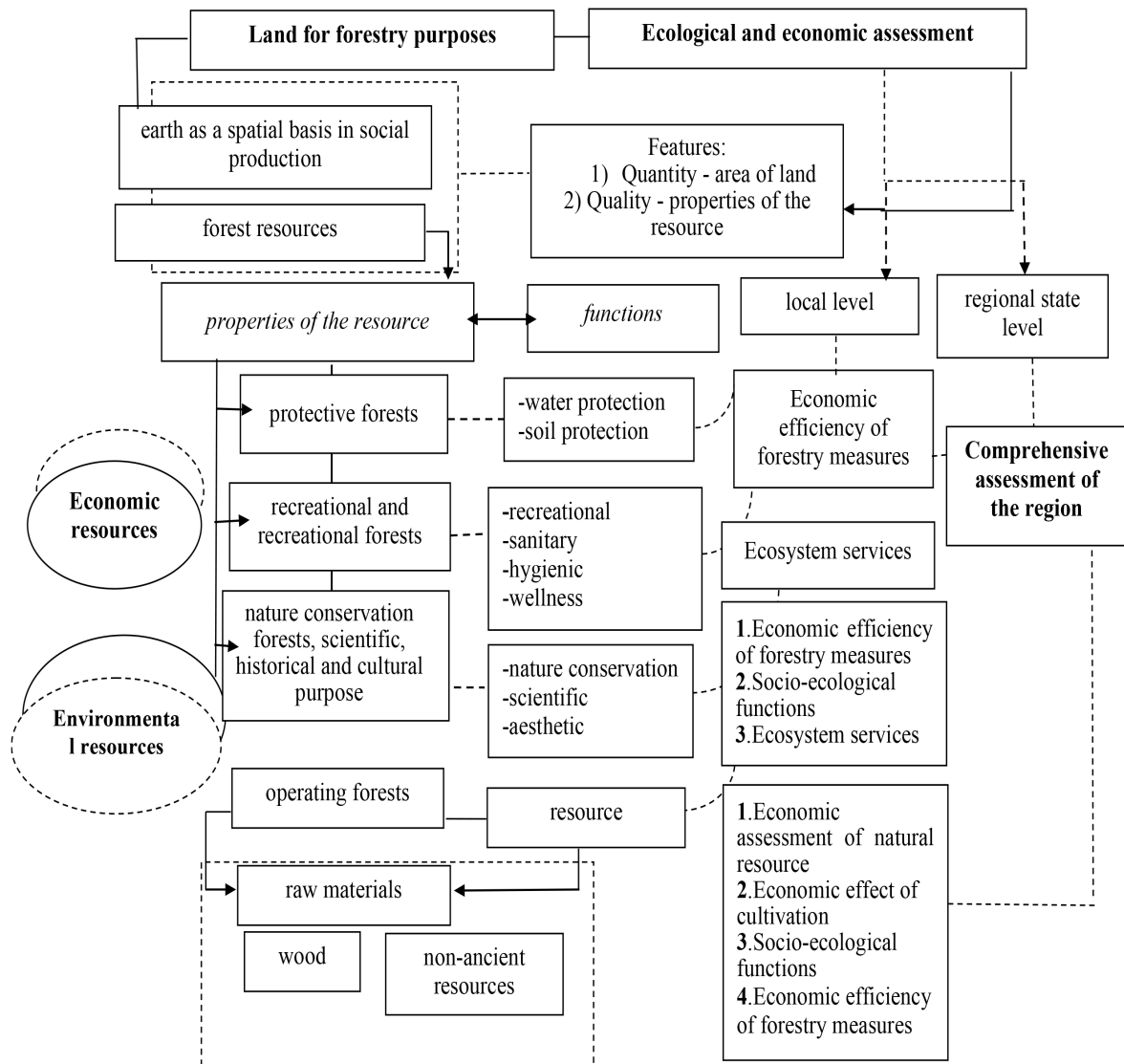
Existing cost-based timber payments are very small. Their low level of cost and price of products does not stimulate rational, sustainable and environmentally friendly forest use. To fulfill the forest payments, they are offered the tasks they need to take into account the market conditions and location of forest resources, regional natural production conditions.

Differentiation of these factors and conditions determines the differentiation of the values of forest rent, which allows to ensure the effectiveness of these payments and the fulfillment of all their inherent functions. However, it is necessary to take into account the environmental component as well, since these approaches (cost and rent) underestimate its real value, which is explained by the complexity of their assessments [17]

The theoretical provisions of the assessment of natural resources, ecological services, socio-ecological functions of forest lands and economic effect in the use of forest land have made it possible to conclude that there is no single methodological approach in the evaluation of forest land. The algorithm of carrying out ecological and economic assessment of forest land for fig. 1.

Since forest land has many aspects and uses, we have proposed a methodological approach to the ecological and economic assessment of forest land based on a systematic approach. The essence of this method will bookmark the chatys b in the assessment of forest resources on the known and existing methods of assessing the potential liosresursnoho or land on different aspects.

Fig. 1. An algorithm for carrying out ecological and economic evaluation of forest lands



Source: Developed by the author

According to the above data in table.1 was the calculation values ecological and economic evaluation to claim ‘ omy parameters are measured. The results are presented in Table. 2, where the implementation of the proposed approach to forest land valuation is indicated, was tested at the local and economic levels (Tables 3, 4). This approach allows you to evaluate the land taking into account their inherent properties, according to their functional use.

It is established that the quantitative expression of ecological and economic assessment of the land plot is influenced by such indicators as the species of timber, the actual age of the felling, the potential tree stock of planting at the age of the felling, the monetary value of the stand at the age of the main felling, the cost of growing the stand up to the age of the main felling, the type of forest management.

Table 1 Local forestry indicators (land)

Indicators	1-land and a link (operating forests)	2-land plot and link (protective forests)	3-land plot and link (recreational wellness forests)	4-land plot and link (forests of nature conservation, scientific, historical and cultural purpose)
1	2	3	4	5
land area	845	60 ha	200	485
kind of wood	Pine ordinary			
age of felling planting	65			
actual planting age	60			
potential tree plantation age of the felling age, m ³ /ha	231			
monetary assessment of the stand in the age of the main felling, UAH;	1180		1180	
the cost of growing the stand up to the age of the main felling	506		3106	
economic estimation of wood stock per unit area	105336		272580	272580
coefficient of economically estimating social and ecological functions of the forest	0.060		0.060	0.060
the cost of manufactured products by the results of the forestry event, UAH / ha	15803 (total)	15803 (total)	15803 (total)	15803 (total)
cost of forestry activities, UAH / ha	2983,6	2983,6	2983,6	2983,6
specific capital investments for forestry event, UAH / ha	648,26	648,26	648,26	648,26
normative ratio of investments	0.15	0.15	0.15	0.15
discount rate	0.02	0.02	0.02	0.02
rate of return	0, 2			
costs of production and transportation of forest products, UAH / m ³	800			
market price of forest products (either timber or non-timber resources - berries, mushrooms, nuts), UAH / m ³	1180			

Source: Developed by author based on data [18]

Table 2 Results of ecological and economic evaluation of 1 ha of land

forestry					
Land plot, square	Economic assessment of natural resource	Economic effect of cultivation	Socio- ecological functions	Economic efficiency of forestry measures	Ecosystem services
1 ha	95406,06	674	6320,16	353	7347,116

Source: calculated by the author.

Table 3 Results of ecological and economic evaluation of forest lands at farm level

Type of use	Type of assessment	Land area, ha	Ecological and economic assessment, thousand UAH
Option 1	Economic efficiency of forestry measures	60	21
Option 2	Ecosystem services	200	1469
Option 3	Socio-ecological functions	485	6065
	Economic efficiency of forestry measures		171
	Ecosystem services		3563
Option 4	Economic assessment of natural resource	845	80618
	Economic effect of cultivation		569
	Socio-ecological functions		5340
	Economic efficiency of forestry measures		298

Source: calculated by the author.

Table 4 Results of ecological and economic evaluation of forest land at farm level in Poltava region

Table 4 Results of ecological and economic evaluation of forest land at farm level in Poltava region

Economy / kind of assessment	Option 1	Option 2	Option 3			Option 4			
	Protective forests	Recreational well-being forests	Forests of nature conservation, scientific, historical and cultural purpose			Scaffolding			
	Economic efficiency of forestry measures	Ecosystem services	Socio-ecological functions	Economic efficiency of forestry measures	Ecosystem services	Economic assessment of natural resource	Economic effect of cultivation	Socio-ecological functions	Economic efficiency of forestry measures
SE "Gadyatsky forestry"	6511,76	53032,95	29521,47	1648,86	34318,38	80618,12	569,53	5340,535	298,285
SE "Kremenchug Forestry"	2138,40	123023,78	78500,81	4384,51	91256,32	-	-	-	-
State Enterprise "Lubensky Forestry"	4330,32	5169,43	23177,29	1294,52	26943,34	-	-	-	-
SE "Mirgorod Forestry"	10643,09	12263,81	3089,93	172,58	3592,01	125649,8	887,658	8323,651	464,901
State Enterprise "Poltava Forestry"	4440,92	92153,41	24779,45	1384,01	28805,84	-	-	-	-
Subsidiary «Novosanzhar Forestry»	5079,32	3765,40	27590,66	1541,02	32073,83	-	-	-	-
SE "Piryatinsky Forestry"	5600,45	8485,18	18889,69	1055,05	21959,06	55907,95	394,964	3703,614	206,858
SE "Dykanskoye DLMG"	2539,23	286,54	24980,43	1395,23	29039,48	-	-	-	-
SE «PDLP« Poltavaoblagricol »	9983,62	3417,14	14868,81	830,47	17284,83	-	-	-	-

Source: calculated by the author.

According to the results of the ecological and economic evaluation at the economic level, it is established that according to the assessment of the area of the operational forests of SE «Mirgorod Forestry» occupies the first place, according to the assessment of the areas of protected forests the leaders are SE «Mirgorodsky Forestry», SE «Poltavaoblagrosy forestry», According to the assessment of the area of recreational forests – SE «Kremenchug forestry», SE «Poltava forestry», SE «Hadyatsky forestry », by the assessment of areas of forests of nature conservation, scientific, historical and cultural purpose – SE «Kremenchug forestry» Children’s Forestry Enterprise, State Enterprise «Novosanzharsky Forestry». It has been found out that land valuation according to one or another variant allows to substantiate the most optimal scenario of development of forestry activity in accordance with the chosen strategy.

The proposed method of ecological and economic assessment of forest land uses the properties of forest resources, rationality of the structure of land area, economic effect obtained from a unit of forest land due to the use of forest land, and also takes into account that the land on which the forest grows basis for planting and growing forest plantations and that the land plot, together with the existing forest vegetation and other natural resources is the only natural complex - the forest. Based on the data obtained on the state of land use, it becomes possible to

develop and implement measures for balanced use of forest resources.

4. CONCLUSIONS

From the above we can conclude that a methodological approach to the formation of a comprehensive environmental and economic assessment of forest lands is proposed. Land valuation should be preceded by clarification of their defining characteristics, which depend on their inherent properties and functional use. The economic component of the assessment should be determined by land or forest rent. Taking into account the economic effect of forestry and economic efficiency of forestry measures. As for the socio-ecological functions of forest ecosystems and their ecosystem services, their assessment will depend on which function or service is being assessed and the chosen method of its assessment. This methodological approach allows to take into account the multi-purpose nature of forest land use, to introduce a step-by-step or variant method of assessment, which can be extended over time, will provide ongoing monitoring of land status and forecast their future use. It can be argued that the process of improving the methodology of valuation of forest lands is very complex given that forest lands have specific properties, perform different functions and have different uses, which complicates the process of selecting and determining a single method of assessment.

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