

## ASSESSMENT OF THE EFFICIENCY OF SUSTAINABLE FOREST MANAGEMENT IN UKRAINE

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### Abstract

Determined that in connection with decentralization in the sphere of forest in Ukraine, the state forest management authority needs to assess the effectiveness of the implementation of the powers delegated to the regions. The results of the study of regulatory framework and practice of assessing the effectiveness of forest resources use in the context of various management entities led to the conclusion that there is no single approach to both assessing and determining criteria and indicators of forestry management effectiveness. In this regard, the article presents a methodological approach to assessing the effectiveness of sustainable forest management, which involves the application of a set of evaluation criteria and indicators, unlike existing ones, characterizing the combination of forest, forest exploitation, forest protection and reforestation processes in the forest management system. The choice of the system of assessment indicators for sustainable forest management in Ukraine was carried out taking into account the accumulated national experience and pan-European criteria and indicators of sustainable forest management. The key principle of the proposed approach is elimination of the difference in the dimensions of reduced parameters by normalization, that is, their translation into a dimensionless form. Application of this approach allows to determine the level of use of productive, ecosystem, protective and socio-economic functions of forest ecosystems, and to identify problem aspects of forest management, depending on the elements of forestry activities.

**Key words:** criteria, evaluation, indicators, forest management, sustainable.

### Introduction

The management system that has been developed in Ukraine's forestry in recent years can be characterized by a number of problems, including environmental and economic barriers to improving the efficiency of forestry production and the

transition to sustainable development of the industry. This requires development of new mechanisms for sustainable forest management aimed at improving the efficiency of use and reproduction of natural resources of forest ecosystems.

Today the domestic forestry is faced with the task of gradually abandoning the

extensive use of forest resources, taking into account the growing crisis of the provision of forestry with necessary raw materials. Extensive forest management is contrary to current trends in the development of international markets towards greening economic activity and biodiversity conservation. Therefore, to replace the extensive model, an intensive forest management model is being increasingly introduced, which is based on the principles of sustainable management and provides for ensuring a sufficient level of reforestation, enhancing the care of the young, planning commercial thinning, thinning of mature plantations, etc. 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 ecological functions (MacDicken et al. 2015).

Theoretical approaches to forest management with regard to sustainable development are characterized by a number of forest management elements, in particular, 'environmentally oriented forest management' (Zheldak 2010), 'sustainable forest management' (Wijewardana 2008), 'environmentally sustainable forest management' (Dubas 2011), 'ecosystem management of forestry' (Yarova 2010), 'sustainable forest management' (Drebot et al. 2014), etc. These approaches meet with the postulates and principles of sustainable forest management, giving priority to certain aspects (economic, environmental, social).

The concept of sustainable forest management has been mentioned during the Ministerial Conference on the Protection of Forests in Europe and later adopted by the Food and Agriculture Organization (FAO) as the basis for forestry development. By their definition, sustainable forest management is the management of

forests and forest lands, allowing them to maintain their biodiversity, productivity, resilience, viability and potential to perform, now and in the future, relevant environmental, economic and social functions without compromising other ecosystems at local, national and global levels (FAO 2014).

In general, management from an economic point of view interests the society, first of all, as a type of effective activity on the management of forest resources for the achievement of goals. It should be noted that the main task of management is the formation of a unified system of interaction of its elements to achieve the planned result at minimum cost.

According to the concept of sustainable development, forest management should be aimed at preserving the ecological, economic and social value of forests, providing favorable conditions for rational and, most importantly, sustainable forest management, planning activities for the protection and reproduction of forest ecosystems. Accordingly, the essential-substantial bases of the concept of 'sustainable forest management' takes on a refined value of systematic purposeful influence of subjects of management of forestry process together with mechanisms, institutions, forms and techniques aimed at balancing the economic interests of forestry and forest ecosystems capacity to conserve their productivity and environmental functions. In this circumstance, it is necessary to conduct a detailed scientifically based analysis of the system of sustainable forest management and reporting on the implementation of management decisions.

Forestry, as an economic sector, includes forestry, logging, production and primary processing of industrial or fuel wood, the collection of non-timber forest

resources, recreational forest use, ecological entrepreneurship, forest management, etc. Forestry is a sphere of economic activity that deals with the cultivation, protection and use of forest resources. In general, forest management can be defined as an activity aimed at using forest resources and other beneficial properties of a forest to satisfy the material and spiritual needs of society, depending on the socio-economic level of its development, environmental conditions and the actual state of forest resources in a certain area (Furdychko 2014).

The project developed by scientists from the Institute of Agroecology and Environmental Management of NAAS (Furdychko et al. 2012), provides for the creation of a system of national criteria and indicators for sustainable forest management, the development of the situation on the improvement of reporting forms that are used in the context of individual forest enterprises. However, the proposed indicators do not clearly define the norms and criteria for the improvement of economic processes in order to adapt them to the system of sustainable forest management. Further development requires methodological and methodical approaches to systematization of the main indicators of forest management into a unified system for evaluating management decisions.

In Ukrainian forest legislation, the concept of forest management has traditionally been shared, limiting public administration only to the definition of the competence of the relevant state authorities. The new edition of the Forest Code of Ukraine (in 2006) for first time gave a broad definition of the tasks of state regulation and management in the field of forest relations to ensure the effective protection, rational use and reproduction of forests. Today, the forest management system in Ukraine

is characterized by authoritarian methods, which provides for the accumulation of the economic, managerial, control and other functions of forest management almost one forest relations entity – the State Forest Resources Agency of Ukraine. However, in order to improve the efficiency of forest management, separate administration powers in the field of forest relations have been transferred to the regional level – to the regional forestry and hunting departments.

In modern economic conditions, optimization of management decisions in the use of forest resources is one of the most important questions about the growth of economic efficiency in this area (Kolesnik and Sinyatullina 2017, Lim and Innes 2017, Trishkin et al. 2017). At the same time, the technology of functioning of organizational and economic tools and methodological support for sustainable forest management reflects the set of stages of preparation, adoption and implementation of management decisions on the rational use of forest resources in order to harmonize environmental and economic goals towards achieving sustainable forest management.

As mentioned earlier, the methods currently used by the authorities to assess the effectiveness of forest management are based mainly on comparing the actual value of a given statistical indicator with the corresponding value for the previous year (or plan for a year), which does not allow conducting an objective assessment of the quality of performance of functions by forestry entities. Evaluating the effectiveness is carried out according to criteria that assess the quality of execution of powers delegated to the entity for the reporting fiscal year, and not the level of forest management. As a result, evaluating the effectiveness is based on compar-

ing the actual level of target indicators for the reporting period with similar indicators of the previous year. That is, the assessment is carried out in relation to what has been achieved, and not on the basis of comparison with individual criteria, since such criteria are not taken into account today, which does not allow us to assess the objectivity of the functions performed by forest management.

That is why, in the context of decentralized forest management, in order to form an objective view of the regions and inter-regional comparisons, a big problem is to assess the effectiveness of the execution of powers transferred to the regions in the field of forest relations (Shmatkov and Grigoriev 2011).

The results of the researching of regulatory framework and practice of assessing the efficiency of forest resource use in the context of various management subjects (state, region, forestry enterprise) allow to conclude that there is no uniform approach to assessing and determining criteria and indicators for forest management effectiveness. For example, representatives of the School of the National Forestry University suggest to determine the effectiveness of forest management in three main areas: goal setting efficiency, adaptability and reorganization efficiency (Lytsur and Holovko 2011). From their point of view, management system adaptability can be characterized by such qualitative parameters as the existence of mechanisms for maintaining feedback with the public and interested people, the existence of mechanisms for introducing the achievements of science into management practice. Reorganization efficiency can be estimated by the costs of converting the current management system and the level of risk associated with the failure of this transformation.

Storozhuk (2016) for the purpose of operational assessment of the state and effectiveness of forest management in the reserch uses a comprehensive set of criteria suggested by the Department of Agriculture and Rural Development of the World Bank. A group of international experts suggests a methodology for assessing the effectiveness of forest management, where the indicators, characterizing it, are formed according to the cost principle. Many indicators are determined by the sum of the costs of carrying out certain activities or in relative terms (Rametsteiner and Mayer 2004, Gough et al. 2008, Baycheva et al. 2013, Lim and Innes 2017).

Researches conducted by Shmatkov and Grigoriev (2011) adhere to the approach to assessing the quality and effectiveness of state forest management in the form of a rating. In particular, the rating offered by them widely presents a number of environmental, social and economic indicators that are absent in the set of assessment criteria of the Russian assessment system. However, the structure of the rating objectives according to this methodology does not include an assessment of the effectiveness of forest management, including forest reproduction, which combined forestry and logging into a single process (Mironov 2013).

Taking into account all the varieties of existing approaches to assessing forest management, it is determined that some of them do not take into account national peculiarities of forest management, others are informational, others are not entirely objective, since they are based on unconfirmed benchmark efficiency values. The current approach to assessing the effectiveness of forest management based on an analysis of target forecast indicators, which is used today by the authorities,

also cannot be considered satisfactory, because its use does not illustrate the quality of forest management and the effectiveness of the transferred powers to regional authorities. The results of the assessment according to the current approach are based on a comparison of the actual value of target indicator for the year with the forecast, that is, the assessment was carried out in relation to the achieved, and not on the basis of comparison with the optimal value of the indicator. Given this, the purpose of the article is to analyze the problems of assessing the effectiveness of forest management and the theoretical and methodological justification for its improvement, taking into account the specifics of the forest sector of economy of Ukraine.

## Material and Methods

Classically, to determine the effectiveness of the management system, regardless of its level, is to evaluate the results of work compared to the nested resources, while taking into account their qualitative characteristics. In this regard, it is advisable to establish the effectiveness of the public administration system through a comparison of relevant indicators, criteria and established standards, requirements at the initial stage and at the final stage, that is, after the implementation of specific measures to improve and transform management forms and methods (McDonalda and Lane 2004). As noted above, a numerical demonstration of a certain criterion is an indicator or their system, reflecting the estimated property of a certain phenomenon. Of course, any criterion can be expressed by a set of indicators that will reveal it, that is, reflect the characteristics of a particular criterion (both in quantitative

terms and descriptive attributes) of forest management system (Kimmins 2004, Spilsbury 2005). Such indicators allow us to estimate the vector of transformations in this system, which, taking into account the time intervals, reflects the corresponding trends in forest management.

As international experience shows, since 1998, that is, from the base of the first indicator system in Europe in a sustainable forest management system and further in the course of its development and improvement of appropriate criteria and indicators are the indispensable tool for integrated national forest policy in all European countries. The Ministerial Conference on the Protection of European Forests is organized as a regional political process based on interstate agreements (MCPFE 1998). This process is on a regular basis attended by the ministers of forestry in Europe, and equivalent people responsible for forest management. Based on the improvement of data collection systems, and given the need for constant updating of information characterizing the indicators of sustainable forest management, in 2015 at the 7th Ministerial on the Protection of Forests in Europe conference in Madrid was updated existing set of European Indicators (MCPFE 2015). According to the developed project, quantitative (34) and qualitative (11) indicators were presented. In particular, quantitative indicators are designed to characterize the status and change of the main aspects considered from the point of view of sustainable forest management. This information helps to facilitate the assessment of the achievement of the objectives of each criterion and provides for the consistent promotion of sustainable forest management. In general, criteria and indicators of sustainable forest management can serve as a basis for definition and as-

assessment of sustainable development of the domestic forest industry.

Thus, at the moment, the European criteria are recognized means of stimulating and supporting sustainable forest management, and the implementation of policies at national level. Nevertheless, there is a large difference in the methods and quality of adaptation of the European criteria to national characteristics.

Therefore, a prerequisite of effective forest management within the existing national forest policy is to create a system of national criteria and indicators for sustainable forest management in Ukraine. At the same time, national criteria should consider international commitments as well as national strategic priorities. Here, it will be important to take into account the experience of the Russian model for assessing the effectiveness of forest management, whereby the Resolution of the Government of Russian Federation approved the 'Criteria for evaluating the effectiveness of the activities of state authorities of the constituent entities of the Russian Federation on the exercise of delegated powers of the Russian Federation in the field of forest relations' characterizing the organization of the use of forests located on land forest fund; organizing and ensuring the protection of forests from forest fires; organizing and ensuring the reproduction of forests located on the lands of the forest fund; organizing and ensuring the protection of forests located on forest land; implementation on the lands of the forest fund of the federal state forest supervision (forest protection); organization of activities for the implementation by state authorities of the constituent entities of the Russian Federation of the transferred powers in the field of forest relations; preservation of forests located on forest land.

The modern forest management sys-

tem is based on the organization of control over the observance of norms 'bottom-up' – from a separate section to the state level, and the main object of control is solely the process of compliance, not the final result. Therefore, the generalized data on the state of forestry on the territory of Ukraine does not include indicators of the effectiveness of forest management according to general indicative indicators, which does not allow the formation of reliable scientifically based forecasts of forest development. In addition, the forecast and resource models for the calculation of indicative indicators of forest management have not been implemented.

In our opinion, apart from economic factors, the system for evaluating the effectiveness of sustainable forest management, designed to establish sustainable development, should take into account environmental factors. This, in turn, makes it necessary to take into account in the system of forest management such elements of forest management as: guarantees the biological productivity of forest biodiversity, ensuring proper implementation of the protective functions of forests, increasing income levels of forest management entities and workers in the forest sector. In general, the criteria for evaluating the effectiveness of sustainable forest management should be characterized by: organization of the use of forests located on forest land; organizing and ensuring the protection of forests from forest fires and pests; organization and maintenance of forest reproduction; organization and protection of forests; implementation of state forest supervision (forest protection) on forest lands; financial and economic organization of activities in the field of forest relations.

At the first stage, it is necessary to select appropriate indicators that will reveal

the effectiveness of the forest management system on the basis of sufficiently developed information support for the implementation of appropriate calculations. The choice of these indicators should be based on the absolute identity of the elements of selected indicative parameters in the design of all forest management systems and include three key canons: existence and ability to access the source data on state reporting (State Statistics Service of Ukraine, Ministry of Ecology and Natural Resources of Ukraine, State Forest Agency) resources of Ukraine, etc.; the ability to use a certain indicator at least at one of the stages of forest management; the ability of the selected indicator to a certain distribution in the calculation of common criteria and analysis of the effectiveness of forest management at all stages of implementation of economic relations. The latter can include both the relations of transitional phase of economic development, and the relations of market economy, and those that are formed during the primary research, the implementation of planning and forecasting functions in the area under researching.

The next stage includes collecting the necessary information materials and, on their basis, analyzing the data obtained regarding the criteria and indicators, in terms of determining the effectiveness of forest management. Through the implementation of such an analysis, it is possible to detect dynamic transformations regarding criteria and indicators during certain periods, and to identify the most important factors influencing these transformations.

The final stage is a retrospective analysis and implementation of conformity assessment of actual data and targets in a given plane. The degree of their achieve-

ment allows us to identify the level of efficiency of the forest management system in general, and the level of efficiency of the executive in the industry in particular.

According to our estimates, the analysis of the effectiveness of forest management requires consideration of the direction, regularity of management influences on the dynamic process of increasing forest, quality, economic and social characteristics of forests (forest cover, marketability, safety, etc.) when performing forest and logging functions by economic entities. Ensuring effective sustainable forest management should include the use of a set of criteria and indicators characterizing the assessment of the effectiveness of forest, forest exploitation, forest protection, forest protection and reforestation processes in forest management. Therefore, the choice of the system of indicators for sustainable forest management (Table 1) was carried out in the light of national experience, and the Pan-European criteria for sustainable forest management indicators.

Priority in the selection of criteria or efficiency indicators depends on the conditions of forest management, including from the spatial distribution of the productive forces. Also, the values of target indicators allow to evaluate the effectiveness of management activities in the field of organization of the use of forest resources, their protection and reproduction. In addition, the proposed system of criteria and indicators takes into account both current problems of forest management, related to supporting the value of wood and non-timber forest resources and services, and the direction of forestry development, environmental-economic and social features.

**Table 1. Criteria and indicators for sustainable forest management.**

Criteria and indicators	Unit
Criterion 1. Conservation and increase of forest resources (C1)	
1.1. Forest cover dynamics	%
1.2. Dynamics of wood stock in forests	%
1.3. Reforestation index (area of forest reproduction relative to the total area of forest land)	%
1.4. The share of sowing and planting forests in the total area of reforestation	%
Criterion 2. Preservation and maintenance of productive functions of forest ecosystems (C2)	
2.1. Using average wood increment	%
2.2. The share of the area of operational forests in relation to the total area of forest land	%
2.3. Dynamics of stock of mature and overmature stands (per 1 ha of forest land)	%
2.4. Volume of harvested wood (per 1 ha of forest land)	m <sup>3</sup>
2.5. Volume of harvested secondary forest products (per 1 ha of forest land)	t
Criterion 3. Maintaining viability and supporting ecosystem functions of forests (C3)	
3.1. Index of logging for the formation and improvement of forests (to the total area of forest land)	%
3.2. Share of the area of forests for conservation and recreational purposes in relation to the total area of forest land	%
3.3. Dynamics of the share of forest conservation area and recreational purposes in relation to the total area of forest land	%
3.4. The share of the area of natural reserve fund in relation to the total area of forest land	%
3.5. Dynamics of the share of the natural reserve fund in relation to the total forest area	%
3.6. The area of dead forest plantations per 1000 ha of forest land	ha
3.7. Dynamics of the area of forest plantations destroyed under the influence of adverse factors (fires, pests, diseases, etc.)	%
3.8. Indicator of the phytosanitary condition of forests (the ratio of the area of damaged forest stands (diseases, pests, fires, etc.) to forest covered lands)	%
Criterion 4. Support and enhance the protective functions of forests (C4)	
4.1. The share of the area of protective forests relative to the total area of forest land	%
4.2. Dynamics of the share of protective forests in relation to the total forest area	%
Criterion 5. Support for the socio-economic functions of forestry (C5)	
5.1. Amount of products, works and services of forestry (per 1 ha of forest land)	eur
5.2. Price of impersonal cubic meters of sold wood	eur
5.3. Profitability of forestry activities	%
5.4. Average monthly wage of full-time employees	eur
5.5. Amount of payments to the consolidated budget of Ukraine (per 1 ha of forest land)	eur

For the formation of the main indicators necessary for the implementation of

our proposed methodological approach, information is used over a five-year period

in order to minimize the influence of natural factors and market conditions.

Proposed methodological approaches to evaluating management efficiency include eliminating differences of dimensions given by normalizing parameters, i.e. transform them into dimensionless form at intervals from 0 to 1 (where 1 corresponds to the best (optimum) values of this index and the 0 – to its worst (unacceptable) values) (Shkuratov 2017). For this, the absolute values of the indicators are compared with the best (in terms of optimization conditions, the maximum or minimum) value of the corresponding indicator among the estimated objects:

$$I_i = X_i/Y_0, \text{ if } I_i \rightarrow \max, \quad (1)$$

$$I_i = Y_0/X_i, \text{ if } I_i \rightarrow \min, \quad (2),$$

where:  $I_i$  – normalized value of the  $i$ -th indicator;  $X_i$ ,  $Y_0$  – accordingly, the current value of this indicator and the target value for this type.

Normalized indicator shows the extent to which the development of forestry, which comprehensively reflects the current level of reserves and possible extensions. To calculate the value of a criterion, it is necessary to determine the arithmetic average of all indicators within the framework of this criterion. The aggregate indicator of the level of efficiency of sustainable forest management, in turn, is defined as the arithmetic average of the five criteria.

The application of the proposed methodological approach allows to determine the level of use of the productive, ecosystem, protective and socio-economic functions of forest ecosystems and to identify problematic aspects of management depending on elements of forest management activities.

## Results

For the purpose of testing the proposed approach, we calculated the integral indicator of the effectiveness of sustainable forest management in the regional dimension of the forestry sector in Ukraine. Table 2 shows the results of evaluating the effectiveness of sustainable forest management in the regions of the country by criteria and aggregate indicators ( $E_{fm}$ ).

For example, if we take the best cumulative indicator of the effectiveness of sustainable forest management in the context of the regions of Ukraine, it is equal to 0.71 (Rivne region). This indicates that some indicators are lower compared with the best in Ukraine, in particular, as can be seen from Table 2 are indicators illustrating Criterion 4. Support and enhancement of the protective functions of forests (0.58) and Criterion 5. Support for the socio-economic functions of forestry (0.61). At the same time, according to Criterion 1. Conservation and increase in the volume of forest resources, the Rivne region is at the highest level in Ukraine, and according to Criterion 2. Preservation and support of the productive functions of forest ecosystems has one of the highest values.

This method involves relative comparability of calculated indicators, because the benchmark is an indicator illustrating not the best indicator for Ukraine among forest enterprises, but the average value of the indicator for the region. However, the advantage of the proposed approach is that it allows you to determine how effectively or ineffectively forest management is conducted at the regional level in relation to the best indicators for the country.

**Table 2. The results of the effectiveness evaluation of sustainable forest management (2012–2017).**

Region	Criteria					
	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$E_{fm}$
Cherkasy	0.42	0.72	0.76	0.78	0.67	0.67
Chernihiv	0.67	0.64	0.74	0.52	0.63	0.64
Chernivtsi	0.58	0.81	0.62	0.71	0.69	0.68
Dnipropetrovsk	0.28	0.22	0.36	0.52	0.26	0.33
Donetsk	0.16	0.18	0.33	0.61	0.24	0.30
Ivano-Frankivsk	0.75	0.67	0.66	0.65	0.52	0.65
Kharkiv	0.34	0.46	0.71	0.61	0.28	0.48
Kherson	0.12	0.28	0.44	0.72	0.17	0.35
Khmelnysky	0.41	0.67	0.72	0.61	0.56	0.59
Kirovograd	0.16	0.52	0.43	0.61	0.50	0.44
Kyiv	0.46	0.78	0.59	0.56	0.60	0.60
Luhansk	0.51	0.21	0.67	0.52	0.31	0.44
Lviv	0.68	0.65	0.66	0.72	0.51	0.64
Mikolaiv	0.18	0.14	0.63	0.48	0.24	0.33
Odesa	0.47	0.19	0.54	0.67	0.22	0.42
Poltava	0.26	0.55	0.64	0.66	0.35	0.49
Rivne	0.87	0.83	0.68	0.58	0.61	0.71
Sumy	0.47	0.72	0.72	0.52	0.69	0.62
Ternopil	0.45	0.57	0.75	0.71	0.42	0.58
Vinnitsa	0.38	0.61	0.73	0.68	0.55	0.59
Volyn	0.47	0.72	0.77	0.59	0.60	0.63
Zakarpattia	0.88	0.43	0.65	0.63	0.46	0.61
Zaporizhia	0.11	0.12	0.62	0.59	0.26	0.34
Zhytomyr	0.65	0.87	0.78	0.46	0.67	0.69

Conventionally, all the regions can be divided into 3 groups (or clusters). For clustering, a cumulative indicator of the effectiveness of sustainable forest management is used (Table 3). This grouping

of regions can be carried out separately for each criterion in order to understand exactly which area in particular region needs to be improved in forest management.

**Table 3. Grouping of Regions on the level of effectiveness of sustainable forest management.**

The value of the total efficiency index	Level of efficiency	Region
0.67–1.00	High (A)	Cherkasy, Chernivtsi, Rivne, Zhytomyr
0.34–0.66	Medium (B)	Chernihiv, Ivano-Frankivsk, Kharkiv, Kherson, Khmelnytsky, Kirovograd, Kyiv, Luhansk, Lviv, Odesa, Poltava, Sumy, Ternopil, Vinnitsa, Volyn, Zakarpattia, Zaporizhia
0.01–0.33	Low (C)	Dnipropetrovsk, Donetsk, Mikolaiv

## Conclusions

Analyzing the changes over time of forest management indicators, it is possible to determine the conditions of any type of reproduction performed within a given territory, and as a result, to grasp the intensity and significance of the impact of sustainable forest management mechanism on forest management in the region. The results of such an assessment will make it possible to evaluate the effectiveness of the entire forest management system in a particular region, determining the degree of compliance with the real goals of activities in the field of increasing forest productivity and improving their quality. And also to identify promising approaches to the management of economic entities of forestry, to create proposals for improving forest legislation in the field of regulatory legal acts regulating forestry management. The practical significance of the results obtained on a comparative assessment of the management system is the ability to determine the direction of activating the administrative influence of forest management authorities and improving the organizational structure of forestry.

Tested our proposed methodical approach to assessing sustainable forest management, it is possible to speak about the relevance of its use in practice, since it enables the public authorities, and business entities and investors to make appropriate management decisions and improve the efficiency of use and reproduction of forest resources.

## References

BAYCHEVA T., INHAIZER H., LIER M., PRINS K., WOLFSLEHNER B. 2013. Implementing Criteria and Indicators for Sustainable Forest

- Management in Europe. Joensuu, European Forest Institute. 132 p.
- DREBOT O.I., SHERSHUN M.KH., SHKURATOV O.I. 2014. Zbalansovanyj rozvytok lisovoho sektoru ekonomiky v konteksti ievropejs'koi intehratsii Ukrainy [Balanced development of the forest sector of the economy in the context of European integration of Ukraine]. Kyiv, Agrarian science. 317 p. (in Ukrainian).
- DUBAS R. 2011. Kryterii ta indykatory formuvannia lisoresurnoi sfery na zasadakh staloho rozvytku [Criteria and indicators of the formation of a resource-based sphere on the principles of sustainable development]. Sustainable Economic Development 6: 153–157 (in Ukrainian).
- FAO 2014. The State of the World's Forest Genetic Resources. Commission on genetic resources for food and agriculture. FAO, Rome. 304 p. Available at: [www.fao.org/3/a-i3825e.pdf](http://www.fao.org/3/a-i3825e.pdf) (accessed 11 May 2018).
- FURDYCHKO O.I. 2014. Formuvannia suchasnykh ekoloho-ekonomichnykh vidnosyn u haluzi ukrainskoho lisivnytstva [Formation of modern ecological-economic relations in the field of Ukrainian forestry]. Ukraine's economy 10: 67–78 (in Ukrainian).
- FURDYCHKO O.I., SHERSHUN M.KH., NEJKO I.S. 2012. Osnovni zasady systematyzatsii i optymizatsii kryteriiv ta indykatoriv pan-ievropejs'koi stratehii zbalansovanoho upravlinnia lisamy [Basic principles of systematization and optimization of criteria and indicators of pan-European strategy of balanced forest management]. Taurian Scientific Bulletin 81: 362–370 (in Ukrainian).
- GOUGH A.D., INNES J.L., ALLEN S.D. 2008. Development of common indicators of sustainable forest management. Ecological Indicators 8(5): 425–430.
- KIMMINS J.P. 2004. Forest ecology. A Foundation for Sustainable Forest Management and Environmental Ethics in Forestry. N.J.: Prentice Hall. 611 p.
- KOLESNIK V.G., SINYATULLINA L.KH. 2017. Sistema gosudarstvennogo upravleniya lesnym kompleksom: Tekushchaya situatsiya i osnovnye problemy [State Management of the Forestry Complex: Current Situation

- and Main Challenges]. *Public Administration Issues* 1: 129–148 (in Russian).
- LIM S.S., INNES J.L. 2017. Forest aesthetic indicators in sustainable forest management standards. *Canadian Journal of Forest Research* 47(4): 536–544.
- LYTSUR I.M., HOLOVKO A.A. 2011. Rol pryntsytyv, kryteriiv ta indyktoriv staloho rozvytku u formuvanni systemy upravlinnia lisamy ta lisovym hospodarstvom Ukrainy [The Role of Principles, Criteria and Indicators of Sustainable Development in the Formation of a Forest Management and Forest Management System in Ukraine]. *Scientific Bulletin of the National Forestry University of Ukraine* 21(17): 91–97 (in Ukrainian).
- MACDICKEN K.G., SOLA PH., HALL J.E., SABOGAL C., TADOUM M., WASSEIGE C. 2015. Global progress toward sustainable forest management. *Forest Ecology and Management* 352: 47–56.
- MCDONALDA G., LANE M. 2004. Converging global indicators for sustainable forest management. *Forest Policy and Economics* 6: 63–70.
- MCPFE 1998. Conference Proceedings: 3th Ministerial Conference on the Protection of Forests in Europe (MCPFE). Lisbon, Portugal, 2–4 June 1998. Lisbon: Liaison Unit. 10 p.
- MCPFE 2015. Conference Proceedings 7th Ministerial Conference on the Protection of Forests in Europe. Madrid, Spain, 20–21 October 2015. Madrid: Liaison Unit. 10 p.
- MIRONOV A.V. 2013. Rejtingovaja ocenka jeffektivnosti upravlenija lesohozjajstvennoj dejatel'nost'ju regionov [Rating assessment of the efficiency of forest management in the regions]. *Economics and entrepreneurship* 12: 375–380 (in Russian).
- RAMETSTEINER E., MAYER P. 2004. Sustainable forest management and Pan-European forest policy. *Ecological Bulletin* 51: 51–57.
- SHKURATOV A.I. 2017. Strategicheskie imperativy upravleniya ekologicheskoy bezopasnost'yu v agrarnom sektore ekonomiki [Strategic Imperatives of Environmental Safety Management in the Agrarian Sector of Economy]. *Public Administration Issues* 4: 207–225 (in Russian).
- SHMATKOV N., GRIGORIEV A. 2011. Reyting kachestva gosudarstvennogo upravleniya lesami v sub'ektah Rossiyskoy Federatsii: sovershenstvovanie metodiki dlya perevoda [The rating of quality of state forest management in the subjects of the Russian Federation: improvement of the methodology]. *Sustainable forest management* 1(26): 15–20 (in Russian).
- SPILSBURY M.J. 2005. The sustainability of forest management: assessing the impact of CIFOR's Criteria and Indicators research. Bogor, Indonesia: CIFOR. 126 p.
- STOROZHUK V.F. 2016. Zahal'na otsinka stanu upravlinnia lisamy v Ukraini [Estimation of the state of forest management in Ukraine]. Kyiv, Ukrderzhlisproekt. 78 p. (in Ukrainian).
- TRISHKIN M., LOPATIN E., SHMATKOV N., KARJALAINEN T. 2017. Assessment of sustainability of forest management practices on the operational level in northwestern Russia – a case study from the Republic of Karelia. *Scandinavian Journal of Forest Research* 32(7): 620–632.
- WIJEWARDANA D. 2008. Criteria and indicators for sustainable forest management: The road travelled and the way ahead. *Ecological Indicators*: 115–122.
- YAROVA I.YE. 2010. Orhanizatsijno-ekonomichni zasady ekolohizatsii upravlinnia lisovym hospodarstvom [Organizational and economic foundations of the ecologization of forest management]. *Mechanism of economic regulation* 3: 227–238 (in Ukrainian).
- ZHELDAK V.Y. 2010. Jekologo-lesovodstvennye osnovy celevogo ustojchivogo upravlenija [Ecological and silvicultural foundations of targeted sustainable forest management]. Moscow, VNYILM. 377 p. (in Russian).