SFI Sustainable Forestry Implementation

With support from Federal Ministry of Food and Agriculture by decision of the German Bundestag

Forest Policy Report **SFI/2025**

Multifunctional forestry (MF)

Close to nature forestry (CNF)

Andriy Bilous

Kyiv, September 2025

About the Project "Sustainable Forestry Implementation" (SFI)

The project "Technical Support to Forest Policy Development and National Forest Inventory Implementation" (SFI) is a project established within the framework of the Bilateral Cooperation Programme (BCP) of the Federal Ministry of Food and Agriculture of Germany (BMEL) with the Ministry of Environment and Natural Resources of Ukraine (MENR). It is a continuation of activities started in the forest sector within the German-Ukrainian Agriculture Policy Dialogue (APD) forestry component.

The Project is implemented based on an agreement between GFA Group, the general authorised executor of BMEL, and the State Forest Resources Agency of Ukraine (SFRA) since October 2021. On behalf of the GFA Group, the executing agencies - Unique land use GmbH and IAK Agrar Consulting GmbH - are in charge of the implementation jointly with the SFRA.

The project aims to support sustainable forest management planning in Ukraine and has a working focus on the results in the Forest Policy and National Forest Inventory.

Author

A. Bilous

Contacts.

Troitska Str. 22-24,
Irpin, Kyiv region
+38 (067) 964-77-02

Table of contents

A. Multifunctional forestry (MF)

1.Scientific Definition and Analysis of MF Implementation in Forest Management and Higher Forestry Education in Ukraine

Globally, forestry development is driven by scientific and technological progress, the formation of new knowledge in the field of natural sciences, and the identification and implementation of priorities in developed countries that disseminate knowledge, experience, and initiate the implementation of new approaches at the international level.

Clarification of MF concepts and terminology

In the world science, the terminology "multifunctional forestry" was systematically used in the second half of the twentieth century under the conceptualisation of "forest functions" [1, 2], in particular, in the 1990s, a trend of use in forest policy was formed [3, 4]. In the legislation of the European Union, direct references to "multifunctional forestry" have been made since the mid-2000s, and in Ukraine, the terms "multifunctional forestry" and "multifunctional forestry" have been in scientific circulation since that time [5]. Since 2004, the terms "multifunctional forest management" and "multifunctional forests" have been used in official documents in Ukraine [6, 7]. For example, in the manual "Close to Nature and Multifunctional Forestry in the Carpathian Region of Ukraine and Slovakia" [8] prepared by G.T. Krynytskyi et al:

- Multifunctional forestry is a type of forestry in which, under certain natural and economic conditions, a complex of forest resources and functions - wood, hunting, protective, recreational, etc. - are simultaneously used and reproduced on the same territory.
- Multifunctional forestry is one of the most advanced approaches to forest management, which perpetuates natural ecological processes by providing goods and services necessary for people, both now and in the future.

According to the Forestry Code of Ukraine [9], the functionality of forests is the basis for the organisation of forestry in Ukraine. Ukrainian forestry legislation does not directly define the term "multifunctional forestry", but the Forest Code of Ukraine has a separate chapter on the functional division of forests and defines the concept of Ukrainian forests with a focus on multifunctionality: "The forests of Ukraine are its national wealth and, by their purpose and location, perform mainly water protection, protective, sanitary and hygienic, health, recreational, aesthetic, educational, and other functions and are a source for meeting the needs of society in forest resources" [9]. The division of forests into categories according to their importance and functions is carried out in accordance with the procedure [10] established by the Cabinet of Ministers of Ukraine [9, 10]. The forests of Ukraine are divided into the following categories according to their ecological and socio-economic importance and depending on the main functions they perform [9]:

1) protective forests (mainly perform water protection, soil protection and other protective functions);
2) recreational and health-improving forests (perform mainly recreational, sanitary, hygienic and health-improving functions);
3) forests of nature conservation, scientific, historical and cultural purposes (perform special environmental, aesthetic, scientific functions, etc;)
4) exploitation forests.

It is important to note that the division into categories according to the significance of forests is carried out precisely according to their **main** functions, which indirectly, by using the word "main", indicates the multifunctionality of forests and, accordingly, forestry. At the same time, according to the Procedure for the division of forests into categories and allocation of specially protected forest areas [10], forests growing on the same territory and meeting the conditions and signs of belonging to different categories belong to the category for which a more restricted forest use regime is established. Thus, the forestry legislation of Ukraine does not directly define and interpret the multifunctionality of forestry, but focuses only on regulating the main functions of forests, the management of which requires improvement of regulatory support, management regime the management of which requires improvement of regulatory support, management regime and creation of monetisation mechanisms. It should be noted that the establishment of a more restricted forest use regime in forests growing on the same territory may actually limit the possibilities of multifunctional forestry.

Overview of their integration into Ukrainian forestry research and education

Multifunctional forestry in Ukraine is entering a stage of active development in both scientific and practical aspects. The scientific definition of the concept has a solid theoretical basis based on the principles of close-to-nature silviculture and ecologically oriented forest management.

Multifunctional forestry is integrated into science and education in Ukraine through the implementation of fundamental and applied research and training programmes in higher education and research institutions, including the National University of Life and Environmental Sciences of Ukraine (NUBiPU), the National Forestry University of Ukraine, and the Ukrainian Research Institute of Forestry and Agroforestry named after H. M. Vysotsky (URIFFM).

The study of multifunctional forestry requires a comprehensive approach, a large sample of empirical data on the various functions of different forest stands to model biological and economic processes, and the use of systems analysis to justify applied solutions for implementation.

At the present stage, references to multifunctional forestry and forestry in Ukraine are found in some publications on close-to-nature forestry [8, 14, 15], where the multifunctional role of forests is considered as a result (derivative)

component of the implementation of close-to-nature forestry. At the same time, the scientific basis for multifunctional forestry is insufficient and requires deeper applied research.

Another important area of research in the context of multifunctional forestry is the assessment of forest ecosystem services. The conceptualisation and implementation of a system of environmental and economic valuation of forest ecosystem services can act as a driving force for the development of multifunctional forestry. In Ukraine, a conceptualisation of the use of forest ecosystem services has been made [16], an example of assessing biophysical indicators of ecosystem services [17], and an attempt has been made to generalise the economic valuation of forest ecosystem services [18]. At the same time, research on the production of forest ecosystem services in Ukraine is rather fragmented and does not allow for practical conclusions on the economic efficiency of multifunctional forestry.

Education is the main sector that ensures the transfer of new knowledge from forest science to practical application in forestry through the learning process. Over the past decade, about 50 educational institutions in Ukraine have been training specialists and workers for the forestry sector, including 23 universities, 22 colleges and five vocational schools. The network of educational institutions that provide training for forestry is constantly changing due to low enrolment in regional institutions and optimisation of the number of educational institutions in Ukraine. At the same time, none of the educational institutions offers courses on multifunctional forestry (silviculture), as well as separate thematic training blocks (lectures, practical work). In general, it can be noted that the implementation of multifunctional forestry in higher education is indirectly implemented through the teaching of such disciplines as silviculture, forest crops, basics of forest exploitation, hunting, as well as a course on forest management, which integrally reveals the principles of organisation and design of management in forests of various functional purposes. The National University of Life and Environmental Sciences of Ukraine is implementing an English-language master's programme "Forest Management in Eastern Europe", which includes a course on "Forest ecosystem services" to study the main ecosystem services, methods of their assessment and management features.

Empirical data to support policy recommendations

Empirical data on research on multifunctional forestry is rather limited. The data from the State Statistics Service of Ukraine is also quite limited, as it only provides data on timber harvesting in Ukrainian forests.

A research group (Bilous et al. (in press)) has conducted a study of multifunctional use of forests and estimated the cash flows of ecosystem services provided by forest plantations. The researchers generated empirical data on biophysical and economic indicators for the forests of the research site, including: wood growth; harvesting of mushrooms and berries; hunting;

and carbon sequestration in plantation biomass. The empirical data on multifunctional use of forests are presented in summary economic indicators per 1 ha of forest plantation.

2.Status of MF Implementation in the Forest Policy of Ukraine

At the present stage, there is a general understanding of the need to develop multifunctional forestry, which is reflected in scientific discussions and key documents of the legal and strategic framework. At the same time, multifunctional forestry is considered only in general terms as an expected future result.

Legal and strategic framework supporting forest functions

The Forest Code of Ukraine defines the key requirement for forest management as ensuring the enhancement of water conservation, protective, climate regulation, sanitary, health and other beneficial properties of forests in order to improve the environment and protect human health. In addition, the main legislative document in the field of forestry stipulates that the organisation of forestry involves the division of forests into categories depending on the main functions they perform. However, the Forest Code of Ukraine does not directly mention multifunctional forestry.

The State Forest Management Strategy of Ukraine until 2035 [19] primarily identifies the need to ensure a balance between the environmental, economic and social functions of forestry as a key issue. This strategic document highlights the assertion that communal forests, which primarily perform ecological and recreational functions, should be financed by local environmental protection funds.

It is worth noting that the legal and strategic framework of Ukraine's forest policy gives priority and support to forest functions, but does not directly refer to multifunctional forestry.

Compatibility with the EU Forest Strategy 2030 and the Green Deal

The implementation of policy initiatives under the European Green Deal [20] has a cascading effect at the international level and systematically affects the implementation of the strategic intentions of European countries in the field of forestry.

It is already evident that the legal framework of Ukraine's forest policy needs to be reviewed and improved in the context of global and regional policy initiatives, in particular, taking into account the New EU Forest Strategy 2030 [21], which emphasises the importance of the multifunctional role of forest ecosystems.

Undoubtedly, the New EU Forest Strategy 2030 is the latest legal document in the field of forestry relations, which will significantly influence the improvement of national legal documents in Europe, in particular, regarding the priority of achieving multifunctional forestry. At the same time, the New EU Forest

Strategy 2030 also only describes the implementation of multifunctional forestry in general terms and declaratively points to the key role of forest multifunctionality in achieving a sustainable and climate-neutral economy and resilient ecosystems. The new strategy focuses on the development of functions for the supply of timber, non-timber products, ecotourism, and physical and mental health of the population [21].

It is important that the new forest strategy focuses on the need to train specialists and experts in enhanced sustainable forest management practices, including adaptive reforestation and afforestation, architects, engineers and designers, food experts, data specialists, chemists, ecotourism facilitators [21].

It is expected that FAO will support the preparation of proposals for a new version of the Forest Code of Ukraine, in particular, the implementation of multifunctional forestry. In general, the Green Deal and the New EU Forest Strategy 2030 create political prerequisites for improving forestry, including in Ukraine in the face of global challenges.

The role of key institutions (e.g. Ministry of Environmental Protection and Natural Resources, State Forest Resources Agency)

The implementation of multifunctional forestry in the forest policy in Ukraine should be ensured by the Verkhovna Rada of Ukraine, the Cabinet of Ministers of Ukraine and the central executive body - the State Forest Resources Agency of Ukraine. The Verkhovna Rada of Ukraine should establish the principles of state policy, adopt laws and approve national programmes, while the State Agency of Forest Resources of Ukraine should implement this policy in the field of multifunctional forestry, subordinated through the Minister of Economy, Environment and Agriculture of Ukraine.

The implementation of multifunctional forestry in the forest policy of Ukraine depends on the prioritisation and activities of key executive authorities, in particular the Ministry of Economy, Environment and Agriculture of Ukraine and the State Agency of Forest Resources of Ukraine. At the same time, insufficient interaction with the scientific and expert community, a significant influence of the political situation on popular decision-making, and limited human and professional potential prevent the Ministry of Economy, Environment and Agriculture of Ukraine (MEEA) and the State Forest Resources Agency of Ukraine (SFRA) from effectively improving forestry legislation, in particular, to introduce new approaches, methods and technologies in the field of forestry.

The Ministry of Economy, Environment and Agriculture of Ukraine is the main body in the formation of the state environmental policy, which coordinates activities to ensure the formation of the state policy in the field of forestry. It is the Ministry that can ensure coordination of multifunctional forestry and develop national programmes for this purpose, and the State Forest Resources Agency of Ukraine should ensure their implementation through the implementation of state administration in the field of forestry and hunting.

The implementation of multifunctional forestry in the forest policy of Ukraine is at the initial stage of development with certain positive developments and significant challenges in terms of a comprehensive vision and organisation of meaningful communication between forestry actors, including forestry enterprises and environmental NGOs.

3.Status of MF Implementation in Ukrainian Forest Administration (incl. FMP)

Multifunctional forestry is declaratively laid down in the basis of forestry organisation in Ukraine, but in economic terms, attention is focused mainly on the main function performed by a particular forest stand. The economic mechanisms of management and the key role of timber in generating income for enterprises determine the focused and targeted actions of the forest administration to use any opportunity to harvest commercial timber in accordance with existing forest use restrictions.

Use of MF principles in planning, monitoring, and reporting

In the process of forest management, the decision to divide forests by ecological and socio-economic significance is agreed and formalised according to a special procedure [10]. According to the Forest Code of Ukraine, the forests of Ukraine are divided into the following categories according to their ecological and socio-economic significance and depending on the main functions they perform

1) protective forests (mainly perform water protection, soil protection and other protective functions);
2) recreational and health-improving forests (perform mainly recreational, sanitary, hygienic and health-improving functions);
3) forests of nature conservation, scientific, historical and cultural purposes (perform special environmental, aesthetic, scientific functions, etc;)
4) exploitation forests.

At the same time, the division of forests by ecological and socio-economic significance is based on their main functions. Thus, the legislation prioritises the main functions for forest management and planning of economic activities, but does not specify the importance of secondary functions.

During forest management, the age of maturity of stands is determined based on the functions they perform and indicates that these are the main ones.

If the division of forests is changed depending on the main functions they perform, forest management makes changes to the estimated cutting area. Belonging of a forest plot to a functional category of forests affects the rate of timber harvesting from the main use felling

The State Forest Cadastre is maintained on the territory of Ukraine with the aim of efficient organisation of forest protection and conservation, rational use of

the forest fund of Ukraine, forest reproduction, and systematic control over qualitative and quantitative changes in forests. The state forest cadastre includes division of forests into categories depending on their main functions. The decision to change the division of forests into categories depending on the main functions they perform is the basis for maintaining and reflecting in the reporting documentation of the state forest cadastre.

The legal act "Procedure for forest management planning" contains a section on the basic principles of designing multi-purpose forest management [22], which describes the key principles of forest management planning without specifying the specifics of designing multi-functional forestry.

Official reporting on the division of forests into categories depending on their main functions in Ukraine should be made once every five years as part of the state forest cadastre and forest accounting, but is not systematically done. Such data should serve as the basis for international reporting on the distribution of forests by functional purpose as part of the Global Forest Resources Assessment. In the 2020 report, Ukraine reported on the area of forests that performed the functions of timber supply, soil and water protection, biodiversity protection, social purposes, and others, as well as the absence of forests with multiple uses.

Degree of modernisation (GIS, remote sensing, forest inventory)

- In the current status, the functionality of Ukraine's forests is reflected at the local level in the forest management materials of forestry enterprises, as well as at the national level in the materials of forest accounting and forest cadastre.
- The Ukrainian State Forest Management Planning Association "Ukrderzhlisproekt" is developing the portal "Geoinformation system of forest resources management of Ukraine" [23], which is gradually being filled with comprehensive information on the forest fund of Ukraine. This database has a prototype forest cadastre, which reflects the distribution of the forest fund by protection categories, containing data on exploitation, protective, recreational and nature protection forests.
- The National Forest Inventory of Ukraine does not directly define the distribution of forest plots and the forest fund by functional purpose. At the same time, a comprehensive combination of forest inventory results with data from forest management and the state forest cadastre can increase the level of reliability of analytical data in reporting and mapping.
- Remote sensing data do not directly provide data on the functional use of forests. For some specific categories of forests, remote sensing data can serve as an information base for scientific research. For example, shelterbelts or protective plantations along roads, which can be identified by remote sensing tools due to their shape.

Institutional constraints and capacity-building needs

The legal framework and practical mechanisms of forestry are based on the division of forests by main functions, but do not specifically mention the multifunctional value of forests and in fact focuses on the main functions of forestry, and planning of forestry activities is based on the principle of the most stringent restriction for a particular forest area. Strategic documents indicate the desired goal of multifunctional forestry, but do not specify detailed aspects, characteristics and ways to achieve multifunctional forest use.

There are no direct institutional restrictions on the development of multifunctional forestry, but at present, Ukraine lacks clear strategic objectives, regulations, governance mechanisms, and guidelines for the implementation and development of multifunctional forestry. This allows for the formation of multifunctional forestry in individual enterprises on the initiative of staff at workplaces, but the systemic development of multifunctional forestry does not occur in the absence of clear programmes for capacity development and diversification of economic activities of forestry enterprises. There are negative trends in the development of multifunctional forestry potential in enterprises with less diversity of forest categories and with a key focus on timber harvesting and sales and a lack of economic motivation to develop other forestry functions.

4.Development and Current Status of MF Implementation in State Forest Management

Although at the present stage multifunctional forestry is not specifically defined in the forestry regulations, in fact, forestry designs, plans and implements management activities according to the functional distribution of forests, taking into account the main function performed by a particular forest area. In cases where it is necessary to strengthen (allocate) another function within such a plot, forestry practice applies the approach of dividing the plot and allocating a new plot to perform another function, which generally leads to the division of the forest fund into small plots, where it is much more difficult and expensive to carry out management activities.

The functional purpose of a forest plot determines the regime of restrictions and intensity of economic activities, which are implemented through the practice of combining a set of plots with the same main function into economic units with appropriate management and age of the main forest use. Thus, the practice of forestry is focused on the main function of the forest plot, however, given the silvicultural need and economic interest of forestry enterprises, in most cases, each forest plot is characterised by the performance of the function of timber supply in addition to the main function, according to the limited economic activity. To summarise, the aggregate of all forest plots of a forestry enterprise with different functions makes forestry multifunctional at the level of the enterprise, although the management of each plot does not provide for its clear multifunctional role. In Ukraine, there is

a long-term trend of reducing the average area of a forest plot by artificially splitting plots to enhance certain forest functions due to the impossibility of formalising and designing the second or third important function of such a plot.

Practical examples and pilot projects

In practical terms, there are two types of actual multifunctionality of forestry. The first example is related to the actual multifunctionality of specific forest plots.

The first example is the forest plot of the Boyarska Forest Research Station, which is located near a large city and is classified as recreational forests according to the main function of the forest. This function is documented and clearly reflected in the forest management planning materials of the Boyarka Forest Research Station. However, in fact, this forest area, in addition to the recreational and health function, also performs the function of supplying timber from planned thinning, sanitary felling and main use, and this area also serves as hunting grounds and as a research and educational forest site. This area is de facto multifunctional, but this status is not formally confirmed in the consolidated forestry documents. The recreational and health-improving function is described in the forest management materials, the timber supply function is tangentially reflected in the felling plans, and the hunting function is described in the hunting grounds management materials.

This example corresponds to "multifunctional forestry" according to the scientific definition of the term [8].

The second example: a state forestry enterprise may have a forest fund divided into four categories (subcategories):

forests of nature conservation, scientific, historical and cultural purposes (nature reserves; biosphere reserves (protected area); biosphere reserves (buffer zone); biosphere reserves (zone of anthropogenic landscapes); biosphere reserves (zone of regulated conservation regime); national nature parks (conservation zone); national nature parks (zone of regulated recreation); national nature parks (zone of stationary recreation); national nature parks (economic zone); regional landscape parks (protected zone); regional landscape parks (regulated recreation zone); regional landscape parks (stationary recreation zone); regional landscape parks (economic zone); protected forest tracts; natural monuments; nature reserves; forests of historical and cultural purpose; forests of scientific purpose, including genetic reserves);

recreational and health-improving forests (forests within settlements; forests of zones 1 and 2 of the zones of sanitary protection zones of water supply sources; forests of zones 1 and 2 of the districts of sanitary protection zones of health-improving territories; forests of zone 3 of the districts of sanitary protection zones of health-improving territories ; forest park part of the forests

of green zones; forestry part of the forests of green zones; recreational and health-improving forests outside the green zones);

protective forests (state protective forest belts; field protective forest belts; erosion control forests; forests along railway rights-of-way; forests along motorway rights-of-way; gully forests; forests along river banks, around lakes, reservoirs, etc.; other protective forests);

exploitation forests.

As we can see, a forestry enterprise can have a set of forest areas, each of which performs different main functions according to the categories and subcategories. This can be seen as a sign of multifunctionality of forestry at the enterprise level, but not at the level of a single plot or territory.

The second example does not correspond to the scientific definition of the term "multifunctional forestry" [8], since it is not about the same territory, where forests perform many functions, but about forestry at the enterprise level, where forest areas perform different individual functions, but in the aggregate - in the structure of the forest fund - play a multifunctional role.

It is important to summarise and note that regulations and documents in the field of forestry and forest management

Training efforts for forest personnel

Opportunities for the development of professional skills of forestry workers in Ukraine are associated with the network of state educational institutions, including universities, institutes, colleges and schools. At the same time, international cooperation with the European Union, the United States and other countries has opened up opportunities for trainings, workshops and seminars with the participation of leading scientists and experts in the field of forestry from Europe and the world.

The main training opportunities for forestry personnel are associated with the Ukrainian Centre for Training, Retraining and Advanced Training of Forestry Personnel [24].

It is worth noting that over the past 20 years, there have been no well-known public targeted specialised trainings on multifunctional forestry in Ukraine.

Needs for structural reform, financing, and regulatory support

Forestry in Ukraine needs to update the forestry development strategy and improve the regulatory framework to implement strategic goals, in particular, to prepare a new version of the Forest Code of Ukraine, which will reflect the legislative framework for the development of multifunctional forestry as a result of the introduction of close-to-nature forestry .

The financial basis for the development of multifunctional forestry should be the development of the ecosystem services market, which should provide cash flows for forestry enterprises for the provision of specific forest ecosystem

services. The development of payment mechanisms for forest ecosystem services will ensure the development of multifunctional forestry, as economic benefits will drive systemic management attention to different forest functions.

Currently, most forestry enterprises in Ukraine can derive their main income from timber harvesting, while other sources of income are insignificant in the current market environment, uncompetitive due to imperfect logistics, or undervalued by forestry decision makers due to an over-emphasis on the economic benefits of timber.

Provided that effective economic mechanisms are developed and implemented in Ukraine to pay for protective, recreational, environmental and other forestry functions, the multifunctionality of forests will play a key role in the sustainable development of forestry enterprises and ensure economic diversification.

The development of multifunctional forestry requires the initiative of stakeholders (NGOs, educational and scientific institutions, forestry enterprises, MPs of various levels, legislative and executive authorities) to improve the Forest Code of Ukraine, followed by a cascade of improvements to existing legislation and the creation of new legal documents for the development of multifunctional forestry. The biggest challenge for the development of multifunctional forestry is the creation of a market for ecosystem services and mechanisms for payments or compensation for the use of the forestry function.

Summary of recommendations on multifunctional forestry

To summarise, we can formulate the main directions of structural changes in forestry to achieve multifunctionality:

1. Review and formulate a list of priority forest functions, taking into account economic and environmental benefits and in line with the New EU Forest Strategy 2030 and the Green Deal.
2. Amend the Forest Code of Ukraine to define multifunctional forestry, its content and organisation. Clarify the general principles and role of functional division and designation of forests. To recognise the introduction of close-to-nature forestry as a priority task for forestry development in order to form a multifunctional role of forests.
3. To introduce forest division not only by the main function, but by five main functions with ranking according to the importance for each forest area.
4. Amend the Forest Management Planning Procedure to reflect the principles of functional division of forests into categories. Adapt the rules for conducting economic activities to the specifics of forestry measures to ensure specific forest functions. For example, to change the conditions for thinning in forests with a recreational function.
5. Reconsider the feasibility of applying the current version of the Procedure for the division of forests into categories and the allocation of specially protected forest areas. Abandon the existing approach to the allocation and management of specially protected forest areas and allocate specially protected areas in accordance with the new (future) list of priority functions. Design management measures with a breakdown by the ranked main functions to support and strengthen them.
6. The Cabinet of Ministers of Ukraine should consider the mechanism of tax exemption and create a grace period for forestry enterprises that introduce services for the implementation of recreational, protective, environmental functions and organise the harvesting (primary processing) of non-wood products (mushrooms, berries, wildlife meat)
7. To recommend that higher education institutions introduce disciplines on the design and application of multifunctional forestry into the educational process.
8. Research institutes and universities should be encouraged to include the multifunctional role of forests and forestry, and the development of monetisation mechanisms in their priority research areas.

B. Close to nature forestry (CNF)

5.Scientific Definition and Analysis of CNF Implementation in Forest Management and Higher Forestry Education in Ukraine

The scientific community in Ukraine is researching and discussing the development and future of forestry in the context of modern challenges and in the areas of adaptive, ecologically oriented forestry [5] and close-to-nature forestry [8, 12, 13, 14, 15].

Clarification of CNF concepts and terminology

The most widely used definition in the Ukrainian scientific community is that of close-to-nature forestry as a system of forestry organisation and management that ensures continuous restoration and formation of forest stands that are as similar in structure and genesis as possible to natural ones [14].

Authored by an international team of scientists, the European Forest Institute's publication "Close-to-Nature Forest Management" states that close-to-nature forestry is a general umbrella term that covers all approaches and terminology that, under the auspices of sustainable forestry, support biodiversity, resilience and climate adaptation in managed forests and forest landscapes.

The new EU Forest Strategy 2030 refers to close-to-nature forestry as forest management that seeks to create multifunctional forests, combining biodiversity (even in artificial forests), carbon storage and timber income. Although there is no universally accepted definition, close-to-nature forestry is a concept that is being actively discussed by private and public organisations in the European Union and around the world [21].

The European Forestry Institute (EFI) defines seven main principles of close-to-nature forestry: 1) conservation of trees as habitats, special habitats and dead wood; 2) promotion of native tree species as well as non-native species adapted to local conditions; 3) promotion of natural regeneration of trees; 4) partial harvesting and promotion of structural heterogeneity of the stand; 5) promotion of tree species diversity and genetic diversity; 6) avoidance of intensive management practices; 7) maintenance of landscape heterogeneity and functioning.

The development of close-to-nature silviculture is based on basic principles, but it is currently difficult to call it a full-fledged system of forestry management. Obviously, before systematic implementation of and ensuring the functioning of close-to-nature forestry, a long way of joint interaction between science, education and industry will be overcome in the coming decades.

The absence of a clear definition of the term "close to nature forestry" creates different interpretations, interpretation and scaling of the role in the forestry sector.

Overview of their integration into Ukrainian forestry research and education

Close-to-nature forestry has been a direct subject of research by Ukrainian scientists over the past two decades [5, 8, 12, 14, 15, 26],with a key role and contribution of scientists from the National Forestry University of Ukraine.

The urgency of implementing close-to-nature forestry has led to the holding of specialised scientific and technical events in Ukraine, in particular, the All-Ukrainian Scientific and Practical Conference "Close-to-Nature Forestry: Problems and Prospects" [27].

In general, limited scientific results and practical recommendations have been identified as a scientific basis for the widespread implementation of close-to-nature silviculture in different forest vegetation zones of Ukraine. Scientists paid more attention to the study of technologies for selective felling and reforestation.

The implementation of close-to-nature forestry in the educational process is at the initial stage of integration and has an insufficient role in the training of forestry specialists. An analysis of the curricula on the official websites of Ukrainian higher education institutions in 2024-2025 revealed only one separate course on "Close to Nature Forestry" (elective discipline) at the Uman National University of Horticulture. Separate sections or lectures on close-to-nature forestry in primary disciplines are offered by the Precarpathian National University and the National University of Life and Environmental Sciences of Ukraine.

It is worth noting that the integration of close-to-nature silviculture into forestry science and education in Ukraine is at an early stage. There is a need to intensify applied research and feasibility studies on the application of close-to-nature silviculture approaches in model farms in different forest vegetation zones and under different financial and economic scenarios.

Empirical data to support policy recommendations

The policy decision support system in Ukraine should be based on empirical data obtained from scientific institutions (universities, research institutes) and the results of the National Forest Inventory of Ukraine.

The main scientific support for the forestry sector is provided by the H.M. Vysotsky Ukrainian Research Institute of Forestry and Agroforestry (URIFFM) and the Pasternak Ukrainian Research Institute of Mountain Forestry (UkrRIMF), which conduct applied research, scale it up at forest research stations and test it in the forestry stock of leading forestry enterprises in all natural and climatic zones of Ukraine. Insufficient funding of research institutions in Ukraine does not allow for

the full creation and transfer of empirical data for policy-making. The efforts of researchers and practitioners in Ukraine have generated empirical data on the experience of certain elements of close-to-nature forestry, including selective felling, plantation restructuring, creation of under-tent crops, etc. In Lviv Oblast, the share of selective and gradual felling is increasing, which is a practical basis for making decisions on scaling up the experience of selective management. Also, for example, in Drohobych supra-forestry of the Carpathian Forestry Office, permanent trial areas for stand reformation have been established to serve as demonstration plots for empirical data. A significant challenge is the lack of practical experience in Ukraine in using the plot-based forest management method as a design basis for close-to-nature forestry.

Management decisions and legislative initiatives should be based on periodic national forest inventory data, which should reliably characterise the state of Ukraine's forests and, in retrospect, reflect the effectiveness of forest programmes at the national level.

6.Status of CNF Implementation in Forest Policy of Ukraine

The implementation of close-to-nature forestry in the forest policy of Ukraine is at the initial stage and is actively discussed among forestry professionals and politicians. Ukraine's forest policy is aimed at developing responsible and sustainable forestry, which has similarities with close-to-nature forestry in terms of its overall goals and objectives. At the same time, there is no clearly defined and targeted implementation of close-to-nature forestry in the forest policy in Ukraine.

Legal and strategic framework supporting forest functions

Of all the laws and bylaws that form the system of forestry legislation in Ukraine, close-to-nature forestry is mentioned only in the State Strategy for Forest Management of Ukraine until 2035 [19] in the wording "close-to-nature forestry methods".

The strategy envisages changes to the rules of forestry activities aimed at close-to-nature forestry methods and the gradual abandonment of clear-cutting for effective forest management. Environmental sustainability is to be ensured by adapting forests to climate change, in particular by switching to forestry methods close to nature with the formation of forests of natural composition and structure. In addition, the strategy envisages increasing forest productivity and enhancing the ecological and resource potential of forests by converting single-age artificial and derivative forests into multi-age mixed multi-tier forests, the composition and structure of which correspond to optimal parameters close to the natural state. Particular attention is paid to the adaptation of forests to climate change and the transition to forestry methods close to nature with the

formation of forests of natural composition and structure. At the same time, the operational action plan for 2022-2024 does not contain specific tasks for implementation, and there is no information on the existence of an operational plan for the following years.

The Head of the State Forest Resources Agency has publicly stated that the forestry industry is getting closer to the introduction of close-to-nature forestry due to the abolition of clear-cutting in the Carpathian region in 2027 and the adoption of the Resolution of the Cabinet of Ministers of Ukraine of 23 April 2024 No. 454 [28]. At the same time, official statements and documents did not detail the procedure and mechanism for the transition to close-to-nature forestry.

Regulatory prerequisites and practical implementation of the experience of harvesting regeneration as a key component of increasing the sustainability of forest stands and preserving their biodiversity play an important role in the introduction of close-to-nature forestry. In addition, the permission to conduct logging for research purposes can significantly contribute to the implementation of close-to-nature forestry by organising a selective system of logging under scientific supervision and support.

In general, there are prerequisites for the introduction of close-to-nature forestry in Ukraine, based on the current rules of forestry organisation and management, the prospects for improving forestry legislation, and the awareness of the absence of contradictions between the principles of close-to-nature forestry and the current forestry principles declared in legislation. At the same time, the lack of priority of close-to-nature forestry enshrined in legislation, the high level of bureaucratic overregulation of forestry, the economic attractiveness and technological simplicity of clear-cutting for main use and sanitary felling, as well as the low level of professional training of personnel, make it impossible to introduce close-to-nature forestry in Ukraine.

Compatibility with the EU Forest Strategy 2030 and the Green Deal

The goals and objectives of the State Forest Management Strategy of Ukraine until 2035 reflect the European trend and goal of strengthening sustainable forest management for climate change adaptation and forest resilience, which is set out in the New EU Forest Strategy 2030 and the Green Deal. At the same time, the definition of close-to-nature forestry is not covered in Ukrainian legislation.

Role of key institutions (e.g. Ministry of Environmental Protection and Natural Resources, State Forest Resources Agency)

The Ministry of Economy, Environment and Agriculture of Ukraine and the State Forest Resources Agency of Ukraine in close cooperation with other executive and legislative authorities should ensure the implementation of close-to-nature forestry in the forest policy of Ukraine. Based on the Ukrainian Forest

Management Strategy until 2035, EU legislation, and in cooperation with scientific institutions and NGOs, the State Forest Resources Agency of Ukraine should define the content, goals and objectives of close-to-nature forestry and develop a roadmap for its implementation in national forestry legislation and practice. An important step should be the development of guidelines on close-to-nature forestry with the involvement of scientists and forestry experts in order to form a clear vision and understanding of the nature, experience and expectations from the implementation of close-to-nature forestry. For the effective implementation of close-to-nature forestry in forest policy and relations in Ukraine, it is necessary to include a legal definition of close-to-nature forestry in the Forest Code of Ukraine.

7. Status of CNF Implementation in Ukrainian Forest Administration (incl. FMP)

In terms of established European practices of close-to-nature forestry, there is currently no implementation of close-to-nature forestry in Ukraine. At the same time, over the past century, forest management authorities in Ukraine have been developing and improving regulations and developing forestry technologies for more rational and balanced forestry. This was mainly a response to natural emergencies, natural disasters and the implementation of international forestry initiatives, including responsible forestry practices.

Forest management in Ukraine, through design and planning measures, ensures the rational use and enhancement of the environmental and resource potential of forests of forestry enterprises. This is in line with the general concept of sustainable forestry development, but there is no direct design of forest management close to the nature of forestry in Ukraine .

Forest management is faced with the task of adapting the use of the age class method and introducing the plot method of management to the system of designing management measures in close-to-nature forestry. In classical forest management, the age class method allows for the creation of separate management sections with the practice of close-to-nature silviculture.

Use of CNF principles in planning, monitoring, and reporting

The general principles of close-to-nature silviculture are in the plane of sustainable forestry development, so they have much in common with the system of forestry design and planning in Ukraine. More than 20 years of experience in implementing forest certification in Ukraine and a high level of forest certification under the FSC (Forest Stewardship Council) and PEFC (Programme for the Endorsement of Forest Certification Schemes) systems, leads to the widespread use of international standards and ensures economically, environmentally and socially balanced forest management.

The principle of preserving trees as habitats, special habitats and dead wood is partially implemented through the practice of allocating specially protected forest areas and the application of the FSC Forest Management System Standard for Ukraine.

The principle of promoting the propagation of native tree species, as well as non-native species adapted to local conditions and promoting tree species diversity and genetic diversity is reflected in the Rules for Forest Reproduction in Ukraine [30], but focuses more on the use of valuable species and prevention of the spread of invasive species.

The principle of promoting natural regeneration of trees in forestry legislation and forestry is a key way to restore stands, although it is not sufficiently implemented in practice.

Partial harvesting and promotion of structural heterogeneity of the stand are defined by the Forest Code of Ukraine and other regulatory documents that regulate the use of selective felling.

The principle of avoiding intensive management activities is partially implemented by limiting the area of the main use logging areas, in particular for clear-cutting. The Law of Ukraine "On Environmental Impact Assessment" [31] has a significant impact on the avoidance of intensive management activities.

The system of forestry organisation and management in Ukraine provides for planning of management activities to ensure that forests fulfil their functions, which indirectly ensures the maintenance of landscape heterogeneity and functioning.

Degree of modernisation (GIS, remote sensing, forest inventory)

Since the implementation of close-to-nature forestry is at the initial stage, modernisation of management, monitoring, control and decision-making support processes using GIS and remote sensing tools is a promising task. The practice of using remote sensing in the forestry sector is focused on the study of forest cover dynamics and mapping of forest disturbances, with a special focus on forest fires.

Some conclusions about the effectiveness of forest management at the national level and compliance with the principles of sustainable forestry development can be drawn based on the first results of the national forest inventory of Ukraine. The forest inventory in Ukraine will not provide information on the level of implementation of close-to-nature forestry, but it will indirectly become a source of reliable information on the implementation of certain principles of responsible forest management and sustainable forest management.

Institutional constraints and capacity-building needs

Forestry in Ukraine has the basic prerequisites for the introduction of close-to-nature forestry and its gradual development and scaling up. The current forestry legislation does not allow for the full implementation of close-to-nature forestry, but the partial implementation of these approaches is consistent with existing legislation. The experience of applying the principles of responsible forestry in Ukraine makes it easier to understand the principles of close-to-nature forestry and how to implement them.

The main institutional constraints to the implementation of close-to-nature forestry are

- Lack of political will to decide on the systematic and actual implementation of close-to-nature forestry and vision of complex tasks to achieve this;
- Lack of consensus in society on the vision of the direction of forestry development: limiting forestry to protect biodiversity or applying an integrated approach with productive forestry with elements of biodiversity protection included;
- uncertainty with terminology, lack of a clear definition of "close-to-nature forestry", taking into account national forestry practices and specific forest structure. The State Forest Management Strategy until 2035 uses the term "close-to-nature forestry methods", which has no defined interpretation and differs from the term "close-to-nature forestry" used by scientists;
- high level of state regulation of forestry and lack of legal definition of close-to-nature forestry in forestry legislation;
- insufficient level of research (forestry and economic) and empirical data on the effectiveness of the main approaches of close-to-nature silviculture in plantations of the main forest-forming species and different natural and climatic zones;
- lack of a sufficient educational component on close-to-nature forestry in the curricula of the speciality H4 Forestry of higher education institutions of Ukraine to train specialists in forestry and forest management;
- inadequacy of the legislative framework for large-scale and comprehensive implementation of selective felling, in particular, according to design decisions on the plot method of forest management;
- Lack of experience in forest management of the forest fund of enterprises using the plot method, insufficient staffing for soil-typological surveys, forest inventory and organisation of measures to promote natural regeneration, regeneration felling, and the formation of undercrops;

- Lack of a sufficient network of forest roads of adequate quality to ensure the implementation of the selective felling system;
- imperfection of the forest inventory system, timber accounting in the process of logging and sale of products, as well as the lack of reliable data on the current growth of timber in the forest plantations of forestry enterprises;
- Lack of motivation to change management approaches, bureaucratic obstacles to finding solutions and prompt response to the situation in the forest fund, lack of basic knowledge and experience in close-to-nature forestry at the level of forester - engineer - head of supra-forestry.

For the effective implementation of close-to-nature forestry in the forestry sector of Ukraine, it is necessary to urgently meet the needs for capacity development, in particular

- hold broad and constructive discussions in scientific circles to identify priority research areas, create a representative network of permanent trial areas for active experiments, and formulate scientific principles for the implementation of close-to-nature forestry;
- adopt the principle of Continuous Cover Forestry as the basis for close-to-nature forestry in Ukraine;
- to launch a large-scale programme for high-quality training, retraining and advanced training of personnel for designing, planning and organising the implementation of close-to-nature forestry;
- to make reasonable and relevant technical and economic forecasts of the process of implementing close-to-nature forestry at the level of forestry enterprises, including the need for investment in infrastructure and mechanisation of logging;
- to improve the Forest Code of Ukraine and harmonise forestry legislation in the context of the development of the European Union's legislative framework. Conduct a systematic analysis of the needs and content of improving the regulatory framework for the introduction of close-to-nature forestry;
- Improve the procedure for allocating logging areas (or abandon the procedure for allocation) and accounting for harvested timber at different stages of the technological process, and define quantitative criteria for managing dead wood in forest areas.

8.Development and Current Status of CNF Implementation in State Forest Management

In general, Ukraine has almost all the prerequisites (legislative, silvicultural, economic) for the development of close-to-nature forestry, but a targeted and effective transition to such management approaches requires systematic improvement of the legislative framework, actual implementation in forest policy and adaptation of forest management to new silvicultural practices.

Practical examples and pilot projects

There are no comprehensive pilot projects with well-known practices of close-to-nature forestry in Ukraine yet, but practical examples have been developed for certain approaches of close-to-nature forestry. For example, the Drohobych supra-forestry of the Carpathian Forestry Office Branch has developed scientific and production examples of regeneration logging with observation for almost three decades.

An important example in the conditions of Eastern Polissia of Ukraine, in particular on the basis of the Novgorod-Siverskaya Forest Research Station (Chernihiv Oblast), is the study of the formation of natural regeneration of Scots pine under gradual felling in pine forests [26]. This confirms the ability to positively implement close-to-nature forestry using best practices and the development of scientific support for such implementation.

The important pilot project GCP/021/UKR/EC "Development of proposals for reforming the forest management planning system in Ukraine", implemented by FAO within the framework of the EU-funded project "Inclusive, competitive and sustainable functioning and development of value chains in agriculture, fisheries and forestry" project, aims to develop proposals for reforming the forest management planning system in Ukraine and to test the plot-based forest management method in the Ukrainian Carpathians.

Training efforts for forest personnel

The main training opportunities for learning about the experience of applying close-to-nature forestry by key decision-makers are related to the cooperation of Ukrainian and German governmental and non-governmental organisations in the field of forestry.

In recent years, a network of marteloscopes [32] has developed in Ukraine, which includes more than 11 training stations for personnel training with to improve skills in tree allocation for thinning and the use of selective felling systems.

An important component of staff training is the training programme for foresters and key specialists of the SE "Forests of Ukraine" based on permanent trial areas of thinning and selective felling in the Carpathian region.

The involvement of universities and research institutes in training on close-to-nature forestry at forest research stations has a high training potential.

Needs for structural reform, financing, and regulatory support

Structural reform of forestry enterprises and concentration of production capacities in one large state enterprise "Forests of Ukraine" can contribute to the effectiveness of implementation of close-to-nature forestry, provided there is political will and a holistic understanding of the complexity and comprehensiveness of this process.

Undoubtedly, the introduction of close-to-nature forestry will require additional financial costs associated with forest management by the plot method with detailed soil and typological studies, design, construction and maintenance of forest roads, training and retraining of personnel, and will also require investments for the logging business. At the same time, the introduction of close-to-nature forestry at the enterprise level should be phased in, with the share of these approaches at 20% of the forest fund, which is most appropriate for the specifics of introducing close-to-nature forestry.

At present, it is necessary to formulate a list of urgent legal, technological and economic measures to launch pilot projects on the basis of leading forestry enterprises with a high culture of forestry, a level of responsible management and motivated staff for the gradual introduction of close-to-nature forestry into the production process.

Summary conclusions for close-to-nature forestry

Thus, summarising the experience of forestry and the state of Ukraine's forests, the following conclusions can be drawn:

1. Conceptually, it is necessary to consider the introduction of close-to-nature forestry as a process of managing ecosystem processes to achieve the future result of continuously existing, sustainable and diverse natural forests and their multifunctional role for both nature and people.
2. Nature-based forestry is a realistic and key approach for the sustainable development of multifunctional forestry in Ukraine in the context of diverse natural and climatic conditions of the territory and rapid climate change.
3. As a result of the greening of natural resource management, forest certification, and the spread of responsible and sustainable forestry principles and practices, Ukraine has formed general prerequisites for the introduction of close-to-nature forestry and multifunctional forestry.
4. The main challenges for the development of close-to-nature forestry include
    - Lack of strategic vision, legislative definition of the content and basic principles, principles and indicators of implementation of close-to-nature forestry;
    - low level of interaction and consolidation of the potential of scientific institutions, educational institutions, NGOs, expert community and authorities of different levels to ensure the development of forestry;
    - the need to rethink the system of forest taxation and forest management to create a database of reliable information on the state of forests, current timber growth and prerequisites for sound design decisions;
    - lack of feasibility study for planning the phased implementation of close-to-nature forestry for future multifunctional forestry;
    - low level of personnel readiness for large-scale implementation of close-to-nature forestry;
    - high level of bureaucratic obstacles and regulations and low staff motivation to initiate the introduction of new approaches in the existing legal framework and with excessive and ineffective control by forestry stakeholders;
    - the need for investment in infrastructure development and technical and technological re-equipment of the forestry sector.

5. Implementation of close-to-nature forestry in Ukraine should be based on systematic improvement of forestry legislation, comprehensive support of the authorities, scientific support and feasibility studies of various stages of implementation, highly qualified personnel, cascading of experience from leading farms of the State Enterprise "Forests of Ukraine" to other forest users, and a clear understanding of the duration of the implementation process even if all challenges are successfully overcome.

List of references

1. Dieterich V. (1953). Forstwirtschaftspolitik-Eine Einführung. Hamburg, Berlin. Paul Parey.
2. Bončina, A., Simončič, T., & Rosset, C. (2019). Assessment of the concept of forest functions in Central European forestry. Environmental Science & Policy, 99, 123-135. https://doi.org/10.1016/j.envsci.2019.05.009
3. Ministerial Conference on the Protection of Forests in Europe, Liaison Unit Warsaw. (2007). Implementation of MCPFE commitments: National and Pan-European activities 2003-2007. Warsaw, Poland: MCPFE Liaison Unit Warsaw.
4. European Commission. (1998, November 18). A forestry strategy for the European Union: Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions (COM(98) 649 final). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:51998DC0649
5. Maurer, V. M., Hordiienko, M. I., Brovko, F. M., Fuchylo, Ya. D., Pinchuk, A. P., Kychyliuk, O. V., & Ivaniuk, I. V. (2009, March). Theoretical and technological principles of forest regeneration based on ecologically orientated forestry [Theoretical and technological principles of forest regeneration based on ecologically orientated forestry]. Kyiv: State Committee of Forestry of Ukraine, Scientific-Information Centre for Forest Management (Scientific-Technical Information, Issue 2). [In Ukrainian]. https://wood.openforest.org.ua/wp-content/uploads/2020/02/nti_2.pd. .
6. Agreement between the State Committee of Forestry of Ukraine and the Swiss Agency for Development and Cooperation - 29 November 2004 (FOR-ZA Project in Zakarpattia) .
7. Ministry of Agrarian Policy and Food of Ukraine. (2012, August 14). Order No. 502: On approval of the Rules for the use of beneficial properties of forests [Order "On approval of the Rules for the use of beneficial properties of forests"] (Official publication date September 5, 2012). Retrieved from https://zakon.rada.gov.ua/laws/main/z1536-12
8. Krynytskyi, H. T., Cherniavskyi, M. V., & Derbal, Yu. Iu. (2014). Close-to-nature and multifunctional forestry in the Carpathian region of Ukraine and Slovakia: A guide [in Ukrainian]. Uzhhorod, Ukraine: PP Kolo. .
9. Verkhovna Rada of Ukraine. (1994, January 21). Forest Code of Ukraine [Forest Code of Ukraine] (Law No. 3852-XII, as amended). Retrieved August 20, 2025, from https://zakon.rada.gov.ua/laws/show/3852-12

10. Cabinet of Ministers of Ukraine. (2007, May 16). On approval of the procedure for the classification of forests and the designation of particularly protective forest areas (Resolution No. 733). Retrieved August 20, 2025, from https://zakon.rada.gov.ua/laws/show/733-2007-%D0%BF
11. Krynytskyi, H. T., Cherniavskyi, M. V., Krynytska, O. H., Deineka, A. M., Kolisnyk, B. I., & Tselen, Ya. P. (2017). Close-to-nature forestry as the basis for sustainable forest management in Ukraine. Scientific Bulletin of UNFU, 27(8), 26-31. https://doi.org/10.15421/40270803
12. Cherniavskyi, M. V., Shvitter, R., Kovalyshyn, R. V., et al. (2006). Close-to-nature forestry in the Ukrainian Carpathians (88 pp.). Lviv: Piramida. [In Ukrainian].
13. Cherniavskyi, M. V. (2008). Close-to-nature forest management in Ukraine [Close-to-nature forest management in Ukraine]. Forestry and Hunting Journal, (1), 14-17. [In Ukrainian].
14. Cherniavskyy, M. V., Krynytskyy, H. T., & Parpan, V. I. (2011). Close-to-nature forest management in Ukraine. Scientific Papers of the Forestry Academy of Sciences of Ukraine, 9, 29-35. [In Ukrainian]. https://fasu.nltu.edu.ua/index.php/nplanu/article/download/362/278.
15. Krynytskyi, H. T., Cherniavskyi, M. V., Krynytska, O. H., Deineka, A. M., Kolisnyk, B. I., & Tselen, Ya. P. (2017). Close-to-nature forestry as the basis for sustainable forest management in Ukraine. Scientific Bulletin of UNFU, 27(8), 26-31. https://doi.org/10.15421/40270803
16. Soloviy, I. (2016, November). Evaluation of forest ecosystem services provided by forests of Ukraine and proposals on PES mechanisms. FLEG II Programme.
17. Ecosystem Services of Ukrainian Forests: a Case Study of the Polissya Region: monograph / P. Lakyda, A. Bilous, A. Shvidenko, V. Myroniuk, M. Matsala, R. Vasylyshyn, D. Holiaka, I. Lakyda - Kyiv: NULES of Ukraine, 2018. - 188 p.
18. Tkach, V. P., Vysotska, N. Yu, Kalashnikov, A. O., Zhezhkun, I. M., Koval, I. M., Sydorenko, S. H., Sydorenko, S. V., Bondarenko, V. V., & Bondar, O. B. (2023). Economic evaluation of ecosystem services of Ukrainian forests [Economic evaluation of ecosystem services of Ukrainian forests]. UkrNDILGA. [In Ukrainian] https://uriffm.org.ua/static/main/files/EcoSys.pdf
19. Cabinet of Ministers of Ukraine. (2021, December 29). On the approval of the State Forest Management Strategy of Ukraine until 2035: Resolution No. 1777-r. https://zakon.rada.gov.ua/go/1777-2021-%D1%80
20. European Commission. (2019, December 11). Communication from the Commission to the European Parliament, the European Council, the

Council, the European Economic and Social Committee and the Committee of the Regions: The European Green Deal (COM(2019) 640 final). EUR-Lex. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019DC0640

21. European Commission. (2021, July 16). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: New EU Forest Strategy for 2030 (COM(2021) 572 final). EUR-Lex. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0572
22. Cabinet of Ministers of Ukraine. (2023, February 7). On approval of the procedure for forest inventory (Resolution No. 112). Legislation of Ukraine. Retrieved September 5, 2025, from https://zakon.rada.gov.ua/go/112-2023-п
23. Ukrainian State Forestry Project Union (n.d.). Geoinformation System of Forest Resources Management of Ukraine (GIS-Lisproject) [Web portal]. Retrieved September 17, 2025, from https://gis.lisproekt.gov.ua/portal/apps/sites/#/gis-lisproekt
24. Ukrainian Centre for Training, Retraining and Upgrading the Qualifications of Forest Management Personnel (Ukr. Ukrainian Centre for Training, Retraining and Upgrading the Qualifications of Forest Management Personnel [Institutional profile]. Retrieved September 17, 2025, from https://kadrlis.com.ua/
25. Larsen, J. B., Angelstam, P., Bauhus, J., Carvalho, J. F., Diaci, J., Dobrowolska, D., Gazda, A., Gustafsson, L., Krumm, F., Knoke, T., Konczal, A., Kuuluvainen, T., Mason, B., Motta, R., Pötzelsberger, E., Rigling, A., & Schuck, A. (2022). Closer-to-Nature Forest Management. From Science to Policy, No. 12. European Forest Institute. https://doi.org/10.36333/fs12
26. Zhezhkun, A. M., Nizalov, D. Y., & Kovalchuk, I. M. (2023). Close-to-nature forestry measures in East Polissia Region of Ukraine. *South-east European Forestry, 14*(1), 1-12. https://seefor.eu/zhezhkun-et-al-close-to-nature-forestry-measures-in-east-polissia-region-of-ukraine.htm
27. National University of Life and Environmental Sciences of Ukraine. (2024, April 25-26). Closer-to-Nature Forestry: Challenges and Future Prospects: Proceedings of the International Scientific-Practical Conference (Theses of Reports). Kyiv, Ukraine: Educational-Scientific Institute of Forestry and Park Gardening, NULES of Ukraine. https://nubip.edu.ua/sites/default/files/u184/tezy_april_25_kyiv_nubip_1.pdf.

28. Verkhovna Rada of Ukraine. (2024, June 27). On amendments to certain laws of Ukraine regarding strengthening protection of forests and improvement of forest management (Law No. 454-IX). Retrieved from https://zakon.rada.gov.ua/laws/show/454-2024-%D0%BF
29. Cabinet of Ministers of Ukraine. (2007, May 12). On approval of the Rules for improving the quality composition of forests, conducting other felling and works related and unrelated to forest management: Resolution No. 724 [Legislative act]. Legislation of Ukraine. Retrieved from https://zakon.rada.gov.ua/go/724-2007-%D0%BF
30. Cabinet of Ministers of Ukraine. (2007, March 1). On approval of the procedure for special use of forest resources (Resolution No. 303). Official Gazette of Ukraine, Issue 21, p. 1. Retrieved from https://zakon.rada.gov.ua/laws/show/303-2007-%D0%BF
31. Verkhovna Rada of Ukraine. (2017, May 23). On environmental impact assessment (Law of Ukraine No. 2059-VIII). Retrieved September 21, 2025, from https://zakon.rada.gov.ua/go/2059-19
32. Sylvothèque. (n.d.). Martelage - wood modifications & forest heritage database. Retrieved [Date you accessed the site], from https://martelage.sylvotheque.ch/