



H. T. Krynytskyi¹, M. V. Chernyavskiy², O. H. Krynytska¹, A. M. Deineka², B. I. Kolisnyk¹, Ya. P. Tselen²

¹Ukrainian National Forestry University, Lviv, Ukraine

²Lviv Region Administration of Forestry and Hunting Management, Lviv, Ukraine

CLOSE-TO-NATURE FORESTRY AS THE BASIS FOR SUSTAINABLE FOREST MANAGEMENT IN UKRAINE

Close-to-nature forestry is the system of forest management that favours a continuous renewal and formation of stands which most similar in structure and genesis to natural ones. The methodological basis of it is 8 principles which cover the evaluation of the processes of reproduction and formation of stable, natural, all-aged forests with continuous forest cover, biodiversity conservation, maintenance of the ecological functions of forests, an increase in the growing stock, harvesting of target trees, the greening of felling techniques and timber skidding. The existing set of pan-European criteria and indicators for sustainable forest management according to the standards of FSC certification provides a basis to implement in Ukraine the system of close-to-nature forestry that is most relevant to the nature of the forest and, therefore, is the most promising in terms of environmental, economic and social aspects of multifunctional Forestry.

Keywords: multifunctional close-to-nature forestry; sustainable forest management

Introduction

Throughout the history of forestry production, the main idea of its development has been to obtain an increasing number of wood products without depleting the available wood resources and reducing the productivity of the forest (Lytsur & Tsybaliuk, 2012), as well as maintaining and strengthening stability and multi-faceted social functions of forests (Cherniavskiy, et al., 2006; Cherniavskiy, Krynytskyi & Parpan, 2011). This principle is essentially the idea of sustainable forestry development. The concept of sustainable forest management and international commitments of Ukraine are based on provisions of the Convention on biodiversity (1992) (Verkhovna Rada Ukraine, 1992), the resolution of Ministerial Conferences on forest protection in Europe (1992) (Resolution L2, 2014) which states the general principles of sustainable management in the forests of Europe and the pan-European

criteria, indicators and practical recommendations for sustainable forest management. Based on the decision adopted at the 7th conference of participating countries of the Convention in Kuala Lumpur (CFCS 1002:2001, 2001), sustainable forest management is the practical application of the ecosystem approach to forests (Cherniavskiy, Solovii & Henyk, 2011; Lialson unin Vienna, 2002).

The Protocol on sustainable forest management, prepared to the Framework Convention on the protection and sustainable development of the Carpathians and signed on 27 May 2011 in Bratislava (Verkhovna Rada Ukraine, 2012), implies, in particular, facilitating the close-to-nature regeneration of forests, as well as the use of practical experience in their management. In addition, in 1998, the EU adopted the Forestry Strategy, and in June 2006 the European Commission initiated the development of the EU Forest Action Plan. These documents outlined a shared vision of forestry, namely: forests for society – long-term multifunctional forestry that meets present and future societal needs (Krynytskyi & Cherniavskiy, 2006). The basis of its implementation is the organization of forest management on the principles of close-to-nature forestry.

Close-to-nature forestry is viewed as a system of forest management which ensures continuous reproduction and formation of forest stands similar to natural ones in structure and genesis, and predetermines the constant presence of forests in woodland areas at different stages of development and at different levels of vertical and horizontal structures (Cherniavskiy, et al., 2006; Krynytskyi & Cherniavskiy, 2016).



Hryhorij Krynytskyi,
Dr. Hab., Professor,
Email: krynytsk@ukr.net



Mykola Chernyavskiy,
PhD, Associate Professor,
Email: tschern@mail.lviv.ua



Olga Krynytska,
Junior Researcher,
Email: olk@ukr.net

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Anatolii Deineka,
Dr. Hab., Professor,
Email: kadry_lvivlis@ukr.net



Bogdan Kolisnyk,
PhD, Assistant Rector,
Email: nltu@ukr.net



Yaroslav Tselen,
Dr. Hab., Professor,
Email: tselen@ukr.net

Close-to-natural-ecosystems forest management maximally takes into account the site environmental conditions and peculiarities of the development of natural forest stands. It provides, on the basis of modelling of natural processes, conducting a system of activities which increases the stability of forest stands and their multifunctional role with the minimum appropriate and necessary intervention in the forest. The technology of creating and forming forest stands is based on the cultivation of target stands depending on the objectives of management, climatic and soil-hydrological conditions, biology and ecology of the species. In doing so, various, but as close as possible to the natural forest, differentiated approaches to forest management are used (Forest Stewardship Council, 2014).

Close-to-nature forestry is multifunctional and based on (1) understanding the forest as a natural ecosystem, which, in use, retains its integrity and self-regeneration; (2) management of forests and their use with the intensity that provides natural biodiversity, high viability and productivity of forest stands and their ability to regeneration; (3) performing by the forest of ecological, economic and social functions at the local, national and global levels both at present time and in the future.

Close-to-nature forest management is effective not only in social and environmental terms. It allows for sustained (permanent) forest product yield even from a small area of forest land in the absence of clear cutting.

Close-to-nature forestry allows you to move from the clear-cutting system, which is prevailing in Ukraine, to the selection system – the cultivation of uneven-aged mixed forest stands with a multistoreyed vertically and horizontally closed structure based on natural seed regeneration – and solve a range of topical problems. The main ones are as follows:

- insignificant share of uneven-aged stands area in the Forest Fund which is the basis of a selection management system. Over the past 100 years, forest management has been directed, as a rule, to the cultivation of even-aged or arbitrary even-aged stands.
- aging and gradual degradation of the forests in which, according to the current regulatory acts, the main felling is prohibited. In the Forest Fund of Ukraine, they occupy more than 40 % of the area, and there is a steady tendency to its increasing;

- excessive use of clear-cutting. By using this system of felling, 80 % of timber is harvested in the process of final cutting;
- the presence of large areas of forest stands of vegetative origin (coppice forest) and secondary forest stands, particularly spruce forests in the Carpathian region, which requires replacement by primary forests in accordance with the forest types;
- reduced vitality and stability of forest stands, especially artificial ones, caused by global climate change, environmental pollution, increasing anthropogenic load;
- the prevalence of artificially created stands in the Forest Fund (about 55 % by area) that have a simplified age, species and spatial structure, require intensive care, and, compared to the natural forests, are characterized by impoverished biodiversity, less biological resilience;
- imperfection of current forest legislation and regulations on tending and final felling in which there is no legal provision for formation of uneven-aged stands
- the lack of a legally defined mechanism for involving the public, in particular local communities, in forest management, both the forests of state and communal properties. The voluntary association of foresters "Pro Silva" has not been set up in Ukraine whose purpose is to promote, protect and expand the idea of close-to-nature forestry.

For the close-to-nature forest management in Ukraine, the following principles are recognized as crucial: the continuous existence of forest cover; reproduction of the structure of natural all-aged forests; constant stability of water-protective, climate-regulating, sanitary-hygienic, recreational and other useful properties of forests; constant maintenance of the stability of forest stands; preservation of biotic diversity; timber harvesting in volumes no more than the annual increment; preservation of soil cover; environmentally-friendly technologies of timber harvesting.

The continuous existence of forest cover according to the Ukrainian approach means continuity of forest-renewal processes. Forming and functioning of forests close to natural ones is supported by selection of individual trees or their biogroups. Cutting trees cannot be a complete removal of all trees from the entire area. The clear-cutting system, despite various modifications of its methods, does not ensure the continuity of forest-renewal processes. The result of continuous renewal of forest cover in historical aspect are mixed forests.

Stability of the forest in a certain unit area is related to the light requirements of different species of trees and, as a consequence, the differentiation of the structure of the stand. The ecological potential of forests at a constant, optimally possible level can only be provided by uneven-aged stands which preserve the stability of the forest and are formed during a cleverly implemented system of selection felling using methods of close-to-nature forestry.

Reproduction of the structure of natural uneven-aged forests in Ukraine is aimed at the formation of the species, spatial and age structure close to the primeval forest. In a forest close to natural, individual trees or groups of trees are mixed into uneven-aged parts of the tree stand, creating distinctly differentiated lower, middle and upper storeys formed as a result of gradual cutting down of individual mature trees. Multistoreyed structure of such forest is maintained for an indefinitely long period of time through constant pe-

riodic carrying out of certain forestry activities. These activities include, first of all, the restoration of natural species composition and ensuring natural renewal over artificial.

Permanent stability of the water-conservation, protective, climate-regulating, sanitary-hygienic, recreational and other useful properties of forests is determined primarily by the balance of all components of the forest and most significantly manifested by the close-to-nature forest management. The activities of close-to-nature forestry can support and enhance the desired functions of forests depending on the target purpose of the forest stands and the category of protectiveness of forests.

Constant maintenance of the resilience of forest stands according to the Ukrainian approach is conditioned by continuous existence of the forest cover, as well as activities that regulate and enhance it. The resilience of a forest stand is determined by its ability to withstand the adverse environmental factors (wind, changes in temperature, illumination, etc.) and biotic influences (diseases, pests).

The maintenance or strengthening of the resilience of a forest stand can be achieved by the appropriate formation of its structure, usually by growing woody species appropriate to the site conditions, introducing trees of windfirm species into its composition, forming the horizontal and vertical closure of forest stands which is optimal for the consumption of environmental factors (light, soil nutrient status and moisture, etc.).

The principle of *preserving biotic diversity* is based on continuous maintenance of the forest as an ecosystem. It ensures the preservation of continuity between the generations of the forest, as well as adaptation to changes in the natural environment. Only under the condition of continuous existence of the forest can be preserved the biodiversity of plant, animal and microbial components which are most fully adapted to each other in the long-term dynamics of the ecosystem.

The principle of *cutting wood in the volume of annual increment* means the incremental growth of phytomass and the harvest must be brought into balance. This approach involves economical, not excessive felling of trees. In each particular forest stand, the volume of timber to be harvested in a single cut should not exceed the increment for the period between successive cuts. Realization of this principle in practice can only be achieved by increasing the growing stock of stands and harvesting target trees, rather than hazardous cutting down even of individual trees.

According to the approach adopted in Ukraine, *to preserve the soil cover*, it is necessary that environmentally-friendly technologies of timber harvesting should be applied. Preserving the soil cover is a necessary condition for the continuous existence and full functioning of all living components of the forest. Its preservation is provided, first of all, by the use of forestry facilities and technologies that do not significantly disturb surface soil layers. It is advisable to apply activities that improve the soil quality (nutrient status) and regulate its hydrological regime. Environmentally-friendly technologies for timber harvesting will minimize the negative effects of felling and skidding of timber, as well as skidding machinery on the forest environment. When organizing logging operations, it is necessary to ensure the maximum possible preservation of a viable young growth and ground vegetation that prevent the occurrence of erosion

phenomena on the cutover areas. At the same time, measures should be taken to prevent damage to the remaining trees, especially the so-called "target" trees, with the help of which the improvement of the species structure, productivity and biotic resilience of the stands should be achieved.

The mechanism of introduction of close-to-nature forestry in Ukraine is based on:

- the basic principles of the Forest Code of Ukraine of 8 February 2006;
- "Rules for improving the qualitative composition of forests", approved by the Resolution of the Cabinet of Ministers of Ukraine dated by 12 May 2007, No. 724. The Rules (Clause 3) declare that "Formation and improvement fellings are carried out in ways that... ensure the gradual reproduction and formation of forests close to natural, constant maintenance of the stability of forest stands, "which creates the basis for the practical implementation of the principles of close-to-nature forestry;
- "Rules for principal felling in the Carpathian mountain forests", approved by the Resolution of the Cabinet of Ministers of Ukraine dated by 22 October 2008, No. 929, which state that these are conducted on the basis of the ecosystem approach and principles of close-to-nature forestry;
- using domestic and international experience. The Swiss-Ukrainian project *FORZA* for the development of forestry in Transcarpathian region was implemented in Ukraine, within the framework of which the principles of the close-to-nature forestry were worked out, two textbooks were published – "Close-to-nature forestry in the Ukrainian Carpathians" (2006) and "Close-to-nature and multifunctional forest management in the Carpathian region of Ukraine and Slovakia", training trips of Ukrainian specialists to Switzerland were taken, 126 permanent experimental plots for stand conversion were established within 38 forest types of state forestry enterprises in Transcarpathian region, 12 – in the Carpathian Biosphere Reserve.

Within the framework of the project *FORZA* together with the *Ukrderzhlisproekt* were also developed two-level plans for the organization of forest management based on the principles of close-to-nature forestry at two pilot forest districts – the Shchaulsk forest district (The Rakhiv State Forestry Enterprise) and the Nyzhniobystriv forest district (The Khust State Forestry Enterprise). Two training sessions were given – training for the employees of the *Ukrderzhlisproekt* on conversion felling and the defining criteria for their assignment.

In addition, within the framework of the German-Ukrainian project Dnister during the period 1998-2003, typological features, structure, productivity, methods of forest use were investigated in 43 mixed spruce-, fir-, beech- and oak stands of Lviv region, and close-to-nature activities for these forests were proposed.

In the 1980 s, the P. S. Pasternak Ukrainian Research Institute of Mountain Forestry established research areas involving combined felling in pure beech and coniferous-beech stands in Transcarpathian and the Carpathian regions, as well as conversion felling in the secondary spruce forests of the Carpathian region.

In 1962-1963, the Department of Forestry at the Ukrainian National Forestry University – (UNFU) conducted a unique stationary experiment on the regeneration of complex hornbeam-oak-pine forest stands by natural seeding. In the course of conducting gradual felling of various

types, tending felling and other forestry activities, a young target, of seedling origin, forest stand composed of pine, oak, hornbeam with mixture of maple, sycamore, lime, beech was formed in the permanent experimental plot. In 2003-2006, the Department of Forestry at UNFU and the Lviv Region Administration of Forestry and Hunting Management established 8 research-and-production centers in the hornbeam-pine, hornbeam-oak and beech forests of Lviv region, while the Department of Ecology of the same university created 22 research-and-production centers in floodplain elm-ash-oak and beech-oak forests in Transcarpathian region to test conversion felling of different types.

With the support of the *FORZA* project, the State Forestry Committee of Ukraine established the Carpathian Regional Training Center for retraining of forestry specialists, it provides the study of methods for forest management based on the principles of close-to-nature forestry.

The introduction of close-to-nature forestry is implemented through:

- gradual and systematic transition from the prevailing clear-cutting methods to the rational combination of selection and gradual methods of cutting with the formation of a complex uneven-aged structure of stands and the transition in the future mainly to the selection system of forest management in the mountain forests of the Carpathians and the Crimea, as well as an increase in the share of this management system for the forests in the plains of Ukraine;
- conducting conversion felling for gradual transformation of even-aged pure and mixed stands into uneven-aged mixed (pure – in separate forest sites), multi-storeyed forest stands, and also transformation of coppice stands into uneven-aged high forest stands.

In the Forest Fund of Ukraine, due to conducting clear felling and the creation of forest plantations, the number of uneven-aged mixed forest stands is very small. Forests of Ukraine, as a rule, are intensively farmed, converted to even-aged, often single-species tree stands:

- application in the practice of forest management of differentiated types and methods of tending felling appropriate to the forest types and target forestry programmes for forest growing;
- reviewing and amending the current normative documents, working out and adoption of new regulatory acts – Guidelines or Rules of close-to-nature forestry in Ukraine and, as their derivative normative documents, approval of differentiated systems of management in different categories of forests, development of instructions on methods for close-to-nature forestry and conversion felling for plains- and mountain forests;
- introduction of appropriate changes to the forest management system of Ukraine, provision of appropriate professional training for forest managers through seminars, trainings, establishment of stationary training trial areas, permanent reference stand areas for studying resilience, stability and productivity;
- creation of adequate forest infrastructure, including hydro-technical facilities and construction of an optimal network of forest roads as the basis for conducting an environmentally-oriented forestry;
- application of nature-conservation technologies for forest use on the basis of modern systems of vehicle, reducing the volumes of terrestrial primary transportation of timber and extended application of cableway skidding systems;
- establishment at the state-run forestry enterprises of permanent demonstration plots in virgin forests, prevailing forest

types for testing methods of close-to-nature forestry, conducting trainings for forestry specialists, heads of relevant structural divisions, forest districts and forestry departments engaged in forest management;

- conducting large-scale information and educational work aimed at promoting the principles of close-to-nature forestry through:
 - scientific, scientific and technical, popular science publications, as well as publications in the periodical press about the purpose and tasks of close-to-nature forestry;
 - organization of conferences and seminars on the subject of close-to-nature forestry;
 - studying and application of the experience of introducing close-to-nature forestry in the countries of Europe;
 - introduction of lecture courses and practical sessions on close-to-nature forestry into the educational process at higher educational institutions of forestry and ecological profile, preparation and publication of appropriate textbooks and methodological manuals for students, teachers, practitioners;
 - conducting certification of forests at state forestry enterprises as a market mechanism for introduction of environmentally-oriented forestry.

Thus, the principles and mechanisms for the introduction of close-to-nature forestry determine the system of management, which, in its most general form, corresponds to the following strategic priorities of forestry (Krynytskyi & Cherniavskiy, 2006; Verkhovna Rada Ukrainy, 2012):

- extended reproduction of forest resources in quantitative and qualitative (value) form;
- preservation and restoration of biodiversity of forests, maintenance of their stability and viability;
- rational, integrated and sustained use of forest resources;
- ensuring the effective performance of protective and social functions by forest ecosystems;
- improvement of economic efficiency of forest resources, achievement of profitability of forestry, provision of favorable conditions for the development of woodworking industry.

Certain forest certification criteria can be used to some extent as criteria for close-to-nature forest management. They are based on the main principles governing the management of forest stands, they provide an opportunity to assess the compliance of the forest management system with the established international requirements for the management of forests and forest use on the basis of sustainable development and provide for economically, ecologically and socially balanced forest management. Forest certification is also one of the key tools for implementing the principles of sustainable development in forestry (Cherniavskiy, et al., 2006; Verkhovna Rada Ukrainy, 2012).

In Ukraine, as of today, about 2.7 million hectares, that is, one quarter of the total forest area of the country, have been certified by the Forest Stewardship Council (FSC) certification system (Haida, 2015). It should be noted that such FSC criteria as forest use, environmental impact, management plan, monitoring and evaluation, conservation of especially valuable forests are most appropriate for the creation and cultivation of forests close to natural ones.

Thus, the existing set of pan-European criteria and indicators for sustainable forest management provides the basis for implementing a system of close-to-nature forestry in Ukraine that is more in line with the nature of the forest and therefore is the most promising of the ecological, economic and social components of multifunctional forestry.

Conclusions

Close-to-nature forestry is a system of forest management in which the continuous renewal and formation of forest stands, maximally similar in structure and genesis to natural ones, is achieved. The principles of this system are consistent with the strategic priorities of forestry in Ukraine.

Close-to-nature forestry provides for, on the basis of modelling of natural processes, the implementation of such a system of activities that increases the stability of forest stands and their multifunctional role with the minimum of reasonable and necessary intervention in the forest. The technology of creation and formation of forest stands is based on the cultivation of target stands depending on the objectives of management, climatic and soil-hydrological conditions, biology and ecology of the species.

The implementation of the principles of close-to-nature forestry will contribute to:

- reduction in the volume of clear felling and associated negative effects of anthropogenic, environmental and nature-conservation character.
- transition to selection, close-to-nature, system of management which ensures the cultivation of mixed uneven-aged forest stands of high vigor, productivity and biological stability;
- reducing the cost of procurement of seeds, planting material, establishment of plantations and care for them;
- continuous sustained use by population of forest resources and continuous performance by the forest of environment-forming, climate-regulating, soil-protecting, water-protecting, waterflow-regulating, recreational, sanitary-hygienic and other useful functions;
- conservation of the floristic, faunistic and landscape biodiversity of the autotrophic and heterotrophic complexes of forest ecosystems;
- mitigation of the threat of soil displacement and soil erosion, land degradation and the occurrence of catastrophic floods;
- harmonization of Ukrainian forestry standards with forestry criteria of European countries.

In general, qualitative and quantitative changes in the Forest Fund due to the introduction of close-to-nature forestry will ensure sustained obtaining of the positive environmental, economic and social effect.

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Г. Т. Криницький¹, Н. В. Чернявський¹, О. Г. Криницька¹, А. М. Дейнека², Б. І. Колісник¹, Я. П. Целень²

¹Національний лісотехнічний університет України, м. Львів, Україна

²Львівське обласне управління лісового та мисливського господарства, м. Львів, Україна

НАБЛИЖЕНЕ ДО ПРИРОДИ ЛІСІВНИЦТВО – ОСНОВА СТАЛОГО ВЕДЕННЯ ЛІСОВОГО ГОСПОДАРСТВА В УКРАЇНІ

Наближене до природи лісівництво – система організації та ведення лісового господарства, за якої досягається безперервне відновлення і формування деревостанів, максимально близьких за структурою і генезисом до природних. Методологічною основою його є 8 принципів, які оцінюють процеси відтворення і формування стійких природних різновікових лісів за безперервного лісового покриву, збереження біорізноманіття, підтримання екологічних функцій лісів, збільшення запасу насаджень і заготовку цільових дерев, екологізацію способів заготовки та трелювання деревини. Найвний набір загальноєвропейських критеріїв та індикаторів сталого ведення лісового господарства за схемами сертифікації FSC дає підставу імплементувати систему наближеного до природи лісівництва в Україні як таку, що найбільшою мірою відповідає природі лісу і тому є найперспективнішою з екологічної, економічної та соціальної компонент багатofункціонального лісівництва.

Ключові слова: багатofункціональне наближене до природи лісівництво; стале ведення лісового господарства.

ПРИБЛИЖЕННОЕ К ПРИРОДЕ ЛЕСОВОДСТВО – ОСНОВА УСТОЙЧИВОГО ВЕДЕНИЯ ЛЕСНОГО ХОЗЯЙСТВА В УКРАИНЕ

Приближенное к природе лесоводство – система организации и ведения лесного хозяйства, при которой достигается непрерывное восстановление и формирование древостоев, максимально близких по структуре и генезису к естественным. Методологической основой его является 8 принципов, которые включают оценку процессов воспроизводства и формирования устойчивых природных разновозрастных лесов при непрерывном лесном покрове, сохранение биоразнообразия, поддержание экологических функций лесов, увеличение запаса насаждений и заготовку целевых деревьев, экологизацию способов заготовки и трелевки древесины. Существующий набор общеевропейских критериев и индикаторов устойчивого ведения лесного хозяйства по схемам сертификации FSC дает основание имплементировать систему приближенного к природе лесоводства в Украине как таковую, что в наибольшей степени соответствует природе леса и потому является наиболее перспективной с экологической, экономической и социальной составляющих многофункционального лесоводства.

Ключевые слова: многофункциональное приближенное к природе лесоводство; устойчивое ведение лесного хозяйства.