International Journal of Web of Multidisciplinary Studies
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
website: https://ijwos.com
Volume 3 Issue 2 , Feb 2026
E-ISSN : 3049-2424
DOI: https://doi.org/10.71366/ijwos03022611486

Priority of Phytososological Components in the Development and Analysis of Environmental Management Plans for Logging Enterprises in the Northern Forest-Steppe of Ukraine

Oleksandr Lukash[1], Yurii Nosenok[2]
[1,2] *Department of Ecology, Geography and Nature Management, T.H. Shevchenko National University "Chernihiv Colehium", Chernihiv, Ukraine.*

Article Info

Article History:

Published:25 Feb 2026

Publication Issue:
Volume 3, Issue 2
February-2026

Page Number:
445-451

Corresponding Author:
Oleksandr Lukash

Abstract:

This study analyzes the methodological priorities for developing environmental management plans (EMP) for forest-processing enterprises in the northern Forest-Steppe of Ukraine. The research focuses on SE "Nizhynraiahrolishosp" (Nizhyn) and SE "Bobrovytsyaraiahrolishosp" (Bobrovytsya), operating in highly fragmented landscapes with a plowing rate of up to 80%. Methodologically, the study integrates ISO 14001:2015 standards with phytososological indicators to create a "biocentric management model". Results indicate that the primary environmental risks in this region are agricultural chemical drift and mechanical soil compaction during logging in sensitive habitats. Field mapping identified 46.0 ha of high-value conservation forests in Nizhyn and rare island groves in Bobrovytsya. The study highlights the critical role of Alnus glutinosa communities as hydrological filters for the Oster and Trubizh river basins. We propose the use of ephemeroids (Galanthus nivalis, Scilla siberica) as Key Performance Indicators (KPIs) for environmental audits. Methodological recommendations include the implementation of "Winter Logging Protocols" and "Total Containment Models" for centralized service stations to prevent chemical contamination of isolated forest islets. Conclusions emphasize that EMP effectiveness in agro-industrial matrices depends on the transition from timber-yield metrics to the preservation of rare botanical populations and hydrological stability.

Keywords: environmental management plan, ephemeroids, forest, Forest-steppe zone, integrated risk matrix, rare plant species, logging enterprises

1. Introduction

The new EU Forest Strategy aims to overcome these challenges and unlock the potential of forests for our future, in full respect for the principle of subsidiarity, best available scientific evidence and better regulation requirements. Forest management practices that preserve and restore biodiversity lead to more resilient forests that can deliver on their socio-economic and environmental functions. Therefore all forests should be increasingly managed so that they are sufficiently biodiverse, taking into account the differences in natural conditions, biogeographic regions and forest typology. (European Commission, 2021).

According to Spathelf (2009), the stability of forest certification depends on the auditability of management processes. In fragmented forest landscapes of the Forest-Steppe zone, ecological management shifts from industrial regulation to the preservation of island biodiversity (Keenan, 2015). For enterprises like subsidiary (SE) "Nizhynraiahrolishosp"(we will call it "Nizhyn" for short) and subsidiary (SE) "Bobrovytsyaraiahrolishosp" (we will call it "Bobrovytsya" for short), operating amidst intensive agriculture, an Environmental Management Plan (EMP) serves as a vital tool for preventing ecosystem collapse. The integration of the phytososological component – the protection of rare and endangered flora – into the EMP framework is not merely a legal requirement but a fundamental indicator of sustainable forest management (Sotirov et al., 2020).

European experience, particularly in agricultural regions of Poland and the Baltic states, demonstrates that the presence of ephemeroids such as *Galanthus nivalis* and *Scilla bifolia* can serve as a "biological filter" for evaluating the success of environmental audits (Matuszak-Flejszman et al., 2022). For logging enterprises with their own technical bases (sawmills, repair shops), the primary risk is not only technogenic pollution but also the mechanical destruction of rare habitats during logging. According to Kiviste et al. (2015) in Forestry Studies, the stability of small forest fragments depends on the "micro-reservation" method within the EMP, which prioritizes the protection of specific rare populations over standard harvesting yields.

In the northern Forest-Steppe of Ukraine, this issue is exacerbated by the high level of land plowing (up to 70-80%), where forest belts and small groves remain the sole refugia for rare species like *Lilium martagon* or *Iris hungarica*. Therefore, the development of an EMP must move beyond general ISO 14001 (ISO, 2015) guidelines toward a "biocentric management model". This model integrates phytososological mapping into every stage of the logging cycle – from selecting harvesting machinery with low soil pressure to scheduling log transport during periods of soil frost to protect bulbous plants (Watts et al., 2012).

This study aims to analyze how the inclusion of rare flora monitoring transforms the EMP from a formal document into a proactive strategy for biodiversity conservation in anthropogenically stressed landscapes.

2. Materials and Methods

2.1. Study Area and Objects

The northern forest-steppe of Ukraine is characterized by a combination of oak forests with meadow steppes on fertile gray forest soils and black earths. The research was conducted at two forestry enterprises in the northern Forest-Steppe of Ukraine, (Chernihiv region): SE "Nizhynraiahrolishosp" (6,978.1 ha accoiding to site of Nizhynraiahrolishosp (2026)) and SE "Bobrovytsyaraiahrolishosp" (approx. 7,000 ha accoding to site of Bobrovytsyaraiahrolishosp (2026)). These areas are characterized by a high degree of agricultural transformation (plowing rate up to 70-80%). The forest fund is fragmented, consisting of small groves and protective forest belts. The species composition is dominated by *Quercus robur*, *Fraxinus excelsior*, and *Pinus sylvestris* (68.8% in Bobrovytsya). Hydrologically, the areas belong to the basins of the Oster and Trubizh rivers.

2.2. Environmental Aspect Analysis

The audit included an assessment of technical facilities: 7-9 tractors, trucks, and specialized repair shops (Service Stations). For the Bobrovytsya enterprise, the operation of a sawmill and a service station was identified as a primary technogenic aspect. The assessment focused on the potential for soil contamination by fuel and lubricants and the mechanical impact of machinery on forest floor structures during harvesting operations in 4,519.6 ha of exploitative forests (Nizhyn).

2.3. Phytososological Mapping and Monitoring

The identification of rare flora was based on field surveys and the creation of "Micro-reserve maps". Key indicator species included ephemeroids (very rare *Galanthus nivalis*, rare, *Scilla bifolia*, *Scilla siberica*, relatively rare *Corydalis solida, Corydalis cava, Anemonoides nemorosa*) and rare summer-flowering species (*Lilium martagon, Iris hungarica, Digitalis grandiflora*). The structure of forest phytocenoses in habitats of rare species was studied (Fig. 1).

Figure 1 – Broad-leaved forest phytocenosis with the *Scilla siberica* ephemeral communities in SE "Bobrovytsyaraiahrolishosp"

2.4. Risk Matrix Adaptation

An integrated risk matrix was developed to link technogenic impacts (from sawmills and transport) with phytososological vulnerability. Risks were ranked using a biocentric scale, where the presence of a Red Book species population automatically elevated the priority of the compartment to "High Conservation Value" (HCV), requiring the implementation of seasonal moratoria on harvesting.

3. Results and Analysis

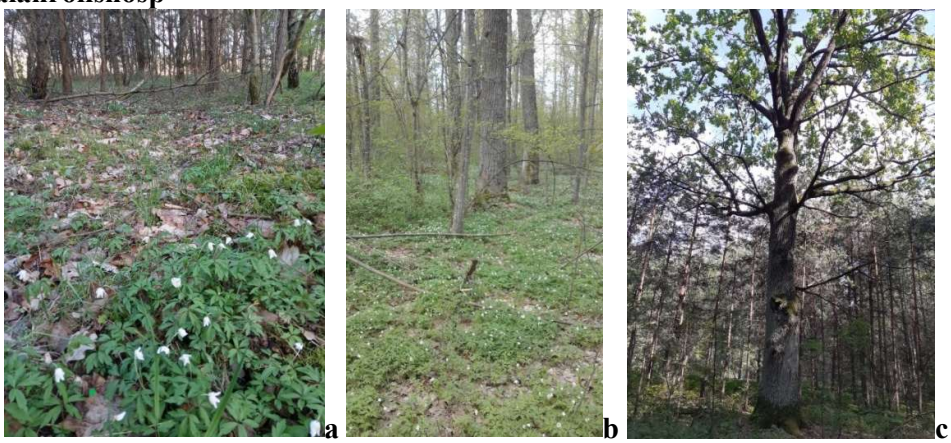
3.1. Technical Infrastructure and Environmental Aspects

The technical audit of SE "Nizhynraiahrolishosp" and SE "Bobrovytsyaraiahrolishosp" identified significant technogenic aspects related to logging and machinery maintenance. In Bobrovytsya, the presence of a centralized service station (for 7 tractors and trucks) and a sawmill adds risks of soil contamination by petroleum products and sawdust accumulation. For the Nizhyn enterprise, the primary aspect is harvesting operations within 4,519.6 ha of exploitative forests, where heavy machinery interacts with fragmented deciduous stands.

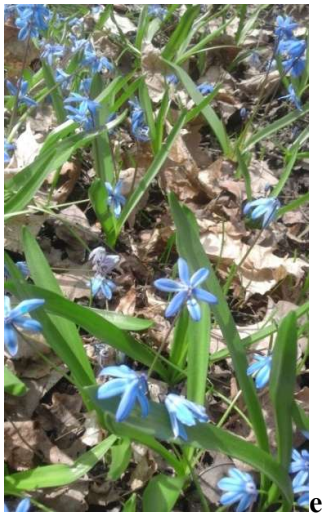
3.2. Phytososological Structure and Rare Species

Field mapping identified 46.0 ha of high-sensitivity sites, forest communities, and rare plants in Nizhyn and Bobrovytsya (Fig. 2).

Figure 2 – High-sensitivity forest communities (a, b), ancient oak tree in a mixed forest (c) in SE "Nizhynraiahrolishosp", and rare forest ephemeroids (d, e) and forest communities (f) in SE "Bobrovytsyaraiahrolishosp"



a **b** **c**


d

e

f

The phytososological value is represented by stable populations of ephemeroids (*Anemonoides nemorosa* (Fig. 2, a, b), *Galanthus nivalis (*Fig. 2, d), *Scilla bifolia*, *Scilla siberica* (Figures 1; 2, e), *Corydalis solida, Corydalis cava*) and rare summer-flowering species (*Lilium martagon, Iris hungarica, Inula helenium, Digitalis grandiflora*). In Bobrovytsya, the presence of *Lilium martagon* and rare communities of *Carpinus betulus* within small forest islands was documented. These species act as bio-indicators for the EMP, as their survival depends on soil integrity and hydrological stability.

3.3. Biocentric Risk Matrix for Forest-Steppe

Based on the synthesis of technical and biological data, an integrated risk matrix was developed (Table 1). Unlike the Polissya region, the dominant risk here is agricultural chemical drift from neighboring fields and mechanical soil compaction in rare plant habitats.

Table 1 – Integrated Risk Matrix based on Phytososological Vulnerability

Source of Risk	Ecological Consequence	Priority
Agricultural Chemistry	Pesticide drift affecting forest entomofauna and flora	High
Logging in Ephemeroid Habitats	Destruction of bulbs and seeds by heavy machinery	Critical
Technogenic Spills (Service Station)	Local soil contamination with petroleum products	Medium
Hydrological Changes	Drying of alder swamps (*Alnus glutinosa*) due to field drainage	High

4. Discussion

4.1. The "Forest Island" Concept and Agricultural Chemical Drift

In the northern Forest-Steppe of Ukraine, the EMP methodology for enterprises like SE "Nizhynraiahrolishosp" must address the unique "island" configuration of forest stands. Unlike the continuous massifs of Polissya, these fragmented groves (islands) and forest belts (corridors) are under constant pressure from surrounding agro-industrial activities. Our results indicate that agricultural chemical drift (pesticides and fertilizers) from adjacent fields is a high-priority risk. According to Wicklein et al. (2012), the edge effect in

small forest patches significantly alters the microclimate and chemical composition of the forest floor. We argue that the EMP should include "green buffer zones" where the use of machinery is restricted to minimize the penetration of agrochemicals into the core habitats of *Lilium martagon* and *Iris hungarica.*

4.2. Phytososological Key Performance Indicators: Ephemeroids and Seasonal Management

A key methodological innovation proposed in this study is the use of synusia of spring ephemeroids (*Anemonoides nemorosa, Anemone ranunculoides*, *Galanthus nivalis*, *Scilla bifolia*, *Scilla siberica*, *Corydalis solida, Corydalis cava*) as key performance indicators (KPIs) for environmental audits. Traditional EMPs often neglect the phenological cycles of the forest floor. However, in the conditions of Nizhyn and Bobrovytsya, mechanical soil compaction during spring logging poses a terminal threat to bulbous plants. As highlighted by Oettel & Lapin (2021), the success of forest management in protected or sensitive areas is directly linked to the micro-reservation of indicator species. We propose that the EMP should mandate Winter Logging Protocols – shifting timber transport to periods of soil frost. Winter logging protocols focus on leveraging frozen ground to minimize soil compaction and damage to sensitive sites, often requiring advanced, multi-season planning. Key practices include using slash for trail reinforcement, operating in extreme cold, utilizing specialized winter-grade lubricants, and preparing for shorter, more variable seasons (US Forest Service, n. d.). This adjustment ensures the physical integrity of the soil seed bank and bulbs, transforming the EMP from a formal document into a proactive tool for biodiversity resilience.

4.3. Industrial Waste and Logging

The integration of technical maintenance facilities, such as the centralized Service Station (STO) at the Bobrovytsya enterprise, into the EMP structure represents a significant technogenic challenge for fragmented forest-steppe landscapes. Unlike Polesia's vast massifs, where localized spills might have a diluted effect, the proximity of the Bobrovytsya service hub to isolated forest "islands" (islets) increases the risk of concentrated chemical soil pollution. Our analysis shows that the primary risk arises from the improper management of waste oils and filtration residues. We argue that for Forest-Steppe enterprises, the EMP must shift from simple "waste storage" to a "total containment model". This includes the mandatory installation of hydrocarbon separators and the use of biodegradable chain lubricants for all 24 chainsaws operating in proximity to sensitive habitats of *Iris hungarica* and *Lilium martagon*.

4.4. Hydrological Buffers: Alder Swamps as Barriers to Agro-Chemical Runoff

A critical finding of our study is the role of *Alnus glutinosa* communities as "ecological filters" in the heavily agriculturalized Nizhyn and Bobrovytsya districts.

Figure 3 – *Alnus glutinosa* communities as hydrological filters in the Oster river floodplain

The EMP methodology should prioritize the preservation of these alder swamps not only as biodiversity hotspots for rare ferns like Dryopteris cristata but as hydrological buffers protecting the Oster and Trubizh river basins from nitrate and pesticide runoff. According to Nijnik et al. (2009), the functional value of riparian forests in agricultural interfaces is often undervalued in traditional forestry audits. We propose that the updated EMP classify these wetlands as "critical ecosystem infrastructure", where any drainage or canal cleaning operations on adjacent agricultural lands must be strictly de-conflicted with the forest's hydrological requirements. Maintaining the groundwater table is the only effective way to prevent the secondary dieback of oak-ash stands and ensure the survival of rare botanical populations at their geographic limits.

5. Conclusion

Developing EMPs for forest enterprises in the northern Forest-Steppe requires a transition from industrial-centric to biocentric management. The effectiveness of the plan should be measured not by timber output, but by the stability of rare flora populations (in particular, species are listed in the Red Book of Ukraine such as *Galanthus nivalis* and *Lilium martagon*), which act as biological indicators of soil and microclimatic integrity.

The "forest island" configuration of the region dictates the necessity of Winter Logging Protocols. Methodologically, shifting harvesting operations to periods of soil frost is the only effective way to prevent the mechanical destruction of the seed and bulb bank of spring ephemeroids.

Centralized technical facilities, such as the service station in Bobrovytsya, must be managed under a "total containment model". The proximity of technogenic hubs to isolated forest fragments requires the mandatory installation of oil separators and the use of biodegradable lubricants to prevent irreversible chemical degradation of small-grove ecosystems.

Hydrological buffering must be a core component of the EMP. The preservation of *Alnus glutinosa* swamps is essential for protecting transboundary river basins from agricultural runoff. Any drainage operations on adjacent farmlands must be strictly regulated within the EMP to maintain the groundwater levels necessary for rare plant communities.

In anthropogenically stressed landscapes, the EMP transforms into a social-ecological contract. Success depends on active communication with agro-enterprises regarding chemical drift and the involvement of local communities in protecting "micro-reservations" of rare flora and vegetation.

References

1. Bobrovytsyaraiahrolishosp. (2026). *Official website of the SE "Bobrovytsyaraiahrolishosp"*. https://bobrovitsya.chor-lis.com.ua/
2. European Commission. (2021). New EU Forest Strategy for 2030. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0572
3. ISO. (2015). *ISO 14001:2015 Environmental Management Systems – Requirements with Guidance for Use*. International Organization for Standardization. https://www.iso.org/obp/ui/#iso:std:iso:14001:ed-3:v1:en
4. Keenan, R. J. (2015). Climate Change Impacts and Adaptation in Forest Management: A Review. Annals of Forest Science, 72, 145-167. https://doi.org/10.1007/s13595-014-0446-5
5. Kiviste, A., Hordo, M., Kangur, A., Kardakov, A., Laarmann, D., Lilleleht, A., Metslaid, S., Sims, A., Korjus, H. (2015). Monitoring and modeling of forest ecosystems: the Estonian Network of Forest Research Plots. *Forestry Studies, 62*, 26–38.
6. Matuszak-Flejszman, A., & Paliwoda, B. (2022). Effectiveness and Benefits of the Eco-Management and Audit Scheme: Evidence from Polish Organisations. *Energies*, *15*(2), 434. https://doi.org/10.3390/en15020434

7. Nijnik, M., Zahvoyska, L., Nijnik, A., & Ode, A. (2009). Public evaluation of landscape content and change: several examples from Europe. *Land Use Policy*, 26(1), 77–86. https://doi.org/10.1016/j.landusepol.2008.03.001.
8. Nizhynraiahrolishosp. (2026). *Official website of the SE "Nizhynraiahrolishosp"*. https://nizhen.chorlis.com.ua/
9. Oettel, J., Lapin, K. (2021). Linking forest management and biodiversity indicators to strengthen sustainable forest management in Europe. *Ecological Indicators 122*, 107275. https://doi.org/10.1016/j.ecolind.2020.107275
10. Sotirov, M., Pokorny, B., Kleinschmit, D., & Kanowski, P. (2020). International Forest Governance and Policy: Institutional Architecture and Pathways of Influence in Global Sustainability. *Sustainability*, *12*(17), 7010. https://doi.org/10.3390/su12177010
11. Spathelf, P. (2009). *Sustainable forest management in a changing world: a European perspective*. Springer.
12. US Forest Service. (n. d.). *Winter logging for mechanical harvesting and fuel treatment operations*. https://www.fs.usda.gov › pubs_journals › rmrs_2020_nash_m001
13. Watts, C. M, Pile, L. S., Straka, T. J. (2012). Ecosystem services of forests: a systematic review. *Sustainability: Science, Practice and Policy*, *6*(1), 1–15. https://doi.org/10.4236/ojf.2012.23019
14. Wicklein, H. F., Christopher, D., Carter, M. E., Smith, B. H. (2012). Edge effects on sapling characteristics and microclimate in a small temperate deciduous forest fragment. *Natural Areas Journal, 32*(1):110–116. https://doi.org/10.3375/043.032.0113