SCIENTIFIC HORIZONS
Journal homepage: https://sciencehorizon.com.ua
Scientific Horizons, 28(12), 41-54
UDC 630.181(477) DOI: 10.48077/scihor12.2025.41

Analysis of the typological structure of forests in western Ukraine

Oleksandr Bondar*
PhD in Agricultural Sciences
West Ukrainian National University
46009, 11 Lvivska Str., Ternopil, Ukraine
https://orcid.org/0000-0002-3448-8943

Anatolii Vyshnevskyi
PhD in Agricultural Sciences
Polissia National University
10008, 7 Staryi Blvd., Zhytomyr, Ukraine
https://orcid.org/0000-0001-5381-1219

Yevhen Melnyk
PhD in Agricultural Sciences
Ukrainian Research Institute of Forestry and Forest Melioration named after H.M. Vysotskyi
61024, 86 Hryhorii Skovoroda Str., Kharkiv, Ukraine
https://orcid.org/0000-0002-9821-2751

Ihor Halahan
PhD in Pedagogical Sciences
Kremenets Taras Shevchenko Regional Academy of Humanities and Pedagogy
47003, 1 Litseina Str., Kremenets, Ukraine
https://orcid.org/0000-0002-0555-6548

Article's History:
Received: 12.05.2025
Revised: 20.10.2025
Accepted: 26.11.2025

Abstract. The aim of the study was to conduct an ecological and typological assessment of forest site conditions across eight administrative oblasts of western Ukraine and to identify regional differences in the proportions of trophotopes and stand types. The classification of forest types was carried out using the silvicultural-ecological scale of forest typology based on state forest inventory materials. Comparative analysis, typological grouping and statistical data processing were applied to determine the areas, proportions and structural features of forest types. The distribution of the area of land covered with forest vegetation across four soil fertility groups was analysed, which made it possible to identify the dominance of sugrud and grud site conditions in the mountainous parts of the region. It was established that the largest areas of sugruds were concentrated in Ivano-Frankivsk and Zakarpattia oblasts, whereas bor and subor complexes remained substantial in Volyn and Rivne oblasts. The number of delineated forest types ranged from 29 in Ternopil Oblast to 89 in Ivano-Frankivsk Oblast, reflecting the contrast of the region's natural conditions. The typological structure

Suggested Citation:
Bondar, O., Vyshnevskyi, A., Melnyk, Ye., & Halahan, I. (2025). Analysis of the typological structure of forests in western Ukraine. *Scientific Horizons*, 28(12), 41-54 doi: 10.48077/scihor12.2025.41.

*Corresponding author

of individual oblasts was detailed and the diversity of the Carpathian sector was demonstrated, where various variants of beech forests, sub-beech forests and suyalychnyk forest types predominated, indicating the combined effects of altitudinal zonation and moisture gradients. It was found that the Polissia sector was characterised by a concentration of areas in oak-pine subors and black alder sugruds, which formed a core of hydrological and biotic stability. It was generalised that the Podillia oblasts were typified by a simpler typological spectrum with the dominance of hornbeam and oak oakwoods, correlating with more homogeneous soil and climatic conditions. The practical value of the results was associated with their potential use by forestry enterprises and nature conservation institutions to substantiate measures for sustainable forest management, stand restoration and the zoning of recreational pressure

Keywords: forest site conditions; typological structure; edaphic grid; trophotopes; hygrotopes; beech communities; oak-pine subors

INTRODUCTION

The typological structure of forests in western Ukraine was a fundamental scientific category upon which the validity of decisions regarding protection, regeneration and economic use of the forest estate depended under conditions of increasing climatic risks and growing anthropogenic pressure. The region combined Polissia lowland complexes, forest-steppe landscapes and the mountainous ecosystems of the Carpathians, which formed a highly mosaic pattern of forest site conditions and required an accurate typological description to maintain water-regulating, soil-protective and biodiversity functions. Existing forest inventory practices and adaptive planning could not be sufficiently effective without refining the spatial distribution of trophotopes, hygrotopes and forest types, as well as without comparing the national typological scale with approaches embedded in European classifications, which gained importance for integrating Ukrainian forest science into international monitoring and reporting systems.

In recent research, typological approaches were actively associated with assessments of forest resilience to disturbances and climatic extremes. J. Altman *et al.* (2024), using global observations, showed that the configuration and intensity of forest disturbances changed under the influence of climatic shifts, which emphasised the need for regionally detailed typological models capable of explaining the unequal sensitivity of different forest formations to stress factors. Similar conclusions were presented by M. Gharun *et al.* (2024), who demonstrated that the response of European forests to extreme drought substantially depended on forest type and site conditions; therefore, typological refinement could serve as a tool for forecasting risks in both mountainous and lowland regions. The development of European classifications acquired new meaning in the study by J.I. Barredo *et al.* (2024), who proposed an archetypal typology of European forest ecosystems that accounted for management intensity and naturalness, thereby creating a methodological bridge for aligning Ukrainian typological units with international frameworks for assessing ecosystem services. In this context, the results of N. Scherpenhuijzen *et al.* (2025) were important, as they demonstrated the possibilities of mapping forest management regimes in Europe and stressed the need for a homogeneous ecological classification as a prerequisite for comparative analyses of management practices.

Studies focused on western Ukraine specified the role of typology as a basis for building climate-resilient regeneration models. According to P. Spathelf *et al.* (2024), the first results of alternative natural regeneration systems in western Ukraine indicated that the success of stand renewal was substantially determined by the type of forest site conditions and by the correspondence of tree species to local edaphic and climatic characteristics, which reinforced the value of precise typological grouping in regional planning. Ukrainian authors O.I. Holubchak *et al.* (2024), within an analysis of protective forests of the Carpathians, emphasised that the typological mosaic of mountainous territories shaped different levels of anti-erosion and water-regulating effectiveness of stands; therefore, any management decisions had to rely on a detailed description of sugrud and grud site conditions within the vertical profile. An important economic and ecological dimension was highlighted by V. Moroz (2024), who showed that the bioproductivity of pine stands in Polissia correlated with site types and moisture regime, which was relevant for the northern oblasts of the studied region where bor and subor complexes formed dominant spatial units. The monitoring dimension of typological research was presented by V. Myroniuk and V. von Dosky (2024), who, based on an analysis of the dynamics of forest attributes in 2019-2023, demonstrated the prospects of integrating inventory and remote data to refine spatial changes in stands with regard to their typological affiliation. From the perspective of more narrowly focused formation studies, V. Lavnyy and O. Matusevych (2022) established regularities of the productivity of spruce forests of the Ukrainian Carpathians across different forest types and stressed the need to align species composition with edaphic parameters to reduce the risks of degradation of secondary spruce stands. A synthetic view of the biological consequences of climate change was offered by V. Skliar *et al.* (2025), who under-

lined those species-specific adaptive responses of tree species required linkage to forest site conditions, since these determined resilience thresholds and potential trajectories of changes in stand composition.

Thus, existing studies provided a methodological and empirical basis for a regionally oriented typological interpretation of the forests of western Ukraine, while simultaneously indicating the need for a harmonised spatial analysis of eight oblasts using state forest inventory materials and contemporary approaches to typological grouping. The aim of this study was to refine regional patterns in the distribution of forest site condition types and forest types within western Ukraine.

MATERIALS AND METHODS

For the analysis of the typological structure of forests in western Ukraine, methodological approaches of the silvicultural-ecological school of forest typology were used (Ostapenko & Tkach, 2002). The classification of stands was carried out according to forest site condition types and forest types. A forest site type was defined as a unit of the edaphic grid constructed on the basis of the coordinates of soil moisture and soil fertility. At this stage, the typological structure of forests was assessed primarily by trophotopes (A–D: bor, subor, sugrud, grud) and by the most representative forest types across the administrative oblasts. The hygrotope distribution was not detailed in this section. Forest types were treated as geographical forms of a forest site type that differed in the composition of forest-forming tree species. The formation of a forest type was associated with climatic conditions and the history of the development of the modern flora. When conditions for natural woody vegetation were unfavourable, forest types were replaced by steppe, meadow or desert types. Different forest types that varied in composition but were dominated by one principal tree species formed an additional taxon, the family (group) of forest types (Pohrebnyak, 1993).

The study region included the following administrative oblasts: Volyn (1), Rivne (2), Lviv (3), Ternopil (4), Khmelnytskyi (5), Zakarpattia (6), Ivano-Frankivsk (7) and Chernivtsi (8), as presented on the schematic map (Fig. 1). The geographical coordinates of the extreme points of the region were as follows: north – 25°15'33", 51°58'09"; south – 24°53'05", 47°43'26"; west – 22°08'31", 48°25'43"; east – 27°54'05", 49°11'10" (Fig. 1).

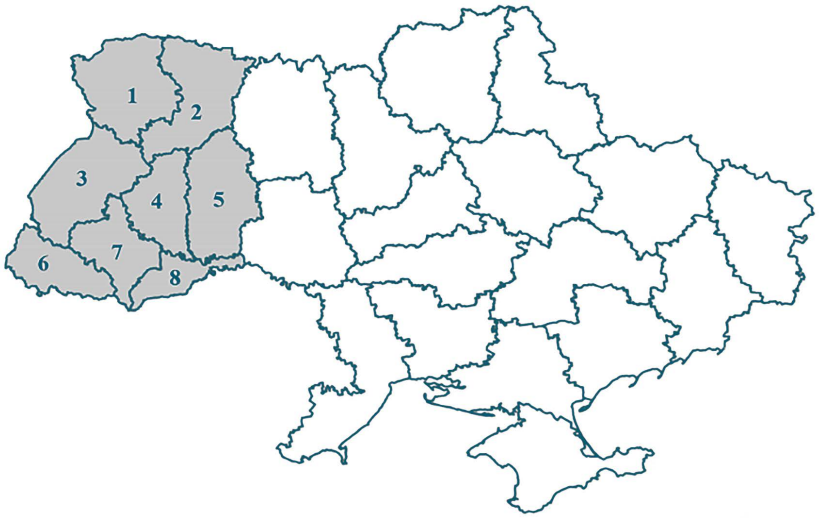

Figure 1. *Schematic map of the study region*
Source: *compiled by the authors based on forest inventory materials of UKRDERZHISPROEKT (n.d.)*

The data for the study were obtained from the electronic database of UKRDERZHISPROEKT (n.d.), which was converted from the ".vff" format into the ".mdb" format of the MS Access software product using the NewUnPackOHOTA programme developed in the Laboratory of New Information Technologies of UkrNDILHA. For subsequent calculations, the required data were exported into the ".xls" format of Microsoft Excel 2019. MapInfo Professional 12.5 beta was used to produce the map and the schematic representation of the study area. The analysis of statistical materials and the calculation of additional indicators were carried out using Microsoft Excel 2021.

RESULTS AND DISCUSSION

The analysis of forest site condition types in western Ukraine was an important stage for assessing the state of forest ecosystems and determining the potential of natural resources in the region. Forest site conditions, which included diverse types of forests, shrubs and herbaceous covers, had a direct impact on biodiversity as well as on forestry practice and nature conservation activities. The assessment of forest site condition types by the number of units and by area, using the example of eight administrative oblasts of western Ukraine (Volyn, Zakarpattia, Ivano-Frankivsk, Lviv, Rivne, Ternopil, Khmelnytskyi and Chernivtsi), made it possible to

examine their silvicultural specificity in greater detail, the influence of climatic conditions and geographical factors, and their use in agriculture and forestry.

The distribution of forest areas by soil fertility (trophotopes) in western Ukraine was an important indicator for determining the significance of different vegetation types for forest management and environmental conservation. Among the studied oblasts of western Ukraine, sugrud occupied the largest area and was widely represented in Ivano-Frankivsk (298.6 thousand ha) and Zakarpattia (205.3 thousand ha) oblasts. These areas confirmed the substantial role of these forests in mountainous regions, where sugrud communities covered large spaces and created ecologically stable conditions for the development of flora and fauna (Table 1). The distribution of areas by trophotopes was formed by aggregating forest inventory data across oblasts and soil fertility groups in accordance with the edaphic grid.

***Table 1**. Distribution of forest area in the oblasts of western Ukraine by trophotopes*

Oblast	Trophotope								Total
	A – bor		B – subor		C – sugrud		D – grud		
	thousand ha	%	thousand ha	%	thousand ha	%	thousand ha	%	thousand ha
Volyn	68.9	15.8	171.5	39.2	173.9	39.8	22.5	5.2	436.8
Rivne	103.8	17.8	288.5	49.4	162.1	27.7	29.8	5.1	584.2
Lviv	2.1	0.5	45.4	10.6	170.0	39.7	210.6	49.2	428.2
Ternopil	0.1	0.1	6.1	3.2	26.8	13.8	160.1	82.9	193.1
Khmelnytskyi	0.7	0.5	17.6	12.7	43.6	31.7	75.8	55.1	137.6
Zakarpattia	-	-	1.9	0.4	205.2	44.5	254.1	55.1	461.2
Ivano-Frankivsk	1.4	0.3	22.4	5.3	298.6	70.1	103.3	24.3	425.8
Chernivtsi	-	-	1.4	0.9	66.6	42.3	89.3	56.8	157.3

***Source:** compiled by the authors*

D – grud occupied a substantial area, with the highest values recorded in Zakarpattia Oblast (254.1 thousand ha), which reflected the dominance of grud forest communities in the foothill and mountain zones with corresponding trophic soil characteristics. A – bor and B – subor covered smaller areas, yet they remained important for forest management because their distribution supported the conservation of forest ecosystem diversity. The most extensive bor areas were represented mainly in Rivne (103.8 thousand ha) and Volyn oblasts (68.9 thousand ha), which was consistent with the presence of forests dominated by pine.

The analysis of forest ecosystems in Volyn Oblast indicated considerable diversity of forest types. Their total number reached 47, which illustrated the richness of the oblast's forest ecosystems. In particular, 4 forest types were identified within bor, 10 within subor, 22 within sugrud, and 8 within grud. The most widespread forest types were the fresh oak-pine subor (15.9%) and the moist oak-pine subor (16.4%). A large share of approximately 11.0% of the total area of forest-covered land was also accounted for by the fresh pine bor and the wet black alder sugrud. These forest ecosystems, characterised by different levels of soil moisture and fertility, formed the basis of ecological stability in the region and played an important role in maintaining biodiversity, the water balance and the regulation of local climatic conditions. The proportion of relatively common forest types, including the dry pine bor (2.4%), wet oak-pine subor (3.7%), fresh hornbeam-oak-pine sugrud (4.7%), moist hornbeam sub-oak forest (3.7%), moist hornbeam-oak-pine sugrud (6.2%), moist hornbeam-pine sub-oak forest (5.1%), drained wet black alder sugrud (3.1%) and the fresh hornbeam oak forest (4.2%), ranged from 2% to 7% of the total forest area. These forest ecosystems represented important elements of the forest cover that shaped the landscape structure of the region and supported the ecological and economic processes of the territory. The total share of the least widespread forest types, including the moist pine bor (1.2%), drained wet oak-pine subor (1.6%), fresh hornbeam oak forest (1.7%) and the fresh hornbeam-pine oak forest (1.0%), amounted to 5.5% of the total area. These forest ecosystems were characterised by more stable water conditions, which made them important for creating optimal conditions for the growth and development of forest plants and animals and for conserving biodiversity (Table 2). The remaining 31 forest types occupied 7.1% of the total forest area and played an important role in maintaining ecological balance. They represented specific landscapes and locally distributed plant formations that were essential for the conservation of the natural environment.

***Table 2**. Distribution of forest area in Volyn Oblast by forest types*

Forest type name	Index	Area, ha	%
Dry pine bor	A_1-C	10,335.9	2.4
Fresh pine bor	A_2-C	48,072.6	11.0
Moist pine bor	A_3-C	5,454.2	1.2

Table 2. Continued

Forest type name	Index	Area, ha	%
Fresh oak-pine subor	B_2-дС	69,259.6	15.9
Moist oak-pine subor	B_3-дС	71,681.2	16.4
Wet oak-pine subor	B_4-дС	16,255.4	3.7
Drained wet oak-pine subor	B_4-дС^{о}	7,190.0	1.6
Fresh hornbeam sub-oak forest	C_2-гД	7,632.3	1.7
Fresh hornbeam-oak-pine sugrud	C_2-гдС	20,431.5	4.7
Fresh hornbeam-pine sub-oak forest	C_2-гсД	4,222.8	1.0
Moist hornbeam sub-oak forest	C_3-гД	16,119	3.7
Moist hornbeam-oak-pine sugrud	C_3-гдС	27,194.6	6.2
Moist hornbeam-pine sub-oak forest	C_3-гсД	22,200	5.1
Wet black alder sugrud	C_4-Влч	47,876.3	11.0
Drained wet black alder sugrud	C_4-Влч^{о}	13,360.5	3.1
Fresh hornbeam oak forest	D_2-гД	18,418.7	4.2
Other		31,133.3	7.1
Total		436,837.9	100.0

Source: *compiled by the authors*

The Zakarpattia Oblast exhibited a very high diversity of forest types, which reflected the substantial ecological resources of the region. The total number of forest types reached 85, of which no forest types were identified within bor, whereas 11 forest types occurred within subor, 41 forest types within sugrud, and 33 forest types within grud (Table 3). The largest share of the forested area was occupied by the moist pure beech forest, which accounted for 21.8% of the total forest area. This forest type played a key role in regulating the regional water balance and forming stable conditions for the development of plant and animal communities. Also highly represented were the moist pure sub-beech forest (11.5%) and the moist beech-fir suyaluchnyk (10.5%). These ecosystems were typical of moderately moist conditions and were essential for maintaining equilibrium between forest vegetation and ecological processes. The areas of the moist hornbeam beech forest (5.9%) and the fresh pure beech forest (5.6%) were slightly smaller yet still widespread. These forest habitats were important for biodiversity conservation in the region due to the variety of plant and animal species adapted to fluctuating moisture regimes.

Table 3*. Distribution of forest area in Zakarpattia Oblast by forest types*

Forest type name	Index	Area, ha	%
Fresh pure beech forest	D_2-Бк	25,756.9	5.6
Fresh beech sub-oak forest of rocky habitats	D_2-бкД^{с}	5,749	1.2
Fresh hornbeam beech forest	D_2-гБк	20,315.4	4.4
Moist pure beech forest	D_3-Бк^{ч}	100,555.8	21.8
Moist beech-fir suyaluchnyk	D_3-бк-яцЯл	15,655.5	3.4
Moist fir-beech forest	D_3-ял-яцБк	9,460.5	2.1
Moist hornbeam beech forest	D_3-гБк	27,207.6	5.9
Moist hornbeam sub-oak forest	D_3-гД	8,396.9	1.8
Moist fir beech forest	D_3-яцБк	6,756.4	1.5
Moist fir-beech forest (variant)	D_3-ял-яцБк	11,450.3	2.5
Fresh hornbeam sub-beech forest	C_2-гБк	6,052.1	1.3
Moist pure sub-beech forest	C_3-Бк^{ч}	53,060.8	11.5
Moist beech-fir sugrud	C_3-бк-яцЯл	48,469.7	10.5
Moist beech sugrud	C_3-бкЯл	11,689.2	2.5
Fresh beech-fir sugrud	C_3-бк-яцЯл	7,740.8	1.7
Moist hornbeam sugrud	C_3-гБк	14,580.9	3.2
Moist pure sugrud	C_3-Я^{ч}	13,970.5	3.0
Moist fir sugrud	C_3-ялБк	4,770.6	1.0
Moist fir-beech sub-beech forest	C_3-ял-яцБк	11,560.2	2.5
Other		58,026.8	12.6
Total		461,225.9	100.0

Source: *compiled by the authors*

The proportion of commonly represented forest types – including the moist beech-fir suyaluchnyk (3.4%), moist spruce–fir beech forest (2.5%), moist hornbeam oak forest (1.8%), moist fir beech forest (1.5%), moist spruce–fir beech forest (2.5%), moist beech sugrud (2.5%), moist hornbeam sub-beech forest (3.2%), moist pure sugrud (3.0%), moist spruce sub-beech forest (1.0%), and the moist spruce-fir sub-beech forest (2.5%) – is comparatively smaller; nevertheless, these ecosystems play a key role in ensuring the stability of forest habitats. They support essential ecological functions, including erosion control and regulation of the hydrological regime, thereby contributing to the preservation of forested landscapes and maintaining regional ecosystem resilience, particularly under changing climatic conditions. The remaining 66 forest types, which together occupy 12.6% of the forest area, are the least widespread yet critically important for the conservation of rare plant and animal species. Thus, the forest ecosystems of Zakarpattia Oblast – dominated primarily by various forms of beech forests, hornbeam beech forests, and sub-beech forests – ensure key ecological functions, including water balance regulation, biodiversity maintenance, and landscape stability.

Analysis of forest ecosystems in Rivne Oblast indicates a substantial diversity of forest types. Their total number reaches 46, reflecting the richness of the region's forest ecosystems. Within this structure, bor includes 7 forest types, subor contains 12, sugrud comprises 21, and grud includes 6 forest types. The most widespread forest type in Rivne Oblast is the moist oak-pine subor (21.9%), which plays a critical role in hydrological regulation, maintaining a stable water balance, and supporting biodiversity conservation. The fresh oak-pine subor (12.0%), wet oak-pine subor (9.1%), and the moist hornbeam-oak-pine sugrud (8.4%) also occupy substantial areas and are highly significant for ecological stability. These forest types help maintain soil fertility, reduce erosion risk, and regulate groundwater levels.

The proportion of other widely distributed forest types – such as the fresh hornbeam-oak-pine sugrud (5.0%), dry pine bor (2.2%), moist pine bor (2.2%), wet birch-pine subor (3.0%), fresh hornbeam oak forest (3.3%), moist hornbeam sugrud (2.0%), moist fir-hornbeam beech forest (3.5%), moist beech-fir sugrud (3.0%), wet oak-pine subor (2.5%), and the moist hornbeam-pine oak forest (3.2%) – varies between 2-5% of the total forest area. These types contribute significantly to ecological stability and biodiversity support. Forest types such as the moist oak-pine subor with azalea (0.9%) and the wet oak-pine subor with azalea (0.2%) possess particular ecological importance due to the presence of rare plant assemblages, including species threatened with extinction. Additional forest types – including the wet pine bor (1.3%), moist pine bor (2.4%), wet oak-pine subor drained (1.6%), moist hornbeam oak forest (1.7%), wet hornbeam-oak-pine sugrud (1.3%), wet alder sugrud drained (1.5%), wet alder sugrud (6.3%), and the wet alder sugrud (1.3%) – play an essential role in supporting wetland ecosystems, regulating water levels, and maintaining habitat functions crucial for rare flora and fauna (Table 4).

Table 4. *Distribution of forest area in Rivne Oblast by forest types*

Forest type name	Index	Area, ha	%
Dry pine bor	A_1-С	12,728.9	2.2
Fresh pine bor	A_2-С	54,919.2	9.4
Moist pine bor	A_3-С	12,878.4	2.2
Wet pine bor	A_4-С	7,364.7	1.3
Marshy pine bor	A_5-С	14,089.4	2.4
Fresh oak-pine subor	B_2-дС	70,281.1	12.0
Moist oak-pine subor	B_3-дС	127,872.6	21.9
Moist oak-pine subor with azalea	B_3-дСа	5,324.8	0.9
Wet oak-pine subor	B_4-дС	53,025.7	9.1
Wet oak-pine subor with azalea	B_4-дСа	1,362.2	0.2
Wet oak-pine subor drained	B_4-дС°	9,155.6	1.6
Wet birch-pine subor	B_5-бС	17,329.2	3.0
Fresh hornbeam oak forest	D_2-гД	19,219.3	3.3
Moist hornbeam oak forest	D_3-гД	10,111.1	1.7
Fresh hornbeam-oak-pine sugrud	C_2-гдС	29,099.7	5.0
Moist hornbeam sugrud	C_3-гД	11,497.3	2.0
Moist hornbeam-oak-pine sugrud	C_3-гдС	48,961.4	8.4
Wet alder sugrud drained	C_4-Влч°	8,950.6	1.5
Wet alder sugrud	C_4-Влч	36,824.6	6.3
Wet hornbeam-oak-pine sugrud	C_4-гдС	7,738.1	1.3
Moist alder sugrud	C_5-Влч	7,403.7	1.3
Other		18,038.4	3.1
Total		584,176	100.0

Source: *compiled by the authors*

The remaining 26 forest types, which together occupy 3.1% of the total forest area, belong to the least widespread categories; however, they also play an important role in maintaining ecological balance, supporting biodiversity, and protecting soil and water resources. Thus, the forest ecosystems of Rivne Oblast, characterised by a considerable diversity of forest types, perform complex ecological functions that contribute to biodiversity conservation, water balance regulation, and landscape stability. Although the forest types occupying smaller areas are less common, they are essential for maintaining ecological equilibrium and ensuring the resilience of forest ecosystems in the region.

The forest ecosystems of Ternopil Oblast demonstrate a moderate diversity of forest types. The total number of forest types reaches 29, indicating some level of variability but representing the lowest value among the analysed regions. Within this structure, bor contains 3 forest types, subor includes 5, sugrud comprises 10, and grud contains 11 forest types (Table 5). The fresh hornbeam oak forest (48.2%) is the most widespread forest type in Ternopil Oblast. This forest type is essential for maintaining hydrological stability and supporting species diversity adapted to the specific conditions of hornbeam-dominated ecosystems. The fresh hornbeam-beech forest (9.5%), fresh hornbeam oak forest (8.4%), fresh hornbeam-oak sugrud (5.4%), and the fresh hornbeam sub-oak forest (4.9%) also occupy significant areas and play important roles in shaping the region's landscape structure. The moist hornbeam oak forest (11.4%), moist hornbeam beech forest (1.1%), moist hornbeam-beech forest (3.5%), and moist hornbeam-oak sugrud (1.2%) are critical for ecosystem stability, particularly under elevated soil moisture conditions. These ecosystems play key roles in maintaining water balance and regulating water exchange within forested landscapes. The proportion of the fresh oak-pine subor (2.9%) and the dry oak forest (1.0%) is also notable, while the combined area of the remaining 18 forest types reaches only 2.4%. Despite their limited spatial coverage, these forest types support ecological stability by preserving landscape integrity, biodiversity, and performing essential functions related to water regulation and soil protection.

***Table 5**. Distribution of forest area in Ternopil Oblast by forest types*

Forest type name	Index	Area, ha	%
Fresh oak-pine subor	B_2-дС	5,587.4	2.9
Fresh hornbeam beech forest	D_2-гБк	16,308	8.4
Fresh hornbeam-beech oak forest	D_2-гбД	18,298.4	9.5
Fresh hornbeam oak forest	D_2-гД	93,169.7	48.2
Moist hornbeam beech forest	D_3-гБк	2,220	1.1
Moist hornbeam-beech oak forest	D_3-гбкД	6,818.9	3.5
Moist hornbeam oak forest	D_3-гД	22,039.5	11.4
Dry oak forest	C_1-Д	1,974	1.0
Fresh hornbeam sub-oak forest	C_2-гД	9,409.7	4.9
Fresh hornbeam-oak sugrud	C_2-гдС	10,383.9	5.4
Moist hornbeam-oak sugrud	C_3-гдС	2,313.9	1.2
Other		4,590.3	2.4
Total		193,113.7	100.0

***Source:** compiled by the authors*

In general, the forest ecosystems of Ternopil Oblast, represented by various types of hornbeam and oak forests, play a key role in maintaining the stability of ecological processes. The most widespread forest types, particularly the fresh hornbeam oak forest, ensure important ecological functions, including regulation of the water balance, preservation of biodiversity, and landscape stability.

The forest ecosystems of Lviv Oblast are characterised by a high diversity of forest types. The total number of forest types reaches 81, which indicates substantial ecological variability in the region. Within this structure, bor includes 5 forest types, subor contains 9, sugrud comprises 27, and grud includes 40 forest types (Table 6). Among such a large number of forest types, seven principal types dominate the region: the moist oak-pine subor (5.8%), the fresh beech-hornbeam beech forest (6.2%), the moist beech-spruce suyaluchnyk (5.0%), the moist hornbeam oak forest (9.3%), the moist beech-hornbeam beech forest (8.2%), the moist beech suyaluchnyk (7.6%), and the moist hornbeam-oak sugrud (7.0%), which together account for 49.1% of the total forest area of the region. The proportion of other fairly widespread forest types, such as the fresh oak-pine subor (4.0%), the moist beech-fir suyaluchnyk (3.4%), the moist fir beech forest (2.4%), the moist fir oak forest (2.1%), the moist spruce-fir beech forest (2.4%), the fresh hornbeam-oak sugrud (2.6%), the moist beech-fir suyaluchnyk (3.1%), the moist hornbeam sub-oak forest (3.7%), the moist hornbeam-pine sub-oak forest (3.6%), the moist spruce-fir sub-beech forest (2.5%), and the wet alder sugrudok (4.2%), is also substantial (20.0%)

and varies between 2 and 4.5%. The area of less widespread forest types, such as the fresh hornbeam-beech oak forest (1.3%), the fresh hornbeam oak forest (1.7%), the moist beech oak forest (1.0%), the moist hornbeam–beech suyaluchnyk (1.6%), and the wet alder sugrud (1.3%), reaches 6.9% of the total forest area.

***Table 6**. Distribution of forest area in Lviv Oblast by forest types*

Forest type name	Index	Area, ha	%
Fresh oak-pine subor	B_2-дС	17,017.7	4.0
Moist oak-pine subor	B_3-дС	24,895.3	5.8
Fresh hornbeam-beech oak forest	D_2-г-бкД	5,667.6	1.3
Fresh hornbeam oak forest	D_2-гД	7,441.2	1.7
Fresh beech-hornbeam beech forest	D_2-бк-гБ	26,634.3	6.2
Moist beech oak forest	D_3-бкД	4,225.4	1.0
Moist beech-fir suyaluchnyk	D_3-бк-яцЯ	14,581.7	3.4
Moist beech-spruce suyaluchnyk	D_3-бкЯ	21,316.5	5.0
Moist hornbeam-beech suyaluchnyk	D_3-г-бкЯ	6,857.0	1.6
Moist hornbeam-oak sugrud	D_3-гД	39,866.7	9.3
Moist hornbeam oak forest	D_3-бк-гБ	35,214.7	8.2
Moist beech-hornbeam beech forest	D_3-яцБ	10,393.2	2.4
Moist fir beech forest	D_3-яцД	9,179.9	2.1
Moist fir oak forest	D_3-ял-яцБ	10,484.2	2.4
Moist spruce-fir beech forest	D_4-Влч	5,764.0	1.3
Wet alder grud	C_2-гдС	11,104.9	2.6
Fresh hornbeam-beech sugrud	C_3-бкЯл	32,830	7.6
Moist beech sugrud	C_3-бк-яцЯ	13,448.5	3.1
Moist beech-fir sugrud	C_3-гД	15,730.8	3.7
Moist hornbeam sub-oak forest	C_3-гдС	29,805.7	7.0
Moist hornbeam-pine sub-oak forest	C_3-гсД	15,582.6	3.6
Moist spruce-fir sub-beech forest	C_3-ял-яцБ	10,768.7	2.5
Wet alder sugrudok	C_4-Влч	18,088.1	4.2
Other		41,257.6	9.6
Total		428,156.3	100.0

***Source:** compiled by the authors*

The remaining 58 forest types occupy 9.6% of the area. Although they cover a smaller territory, these forest types also contribute to maintaining ecological stability and perform important functions within the forest ecosystems of Lviv Oblast.

The forest ecosystems of Khmelnytskyi Oblast are characterised by a moderate level of diversity of forest types. The total number of forest types reaches 31, which indicates a moderate richness of forest ecosystems in the region. Within this structure, bor includes 4 forest types, subor contains 6, sugrud comprises 11, and grud includes 10 forest types. The most widespread forest type is the fresh hornbeam oak forest (46.2%), which occupies almost half of the forest area in the region (Table 7). The fresh hornbeam-oak-pine sugrud (11.0%), the fresh hornbeam sub-oak forest (7.1%), the fresh oak-pine subor (6.5%), and the moist oak-pine subor (5.1%) cover a significant part of the forest area of the region and are important for maintaining the stability of forest ecosystems. The proportion of less widespread forest types, such as the moist hornbeam sub-oak forest (4.7%), the moist hornbeam-oak-pine sugrud (4.0%), the moist hornbeam–pine sub-oak forest (1.4%), the wet alder sugrud (2.7%), the dry hornbeam oak forest (1.4%), the fresh hornbeam-beech oak forest (2.1%), and the moist hornbeam oak forest (4.5%), varies from 1.4% to 4.7%. These forest types ensure the stability of ecological processes in forests, particularly due to their capacity to regulate groundwater levels and maintain biodiversity. All other 19 forest types together occupy 3.4% of the area; although they cover a smaller territory, they also contribute to maintaining ecological balance and perform important functions in preserving biodiversity.

***Table 7**. Distribution of forest area in Khmelnytskyi Oblast by forest types*

Forest type name	Index	Area, ha	%
Fresh oak-pine subor	B_2-дС	8,900.2	6.5
Moist oak-pine subor	B_3-дС	7,048.4	5.1

Table 7. Continued

Forest type name	Index	Area, ha	%
Fresh hornbeam sub-oak forest	C_2-гД	9,778.1	7.1
Fresh hornbeam-oak-pine sugrud	C_2-гдС	15,203.9	11.0
Moist hornbeam sub-oak forest	C_3-гД	6,445.8	4.7
Moist hornbeam-oak-pine sugrud	C_3-гдС	5,479.8	4.0
Moist hornbeam-pine sub-oak forest	C_3-гсД	1,937.2	1.4
Wet alder sugrud	C_4-Влч	3,679.7	2.7
Dry hornbeam oak forest	D_1-гД	1,871.8	1.4
Fresh hornbeam-beech oak forest	D_2-гбД	2,913.8	2.1
Fresh hornbeam oak forest	D_2-гД	63,615.5	46.2
Moist hornbeam oak forest	D_3-гД	6,147.0	4.5
Other		4,611.7	3.4
Total		137,632.9	100.0

Source: *compiled by the authors*

Thus, the forest ecosystems of Khmelnytskyi Oblast, represented by various types of hornbeam, oak, and pine forests, are important for ensuring ecological stability, maintaining the water balance, and supporting biodiversity. Although the forest types that occupy smaller areas are less widespread, they play a significant role in maintaining functional processes within ecosystems and in ensuring the sustainable development of forest habitats.

The forest ecosystems of Ivano-Frankivsk Oblast have the greatest diversity of forest types among the regions studied, which indicates a very high richness of natural resources. The total number of forest types reaches 89. Within this structure, bor includes 6 forest types, subor contains 17, sugrud comprises 40, and grud includes 26 forest types. The most widespread forest types are the moist beech-fir suyaluchnyk (19.8%), the moist beech suyaluchnyk (14.8%), the moist pure suyaluchnyk (10.6%), and the moist spruce-fir sub-beech forest (7.8%). These forest types play an important role in stabilising the water regime, preserving soil fertility, and maintaining biodiversity, especially under conditions of high soil moisture. Among the widespread forest types are the moist spruce subor (3.3%), the fresh hornbeam oak forest (2.5%), the moist beech-fir suyaluchnyk (3.3%), the moist beech-spruce suyaluchnyk (2.9%), the moist hornbeam beech forest (3.7%), the moist hornbeam sub-oak forest (4.4%), and the moist fir sub-oak forest (2.1%); their proportions range from 2.0% to 4.4% and together constitute 22.2% of the total forest area of the region (Table 8). The combined share of forest types such as the fresh beech-hornbeam beech forest (2.0%), the moist hornbeam–beech suyaluchnyk (1.2%), the moist oak–hornbeam beech forest (1.3%), the moist fir beech forest (1.0%), the moist spruce-fir beech forest (2.0%), the fresh hornbeam sub-oak forest (1.2%), the moist oak suyaluchnyk (1.4%), the moist fir sub-beech forest (1.2%), and the moist fir suyaluchnyk (1.1%) reaches 12.4% of the total forest area. These forest types play an important role in maintaining the water balance, supporting biodiversity, and regulating the microclimate of the region.

Table 8*. Distribution of forest area in Ivano-Frankivsk Oblast by forest types*

Forest type name	Index	Area, ha	%
Moist spruce subor	B_3-Ял	14,132.5	3.3
Fresh hornbeam oak forest	D_2-гД	10,604.1	2.5
Fresh beech-hornbeam beech forest	D_2-бк-гБк	8,417.1	2.0
Moist beech-fir suyaluchnyk	D_3-бк-яцЯ	13,870.3	3.3
Moist beech suyaluchnyk	D_3-бк-Ял	12,285.8	2.9
Moist hornbeam-beech suyaluchnyk	D_3-г-бкЯл	4,960.2	1.2
Moist hornbeam oak forest	D_3-гБк	15,691.2	3.7
Moist oak-hornbeam beech forest	D_3-дгБк	5,324.1	1.3
Moist fir beech forest	D_3-яцБк	5,426.2	1.0
Moist fir beech forest (variant)	D_3-ял-яцБк	8,597.1	2.0
Fresh hornbeam sub-oak forest	C_2-гД	5,100.6	1.2
Moist beech-fir sugrud	C_3-бк-яцЯл	8,4245	19.8
Moist beech sugrud	C_3-бкЯл	54,863.9	14.8
Moist hornbeam sugrud	C_3-гД	18,646.4	4.4
Moist oak sugrud	C_3-дЯл	5,924.5	1.4
Moist fir sub-beech forest	C_3-яцБ	4,910.7	1.2
Moist fir sub-oak forest	C_3-яцД	9,103.5	2.1

Table 8. Continued

Forest type name	Index	Area, ha	%
Moist fir sub-oak forest (variant)	$С_3$-яцЯл	4,741.6	1.1
Moist spruce-fir suyaluchnyk	$С_3$-Я^{ч}	45,016.9	10.6
Moist pure suyaluchnyk	$С_3$-ял-яцБ	33,103.1	7.8
Other		52,682.5	12.4
Total		425,768.3	100.0

Source: *compiled by the authors*

Other 69 forest types, occupying 12.4% of the area, although covering smaller territories, perform important functions for maintaining ecological balance and stability of forest landscapes. Overall, the forest ecosystems of Ivano-Frankivsk Oblast, represented by diverse forest types, perform complex ecological functions, including sustaining the water balance, preserving biodiversity, and maintaining landscape stability. Forest types occupying smaller areas, although less widespread, play an important role in ensuring the resilience of forest ecosystems and preserving ecological balance in the region.

The forest ecosystems of Chernivtsi Oblast also demonstrate a high diversity of forest types, indicating the ecological importance of the region. The total number of forest types is 73. No forest types were identified in the bor category, while the subor category includes 2 forest types, the sugrud category comprises 37 forest types, and the grud category includes 34 forest types. The most widespread forest types are fresh oak-hornbeam beech forest (13.9%), moist beech fir forest (16.0%), moist beech-fir subfir forest (12.2%), and moist beech subfir forest (11.0%). These forest types are essential for maintaining water regime stability, improving soil fertility, and sustaining ecological balance, and together constitute more than half (53.1%) of the region's forest area (Table 9). The proportion of fairly widespread forest types, such as fresh beech oak forest (4.1%), moist beech-fir spruce forest (2.0%), moist oak-hornbeam beech forest (5.5%), moist oak fir forest (2.3%), moist fir subfir forest (3.3%), and moist pure subfir forest (7.8%), ranges between 2.3% and 7.8% and in total accounts for exactly one-quarter (25.0%) of the forest area. Less common forest types – dry hornbeam oak forest (1.1%), moist spruce-fir beech forest (1.6%), fresh hornbeam suboak forest (1.0%), moist oak subfir forest (1.2%), and moist fir sub-beech forest (1.3%) – together occupy 6.1% of the total forest area. The remaining 57 forest types (9.0%), although covering smaller territories, are essential for conserving ecological balance and maintaining the stability of natural systems.

Table 9*. Distribution of forest area in Chernivtsi Oblast by forest types*

Forest type name	Index	Area, ha	%	
Dry hornbeam oak forest		D_1-гД	1,778.2	1.1
Fresh beech oak forest	D_2-бкД	6,476	4.1	
Fresh hornbeam oak forest	D_2-гД	15,736.9	10.0	
Fresh oak-hornbeam beech forest	D_2-дгБк	21,934	13.9	
Moist beech fir forest	D_3-бкЯл	25,084.3	16.0	
Moist beech-fir spruce forest	D_3-бк-яцЯл	3,107.2	2.0	
Moist oak-hornbeam beech forest	D_3-дгБ	8,637.3	5.5	
Moist oak fir forest	D_3-дЯл	3,682.5	2.3	
Moist spruce-fir beech forest	D_3-ял-яцБк	2,481.5	1.6	
Fresh hornbeam suboak forest	$С_2$-гД	1,504.1	1.0	
Moist beech-fir subfir forest	$С_3$-бк-яцЯл	19,124.7	12.2	
Moist beech subfir forest	$С_3$-бкЯл	17,232.5	11.0	
Moist oak subfir forest	$С_3$-дЯл	1,924.8	1.2	
Moist fir sub-beech forest	$С_3$-яцБк	2,061.2	1.3	
Moist fir subfir forest	$С_3$-яцЯл	5,130.1	3.3	
Moist pure subfir forest	$С_3$-Ял^{ч}	12,339.1	7.8	
Other		14,150.7	9.0	
Total		157,257	100.0	

Source: *compiled by the authors*

Thus, the forest ecosystems of Chernivtsi Oblast, represented by a wide spectrum of forest types, perform important ecological functions, including the maintenance of water balance, the conservation of biodiversity, and landscape stability. Forest types occupying smaller areas, although less widespread, remain significant for ensuring the resilience of forest ecosystems and preserving ecological equilibrium within the oblast.

The synthesis of the obtained results indicates that the typological structure of forests in western Ukraine reproduces a clear gradient from Polissia to forest-steppe and Carpathian ecosystems, which is traced both in the spectrum of trophic site conditions and in the number and dominance of individual forest types. The identified prevalence of sugrud and grud conditions in the Carpathian oblasts and the increasing share of bor and subor conditions in Polissia is consistent with contemporary views on the place of Ukrainian forest formations within European classification systems, where moisture regime, trophicity, and altitudinal zonation act as decisive determinants (Tkach *et al.,* 2024). At the level of the regional pattern, it is confirmed that forest-steppe oblasts demonstrate lower typological mosaicity and a concentration of area in hornbeam and hornbeam-beech oak forest formations, whereas the Carpathians are characterised by maximal diversity of forest types, reflecting complex climatic-orographic and edaphic contrasts.

The comparison of the obtained data with the results of other researchers within the forest-steppe zone shows that the dominance of oak forest types in Ternopil and Khmelnytskyi oblasts logically continues the regularities established for ecologically similar territories of Ukraine. Thus, I. Solomakha and O. Chornobrov (2021) demonstrated for the Middle Dnipro region a high contribution of oak-hornbeam and hornbeam communities to the structure of forest vegetation, which correlates with the concentration of areas in fresh hornbeam oak forests revealed in this study for the Podillia oblasts. A similar pattern at the local level was described for the Emerald Network site "Tsyrkunivskyi Forest", where typological organisation is also determined by a combination of trophic soils and moderate moisture, forming the predominance of broadleaf formations (Tymochko *et al.,* 2022). The regional data obtained here extend these conclusions by demonstrating that analogous mechanisms operate not only in individual conservation nodes but also at the scale of the entire western Ukrainian forest-steppe.

For Polissian landscapes, a substantial share of pine bor and oak-pine subor types appears characteristic, especially in Volyn and Rivne oblasts, which logically corresponds to contemporary assessments of the role of protected areas in maintaining the ecological stability of forests in the Volyn forest-steppe and adjacent zones. In particular, I. Myskivets (2024) emphasises the importance of protected nuclei for the conservation of typological and biotic diversity, which is consistent with the high proportion of forest types in Volyn associated with different moisture regimes, including the participation of alder sugrud complexes that are important for the wetland component of the region. Accordingly, the regional typological mosaic of Polissia may be considered a sensitive indicator of the effectiveness of conservation strategies.

The most pronounced parallels are observed for the Carpathians. According to O. Kameniar *et al.* (2023), primary spruce and beech forests of the Western Carpathians differ substantially in structure and avifauna regardless of disturbance regimes, which confirms the ecological autonomy of dominant beech and conifer formations in the mountain belt. This is consistent with the results obtained in this study regarding the leading role of various beech forest types and beech-fir suyaluchnyk types in Zakarpattia, Ivano-Frankivsk, and Chernivtsi oblasts, as well as with the almost complete absence of bor types under mountain conditions. An additional spatial dimension is provided by the use of modern geoinformation approaches: V. Rushchak and I. Chepurnyi (2025) demonstrated the dynamics of forest cover in landslide-prone areas of the Carpathians based on Google Earth Engine, which helps explain the high heterogeneity of forest types identified here within the mountainous oblasts, where local geomorphological processes can shape a mosaic of site conditions. In this sense, the typological data obtained provide a reliable basis for interpreting spatial changes recorded by remote methods.

The functional implications of the identified differences are also supported by modern ecological studies. D. Sun *et al.* (2024) showed that forest types control the contribution of litter and roots to the formation of labile and stable soil organic carbon, underscoring the significance of the revealed trophic-site distribution for forecasting soil and biogeochemical processes in the region. At the same time, modelling of future changes in the seasonal carbon cycle under climatic influence suggests that structural-typological relationships may transform over several decades, making the baseline regional pattern established in this study an important reference point for monitoring (Morichetti *et al.,* 2024).

The approach proposed by H. Kitano *et al.* (2025) demonstrated that classification of forest vegetation can be substantially refined when vertical stratification derived from airborne laser scanning is considered, because structural attributes help differentiate units that may appear similar within purely edaphic-climatic schemes; this directly supports the feasibility of combining state forest inventory data with remote-sensing metrics to improve the spatial delineation of forest site conditions and dominant forest types across Western Ukraine. The evidence presented by Q. Ridwan and M. Hanief (2025) further indicated that tree composition and regeneration potential vary sharply among major forest types under different levels of anthropogenic disturbance in mountain landscapes, which conceptually parallels the Carpathian pattern where the prevalence of sugrud and grud conditions and the dominance of beech-related formations suggest not only ecological differentiation along altitudinal gradients but also unequal sensitivity to management pressure. In turn, the findings of J. Zhao *et al.* (2025) showed that

forest type interacts with landowner practices and climate in shaping tree species diversity, reinforcing the interpretation that the observed contrasts between Polissia bor and subor complexes and the forest-steppe concentration of broadleaf formations may reflect a combined effect of trophic status, moisture regime and historically formed management models. Thus, the comparative analysis indicates that the results of the regional assessment of site conditions and forest types in western Ukraine are generally consistent with contemporary Ukrainian and international research, while extending them due to the scale of coverage of eight oblasts and the detailed characterisation of the relationship between trophic site conditions and leading forest types within each of them.

CONCLUSIONS

The results of the typological analysis of forest site conditions in the forests of western Ukraine indicate a high structural diversity of forest ecosystems covering more than 2.9 million ha across eight administrative oblasts. It was shown that the Polissian oblasts retain a substantial share of bor and subor conditions, which is clearly manifested in Volyn and especially in Rivne oblasts, where large areas are occupied by pine bor and oak-pine subor forests. In contrast, the Podillia oblasts of Ternopil and Khmelnytskyi are dominated by grud and sugrud conditions, while the structure of forest types is characterised by the prevalence of hornbeam and hornbeam-beech oak forest formations, reflecting higher soil trophicity and a distinct moisture regime. The Carpathian oblasts demonstrate the highest typological mosaicity and the greatest number of forest types, as confirmed by 85 types in Zakarpattia, 89 in Ivano-Frankivsk, and 73 in Chernivtsi, where various forms of beech forests, sub-beech forests, and beech-fir and spruce-fir communities play the leading role. Lviv oblast occupies an intermediate position combining lowland oak-pine complexes with mountainous beech formations. Additionally, the overall diversity of forest types varies from 47 in Volyn and 46 in Rivne to 31 in Khmelnytskyi and the minimum of 29 in Ternopil, whereas 81 types were recorded in Lviv, highlighting the transitional nature of its landscapes. Volyn is characterised by high shares of fresh and moist oak-pine subor and a substantial contribution of wet alder sugrud types, reflecting the importance of wetland complexes. In the Carpathians, the practical absence of bor types and the concentration of sugrud and grud conditions confirm the decisive role of altitudinal zonation. Prospects for further research are associated with a more detailed analysis of forest types at the forest district level, the integration of remote sensing, and an assessment of typological dynamics under climate change and anthropogenic pressures.

ACKNOWLEDGEMENTS

None.

FUNDING

None.

CONFLICT OF INTEREST

None.

REFERENCES

[1] Altman, J., Fibich, P., Trotsiuk, V., & Altmanova, N. (2024). Global pattern of forest disturbances and its shift under climate change. *Science of The Total Environment*, 915, article number 170117. doi: 10.1016/j.scitotenv.2024.170117.

[2] Barredo, J. I., Vizzarri, M., & Kuželová, K. (2024). Archetypal typology of European forest ecosystems integrating management intensity and naturalness. *Ambio,* 53, 1587-1598. doi: 10.1007/s13280-024-02050-3.

[3] Gharun, M., Shekhar, A., Xiao, J., Li, X., & Buchmann, N. (2024). Effect of the 2022 summer drought across forest types in Europe. *Biogeosciences,* 21(23), 5481-5494. doi: 10.5194/bg-21-5481-2024.

[4] Holubchak, O.I., Hnatiuk, O.R., Ivaniuk, A.P., & Hudyma, V.D. (2024). Typological structure of protective forests in the Ukrainian Carpathians. In *Forestry education and science: Current challenges and development prospects. International science-practical conference* (pp. 1-3). Lviv: Ukrainian National Forestry University. doi: 10.36930/conf150.1.25.

[5] Kameniar, O., Baláž, M., Svitok, M., Mikoláš, M., Ferenčík, M., Frankovič, M., Ralhan, D., Gloor, R., & Svoboda, M. (2023). Spruce- and beech-dominated primary forests in the western Carpathians differ in terms of forest structure and bird assemblages, independently of disturbance regimes. *European Journal of Environmental Sciences*, 13(1), 47-59. doi: 10.14712/23361964.2023.6.

[6] Kitano, H., Nagashima, K., & Nakata, Y. (2025). Classification of forest vegetation types considering forest vertical stratification using airborne laser scanning data in Japan. *Ecological Indicators,* 179, article number 114244. doi: 10.1016/j.ecolind.2025.114244.

[7] Lavnyy, V., & Matusevych, O. (2022). Typological structure and productivity of spruce forests in the Ukrainian Carpathians. *Proceedings of the Forestry Academy of Sciences of Ukraine,* 24, 66-78. doi: 10.15421/412206.

[8] Morichetti, M., Vangi, E., & Collalti, A. (2024). Predicted future changes in the mean seasonal carbon cycle due to climate change. *Forests,* 15(7), article number 1124. doi: 10.3390/f15071124.

[9] Moroz, V. (2024). Bioproductivity of pine forests in Polissia. *Scientific Reports of the National University of Life and Environmental Sciences of Ukraine,* 20(5), 120-134. doi: 10.31548/dopovidi/5.2024.120.
[10] Myroniuk, V., & von Dosky, V. (2024). *Analysis of temporal changes (2019–2023) of forest attributes in Ukraine*. Kyiv: SFI.
[11] Myskivets, I. (2024). The ecological role of nature reserves in the Volyn Forest-Steppe of Ukraine. *Ecological Sciences,* 6(57), 15-19. doi: 10.32846/2306-9716/2024.eco.6-57.2.
[12] Ostapenko, B.F., & Tkach, V.P. (2002). *Forest typology.* Kharkiv: Pleyada.
[13] Pohrebnyak, P.S. (1993). *Forest ecology and forest typology.* Kyiv: Naukova dumka.
[14] Ridwan, Q., & Hanief, M. (2025). Tree composition, regeneration potential and anthropogenic disturbanc es across major forest types of Rajouri in the Pir Panjal region of north-western Himalaya. *Forest Ecology and Management,* 595, article number 123030. doi: 10.1016/j.foreco.2025.123030.
[15] Rushchak, V., & Chepurnyi, I. (2025). Assessment of Forest cover dynamics in landslide-prone areas of the Ukrainian Carpathians using remote sensing data. In *18th International conference monitoring of geological processes and ecological condition of the environment* (pp.1-5). Kyiv: European Association of Geoscientists & Engineers. doi: 10.3997/2214-4609.2025510172.
[16] Scherpenhuijzen, N., West, T.A.P., Debonne, N., Oostdijk, S., Adame, P., Astrup, R., & Verburg, P.H. (2025). Mapping forest management regimes in Europe. *Forest Ecology and Management,* 594, article number 122940. doi: 10.1016/j.foreco.2025.122940.
[17] Skliar, V., Sherstiuk, M., Shepeliuk, M., Kovalchuk, N., & Matiukha, D. (2025). Impact of global climate change on the biological characteristics of tree species in forest ecosystems. *Ukrainian Journal of Forest and Wood Science*, 16(1), 44-63. doi: 10.31548/forest/1.2025.44.
[18] Solomakha, I.V., & Chornobrov, O.Yu. (2021). Ecological-typological assessment of forest vegetation in the Middle Dnieper region (Forest-Steppe of Ukraine). *Agroecological Journal,* 2, 7-18. doi: 10.33730/2077-4893.2.2021.234448.
[19] Spathelf, P., Lavnyy, V., Matysevych, O., & Danchuk, O. (2024). German-Ukrainian efforts towards building climate-resilient forests in Western Ukraine – first results of alternative regeneration systems. *South-East European Forestry,* 15(1), 81-89. doi: 10.15177/seefor.24-04.
[20] Sun, D., Qiu, X., Feng, J., Ru, J., Song, J., & Wan, S. (2024). Forest types control the contribution of litter and roots to labile and persistent soil organic carbon. *Biogeochemistry,* 167, 1609-1617. doi: 10.1007/s10533-024-01185-5.
[21] Tkach, V.P., Tarnopilska, O.M., & Orlov, O.O. (2024). *Types of forest formations of Ukraine in the system of European classifications.* Kharkiv: LLC Typography Madrid.
[22] Tymochko, I., Chornobrov, O., & Solomakha, I. (2022). Ecological and typological features of forest vegetation of the Emerald Network object "Tsirkunivskyi forest" in the North-Eastern Forest Steppe of Ukraine. *Scientific Reports of the National University of Life and Environmental Sciences of Ukraine,* 18(1). doi: 10.31548/dopovidi2022.01.001.
[23] UKRDERZHISPROEKT. (n.d.). Retrieved from https://lisproekt.gov.ua/objednannja.
[24] Zhao, J., Daigneault, A., Wei, X., Salcido, E., & Weiskittel, A. (2025). Forest type, landowner practices, and climate shape tree species diversity in Maine, USA. *Forest Ecology and Management,* 593, article number 122919. doi: 10.1016/j.foreco.2025.122919.

Аналіз типологічної структури лісів заходу України

Олександр Бондар
Кандидат сільськогосподарських наук
Західноукраїнський національний університет
46009, вул. Львівська, 11, м. Тернопіль, Україна
https://orcid.org/0000-0002-3448-8943

Анатолій Вишневський
Кандидат сільськогосподарських наук
Поліський національний університет
10008, бульв. Старий, 7, м. Житомир, Україна
https://orcid.org/0000-0001-5381-1219

Євген Мельник
Кандидат сільськогосподарських наук
Український науково-дослідний інститут лісового господарства та агролісомеліорації
ім. Г. М. Висоцького
61024, вул. Григорія Сковороди, 86, м. Харків, Україна
https://orcid.org/0000-0002-9821-2751

Ігор Галаган
Кандидат педагогічних наук
Кременецька обласна гуманітарно-педагогічна академія ім. Тараса Шевченка
47003, вул. Ліцейна, 1, м. Кременець, Україна
https://orcid.org/0000-0002-0555-6548

Анотація. Метою роботи було здійснити еколого-типологічну оцінку лісорослинних умов восьми адміністративних областей макрорегіону України та визначити регіональні відмінності у співвідношенні трофотопів і типів насаджень. Класифікацію типів лісу здійснено за лісівничо-екологічною шкалою лісової типології на основі матеріалів державного лісовпорядкування. Застосовано методи порівняльного аналізу, типологічного групування та статистичної обробки даних для визначення площ, співвідношень і структури типів лісу. Було проаналізовано розподіл площі вкритих лісовою рослинністю земель за чотирма групами багатства ґрунтів, що дозволило виявити домінування сугрудових і грудових умов у гірських частинах регіону. Було встановлено, що найбільші площі сугрудів зосереджені в Івано-Франківській і Закарпатській областях, тоді як у Волинській та Рівненській областях вагомими залишаються борові й суборові комплекси. Діапазон кількості виділених типів лісу коливався від 29 у Тернопільській до 89 в Івано-Франківській області, що відображає контрастність природних умов регіону. Було деталізовано типологічну структуру окремих областей і показано різноманітність у Карпатському секторі, де переважають різні варіанти бучин, субучин і суяличників, що відображає поєднання висотної поясності та зволоження. Було з'ясовано, що для Поліського сектору характерна концентрація площ у дубово-соснових суборах і чорновільхових сугрудах, які формують ядро гідрологічної та біотичної стабільності територій. Було узагальнено, що для Подільських областей типова простота типологічного спектра з домінуванням грабових і дубових дібров, що корелює з більш однорідними ґрунтово-кліматичними умовами. Практична цінність одержаних результатів полягає у можливості їх використання лісогосподарськими підприємствами та природоохоронними установами для обґрунтування заходів сталого ведення лісового господарства, відновлення насаджень і зонування рекреаційного навантаження

Ключові слова: лісорослинні умови; типологічна структура; едафічна сітка; трофотопи; гігротопи; бучинові угруповання; дубово-соснові субори