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WINTER BIRD COMMUNITIES IN OAK AND PINE FORESTS IN THE SOUTH OF THE FOREST-STEPPE ZONE

This paper presents the results of a study of wintering bird communities in oak and pine forests in the Kharkiv region (North-eastern Ukraine). Research was conducted on the National Park «Slobozhanskyi», located within the Krasnokutsk United Territorial Community of the Bogodukhiv District in 2023-2025 and the National Park «Homilshanski lisy» located within the Zmiiv United Territorial Community of the Chuhuiv District in 2024. The transect-count technique was used for bird sampling. We registered 27 wintering bird species. 12 species of birds were classified as dominant: Aegithalos caudatus, Parus major, Poecile palustris, Sitta europaea, Regulus regulus, Certhia familiaris, Cyanistes caeruleus, Poecile montanus, Dendrocopos major, Bombycilla garrulus, Corvus corax, Lophophanes cristatus. Total diversity varied from 58,1 inds/sq.km to 350,4 inds/sq.km in pine forests and from 100,1 inds/sq.km to 410,9 inds/sq.km in oak forests. No significant differences between habitats, national parks and years in number of species, total community densities and structure of communities.

Key words: *wintering bird's community, transect counts, pine forests, oak forests, national park, forest-steppe zone.*

Introduction. The Kharkiv region is located in the north-east of Ukraine, within the watershed separating the Don and Dnieper basins. The northwestern part of the region belongs to the forest–steppe zone (about 25% of the territory), the rest – to the steppe (M. Demchenko, & O. Demchenko, 1971). Zonal types of vegetation are upland broad-leaved mixed forests (upland oak grove), meadow steppes and forb-fescue-feather-grass steppes. In addition to zonal types of vegetation, pine and oak-pine forests, floodplain forests, swamp vegetation, floodplain forests, vegetation of open sands and chalk outcrops are widespread (Alekseenko, 1971).

The avifauna of the Kharkiv region is considered well studied. Since the 19th century, several generations of ornithologists have collected rich material: long-term changes in the bird fauna were traced, including the formation of the avifauna in forests, as well as the dependence of the fauna composition on various factors. However, quantitative studies of the bird population in forests began relatively recently, in the 80s of the 20th century (Vergeles, 1993). Since then, data have been obtained on the bird population of various forest types: upland, floodplain and ravine oak groves (Vergeles, 1993; Atemasova, Atemasov, Devyatko, & Chernikov, 2005; Atemasov, Atemasova, Devyatko, & Goncharov, 2010; 2016; Atemasov, Atemasova, Devyatko, Lysenko, & Goncharov, 2011), pine forests (Lisetskiy, & Fedorov, 1979; Vergeles, 1993; Stegniy, & Palval, 2007; Atemasov,

& Atemasova, 2024). Most of these studies were conducted during the nesting period; the number of works devoted to the study of wintering forest birds is very small (Vergeles, 1993; Atemasov, Atemasova, Goncharov, & Devyatko, 2008). Meanwhile, the winter season is of great importance as a regulator of bird population numbers and community composition (Fretwell, 1972; Williams, Henry, & Sinclair, 2015; and others). Wintering birds have been considered sentinels of climate change due to their well-studied metabolic capacities and ability to survive and adapt to winters (Prince, & Zuckerberg, 2015).

This paper aims to examine the patterns of wintering bird species diversity in oak and pine forests in the two national parks in Kharkiv region.

Materials and methods. The study was conducted in two national parks located in the Kharkiv region:

National Park «Homilshanski lisy» (N49°35′, E36°20′). The park is located in the Chuhuiv district of the Kharkiv region (Ukraine). The area is 14138,8 hectares. The park was created with the aim of preserving, reproducing and rationally using typical and unique forest-steppe natural complexes of the Siverskyi Donets River valley. Broadleaf forests (maple-ash-linden oak groves) grow on the high right bank of the Siverskyi Donets River. Pine forests and subors predominate on the third sandy terrace of the left bank of the river. Floodplain forests (birch bark-maple oak grove) are most typical for the floodplain, as well as poplar, willow and alder groves.

National Park «Slobozhanskyi» (N50°04′, E35°14′). The park is located in the Bogodukhiv district of the Kharkiv region. The park area is 5244 hectares. The park is located on the left and right banks of the Merla River and at the confluence of the Merla and Merchik rivers. Forest natural complexes prevail in the park. Oak forests are widespread on the right bank of the Merla River, and natural and artificially planted pine forests on the left bank. Alder and birch swamp forests grow in the depressions of the relief.

The wintering birds were censused using a transect method. Six transects were used, three in each park. The length of each transect was 5 km. In Slobozhanskyi park, surveys were conducted in the pine forest (transects «Pine 1» and «Pine 2») and oak grove («Oak») from 2023 to 2025, in "Homilshanski lisy" – in the oak grove of the protected area («Oak_zap»), in the oak grove of the recreational area («Oak_recr»), and in the pine forest in the economic area («Pine») in 2024. To obtain data on species composition and density, the Hayne–Ravkin transect method was used (Ravkin, 1967, 1986; Vergeles, 1994). When using separate recalculation, all individuals are grouped according to the following intervals, depending on the detection distance: 1) from 0 to 12,5 m to the counter, 2) from 12,5 to 25 m, 3) from 25 to 50 m, 4) from 50 to 100 m, 5) from 100 to 250 m, 6) over 250 m. The population density is calculated for each species separately by distance intervals. The following formula is used for the calculation:

$$D_i = \frac{40n_{i1} + 20n_{i2} + 10_{i3} + 5_{i4} + 2n_{i5} + 0{,}5n_{i6}}{L}$$

where D_i is the population density of the i-th species, individuals/km^2,

n_{ij} is the number of individuals of the i-th species encountered in the j-th interval (j=1,2,3, …, 6),

L is the length of the transect, km.

Dominant species were defined as comprising 10 % and more of all individuals of all species recorded (Kuzjakin, 1962).

Shannon's diversity index, Simpson diversity index, and Buzas and Gibson's evenness were used to characterize the diversity and evenness. PAST 5.0.2 software was used to calculate the indices (Hammer et al., 2001). Non-parametric tests (PERMANOVA) were used to test differences between years and habitats. Statistical processing was carried out using R 4.4.2. The vegan package (Oksanen et al., 2025) for R was used for analysis.

Results and discussion. Transect censuses of wintering birds were conducted in the territory of two national parks located in the Kharkiv region (north-east of Ukraine). In National Park «Slobozhanskyi», counts were conducted along three 5 km transects in 2023–2025. The first

transect was in a pine forest on the territory of the Volodymyrivskyi department. The terrain along the transect is highly mosaic; along with pine areas of different ages, there are birch groves and overgrown forest lakes. The second route is also located in the Volodymyrivskyi department. The transect includes pine areas of different ages and, in small numbers, oak groves. The third transect was in an oak grove on the territory of the Parkhomivska department. In the National Park «Homilshanski lisy», counts were also conducted along three 5 km routes in 2024. The first transect passed through an oak grove in the recreational zone of the park, the second – through an oak grove in the protected zone (both – Koropovsk department), the third – through a pine forest in the economic zone of the park (Zadonetske forestry).

A total of 27 bird species were recorded. Systematics and nomenclature of bird species follow IOC World Bird List (Gill et al., 2024). The number of species detected in each census varied from 5 to 16. Twelve species were classified as dominant: *Aegithalos caudatus* (registered in 10 out of 12 counts), *Parus major* (8), *Poecile palustris* (5), *Sitta europaea* (4). Also on the list of dominants – *Regulus regulus, Certhia familiaris, Cyanistes caeruleus, Poecile montanus, Dendrocopos major, Bombycilla garrulus, Corvus corax, Lophophanes cristatus.* The number of dominant species in each count varying between 2 and 5.

21 species were recorded in pine forests. Seven species were classified as dominant: *Corvus corax, Poecile palustris, Poecile montanus, Parus major, Aegithalos caudatus, Regulus regulus, Lophophanes cristatus.* 20 species were recorded in oak groves. Seven species were classified as dominant: *Dendrocopos major, Bombycilla garrulus, Poecile montanus, Cyanistes caeruleus, Parus major, Aegithalos caudatus, Sitta europaea, Certhia familiaris.*

Total diversity varied from 58,1 inds/sq.km to 350,4 inds/sq.km in pine forests and from 100,1 inds/sq.km to 410,9 inds/sq.km in oar forests (Tables 1, 3). No significant differences between habitats, national parks and years in number of species, total community densities and structure of communities (PERMANOVA, p>0,05). Shannon's diversity index varied from 1,488 to 2,051 in pine forests and 1,713 to 2,247 in oak forests. Simpson's diversity index varied from 0,717 to 0,842 in pine forests and from 0,811 to 0,863 in oak forests. Evenness varied from o,384 to 0,886 in pine forests to 0,487 to 0,653 in oak forests (Tables 2.4).

The bird density in Slobozhanskyi park is higher than in National Park «Homilshanski lisy». Also, the density in oak groves is higher than in pine forests, although in some years (2024) the opposite is observed. The data obtained generally correspond to the data obtained earlier in the Kharkiv region or in other regions of Ukraine. Thus, the bird population density in the forests of the Kharkiv region in the late 80s – early 90s was: in pine forests – from 181 to 262 inds/sq.km, in oak groves – 234 inds/sq.km (Vergeles, 1993), in the forests in the west of Ukraine: in pine forests from 177 to 441 inds/sq.km, in oak groves from 254 to 414 inds/sq.km (Huziy, 2006).

Table 1

Density of bird species in winter in 2024

Species	Slobozhanskyi			Homilshanski lisy		
	Pine 1	Pine 2	Oak	Oak_recr	Oak_zap	Pine
Accipiter nisus	8,0					
Buteo lagopus			0,4	0,4		
Dryobates minor	8,0	2,0			1,0	
Dendrocopos major		1,0	1,0	6,0	20,4	
Dryocopus martius	0,4	0,5	4,0	1,2	0,2	
Corvus cornix				2,0		
*Corvus cor*ax	1,3	1,5	0,5	8,1	0,1	16,1
Bombycilla garrulus		2,0	5,0	20,0		
*Poecile palustri*s	20,0	16,0	28,0		28,0	8,0
Poecile montanus	16,0					
*Cyanistes caerule*us	16,0		2,0	12,0		
*Parus maj*or	57,0	28,0	11,0	4,4	9,0	8,0
*Aegithalos cauda*tus	124,0	80,0			40,0	22,0
*Regulus regul*us	48,0	16,0				
*Sitta europa*ea	4,0	8,0	25,8	27,0	20,0	

Certhia familiaris	2,0	2,0	20,0	16,0	16,0	4,0
Turdus viscivorus		6,0	1,0	5,0		
Coccothraustes coccothraustes				2,0		
Pyrrhula pyrrhula	4,4	2,0	1,4	0,5		
Carduelis carduelis				1,0		
TOTAL	309,1	165,0	100,1	105,6	134,7	58,1

Table 2

Characterization of winter bird communities in 2024

Parameters	Slobozhanskyi			Homil'sha forests		
	Pine 1	Pine 2	Oak	Oak_recr	Oak_zap	Pine
Taxa_S	13	13	12	14	9	5
Simpson_1–D	0,772	0,717	0,807	0,857	0,811	0,750
Shannon_H	1,841	1,713	1,882	2,187	1,771	1,488
Evenness_e^H/S	0,485	0,427	0,547	0,636	0,653	0,886

Table 3

Density of bird species in winter in Slobozhanskyi park in 2023–2025

Species	Pine 1				Pine 2				Oak			
	2023	2024	2025	average	2023	2024	2025	Average	2023	2024	2025	average
Accipiter nisus		8,0		2,67 ± 2,67								
Buteo lagopus			0,4	0,13 ± 0,13			2	0,67 ± 0,67		0,4	5,0	1,80 ± 1,60
Dryobates minor		8,0	8,0	5,33 ± 2,67		2,0		0,67 ± 0,67	0,4			0,13 ± 0,13
Dendrocopos major	8,0		8,0	5,33 ± 2,67	26,0	1,0	8	11,67 ± 7,45	17,0	1,0	19,3	12,42 ± 5,75
Dryocopus martius	2,0	0,4	0,1	0,83 ± 0,59		0,5	0,4	0,30 ± 0,15	4,0	4,0	2,6	3,54 ± 0,46
Picus canus									1,8		1,0	0,93 ± 0,52
Garrulus glandarius	8,0	0,0	2,0	3,33 ± 2,40	5,4		4	3,13 ± 1,62			1,3	0,42 ± 0,42
Corvus corax	0,4	1,3	2,5	1,40 ± 0,61	0,4	1,5	1	0,97 ± 0,32	0,1	0,5	0,4	0,33 ± 0,12
Bombycilla garrulus						2,0		0,67 ± 0,67	0,1	5,0		1,70 ± 1,65
Periparus ater			2,0	0,67 ± 0,67	8,0			2,67 ± 2,67				
Lophophanes cristatus	80,0			26,67 ± 26,67								
Poecile palustris	8,0	20,0	48,0	25,33 ± 11,85	10,0	16,0	64	30,00 ± 17,09	28,0	28,0	36,3	30,75 ± 2,75
Poecile montanus	44,0	16,0		20,00 ± 12,86	44,0			14,67 ± 14,67	4,0			1,33 ± 1,33
Cyanistes caeruleus	24,0	16,0	6,0	15,33 ± 5,21	22,0		44	22,00 ± 12,70	32,0	2,0	25,0	19,67 ± 9,06
Parus major	34,0	57,0	19,4	36,80 ± 10,94	108,0	28,0	11	49,00 ± 29,91	94,0	11,0	85,0	63,33 ± 26,30
Aegithalos caudatus	84,0	124,0	80,0	96,00 ± 14,05	80,0	80,0	110	90,00 ± 10,00	84,0		100,0	61,33 ± 31,01
Regulus regulus	48,0	48,0		32,00 ± 16,00	20,0	16,0	40	25,33 ± 7,42				
Troglodytes troglodytes											12,5	4,17 ± 4,17
Sitta europaea	2,0	4,0	2,0	2,67 ± 0,67	6,0	8,0	16,4	10,13 ± 3,19	61,9	25,8	35,1	40,94 ± 10,82
Certhia familiaris	8,0	2,0	7,0	5,67 ± 1,86	4,0	2,0	4	3,33 ± 0,67	30,0	20,0	40,0	30,00 ± 5,77
Turdus viscivorus			1,0	0,33 ± 0,33		6,0	4	3,33 ± 1,76		1,0	6,3	2,42 ± 1,94
Turdus pilaris					8,0			2,67 ± 2,67				
Pyrrhula pyrrhula		4,4		1,47 ± 1,47	2,0	2,0		1,33 ± 0,67	0,1	1,4	16,3	5,92 ± 5,18
Carduelis carduelis			0,4	0,13 ± 0,13							25,0	8,33 ± 8,33
Spinus spinus									8,0			2,67 ± 2,67
TOTAL	350,4	309,1	186,8	282,10 ± 49,12	343,8	165,0	308,8	272,50 ± 54,71	365,4	100,1	410,9	292,10 ± 96,91

Table 4

Characterization of winter bird communities in Slobozhanskyi national park in 2023–2025

Habitat	Year	Taxa_S	Simpson_1–D	Shannon_H	Evenness_e^H/S
Pine 1	2023	13	0,842	2,051	0,598
	2024	13	0,772	1,841	0,485
	2025	15	0,737	1,750	0,384
Pine 2	2023	14	0,817	2,025	0,541
	2024	13	0,717	1,713	0,427
	2025	13	0,790	1,854	0,491
Oak	2023	15	0,813	1,988	0,487
	2024	12	0,807	1,882	0,547
	2025	16	0,863	2,247	0,591

Conclusions. In this study, we analyzed the results of quantitative censuses of wintering birds in pine and oak forests conducted in two national parks. A total of 27 bird species were recorded, with densities ranging from 58,1 individuals per square kilometer to 410,9 individuals per square kilometer. No significant differences between habitats, national parks and years in number of species, total community densities and structure of communities.

REFERENCES

Alekseenko, M. I. (1971). Vegetation of Kharkiv region. In *Materials of the Kharkiv Department of the Geographical Society of Ukraine* (Vol. 8, pp. 80-94). Kharkiv.

Atemasov, A. A. (2005). Population structure of birds of floodplain forests of the middle reaches of the Siverskyi Donets River. In *Birds of the Seversky Donets basin* (Vol. 9. pp. 10-12). Donetsk.

Atemasov, A. A., Atemasova, T. A., Devyatko, T. N., & Goncharov, G. L. (2016). Structure of the community of nesting birds of byrachnaya oak forests of the Oskol River valley. *Bulletin of Dnipropetrovsk University. Biology, ecology*, 24 (2), 421-429.

Atemasov, A. A., Atemasova, T. A., Devyatko, T. N., Goncharov, G. L., & Lysenko, N. G. (2010). Population structure of nesting birds of upland oak forests at the southern borders of the forest-steppe. In *Birds of the Siverskyi Donets basin* (Vol. 11. pp. 47-54). Donetsk.

Atemasov, A. A., Atemasova, T. A., Devyatko, T. N., Lysenko, N. G., & Goncharov, G. L. (2011). Structure of nesting bird communities in upland oak forests in the south of the Central Russian Upland. In M. V. Banik, A. A. Atemasov, & O. A. Brezgunova (Eds.) *Ecology of birds: species, communities, interrelationships*: proceedings of the scientific conference dedicated to the 150th anniversary of the birth of Nikolai Nikolaevich Somov (1861-1923) (Book 1, pp. 345-358). Kharkiv.

Atemasov, A. A., Atemasova, T. A., Goncharov, G. L., & Devyatko, T. N. (2008). Role of the pubescence effect in the formation of bird populations in oak forests. In *Problems of studying edge structures of biocenoses* (pp. 128-131). Saratov: Izd. of Saratov University.

Atemasov, A., & Atemasova, T. (2024). Breeding bird communities of the pine forests in the forest-steppe zone. *The Journal of V. N. Karazin Kharkiv National University. Series "Biology"*, 42, 4-21. Retrieved from https://doi.org/10.26565/2075–5457–2024–42–1

Atemasova, T. A., Atemasov, A. A., Devyatko, T. N., & Chernikov, V. F. (2005). Ornithofauna of byrachnyh oak forests in the middle reaches of the Siverskyi Donets. In *Birds of the Seversky Donets basin* (Vol. 9. pp. 13-18). Donetsk.

Demchenko, M. A., & Demchenko, O. M. (1971). Physico-geographical zoning of the Kharkiv region. In *Materials of the Kharkoiv Department of the Geographical Society of Ukraine* (Vol. 8, pp. 112-127). Kharkiv.

Fretwell, S. D. (1972). *Populations in a seasonal environment*. Princeton, New Jersey: PrincetonUniv. Press.

Gill, F., Donsker, D., & Rasmussen, P. (Eds.). (2024). *IOC World Bird List (v14.1)*. doi: 10.14344/IOC.ML.14.1. Retrieved from https://webofdeceit.org/2024/01/13/ioc-bird-list-v14-1-released/

Hammer, O., Harper, D. A. T., & Ryan, P. D. (2001). PAST: Paleontological Statistics Software Package for Education and Data Analysis. *Palaeontologia Electronica,* 4(1), 9. Retrieved from https://www.researchgate.net/publication/259640226_PAST_Paleontological_Statistics_Software_Package_for_Education_and_Data_Analysis

Huziy, A. I. (2006). *Spatial and typological organization of the bird population of forest stands in the western region of Ukraine*. Zhytomyr: Volyn Publishing House.

Kuzyakin, A. P. (1962). Zoogeography of the USSR. *Scientific notes of N. K. Krupskaya MOPI. Ser.: Biogeography*, 109 (1), 3-182.

Lisetsky, A. S., & Fedorov, A. V. (1979). Ornithofauna of the middle reaches of the Seversky Donets River and ways of its reconstruction and protection. In *Problems of nature protection and recreational geography of the Ukrainian SSR*: abstract of a republican scientific conference (Vol. 5. pp. 67-69). Kharkiv.

Oksanen, J., Simpson, G., Blanchet, F., Kindt, R., Legendre, P., Minchin, P. ... Borman, T. (2025). *Package vegan: Community Ecology Package*. Version 2.6–10. Retrieved from https://cran.r-project.org/web/packages/vegan/vegan.pdf

Prince, K., & Zuckerberg, B. (2015). Climate change in our backyards: the reshuffling of North America's winter bird communities. *Global Change Biology*, 21, 572-585. doi.org/10.1111/gcb.12740

Ravkin, Yu. S. (1986). Peculiarities of cadastral registration of birds. In *All-Union meeting on the problem of cadastre and accounting of the animal world*: abstract of report. (Vol. 2, pp 186-188). Moscow.

Ravkin, Yu. C. (1967). To the methodology of bird counting in forest landscapes. In *Nature of tick-borne encephalitis foci in Altai (North-Eastern part)* (pp. 66-75). Novosibirsk: Nauka.

Stegniy, B. T., & Palval, A. V. (2007). Population structure of birds of pine forests of Kharkov region. In *Birds of the Siverskyi Donets basin.* (Vol. 10, pp. 8-19). Donetsk.
Vergeles, Y. I. (1993). General features of the bird population of forest biogeocenoses of Kharkiv region. *Berkut*, 2, 14-15.
Vergeles, Y. I. (1994). Quantitative surveys of bird populations: a review of modern methods. *Berkut*, 3 (1), 43-48.
Williams, C. M., Henry, H. A. L., & Sinclair, B. J. (2015). Cold truths: how winter drives responses of terrestrial organisms to climate change. *Biological Reviews*, 90, 214-235. doi.org/10.1111/brv.12105

УГРУПОВАННЯ ЗИМУЮЧИХ ПТАХІВ СОСНОВИХ ТА ДУБОВИХ ЛІСІВ ПІВДНЯ ЛІСОСТЕПОВОЇ ЗОНИ

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У статті наведено результати дослідження угруповань зимуючих птахів у дубових та соснових лісах Харківської області. Дослідження проводили на території НПП «Слобожанський», розташованого в межах Краснокутської об'єднаної територіальної громади Богодухівського району у 2023–2025 рр. та НПП «Гомільшанські ліси», розташованого на території Зміївської ОТГ Чугуївського району у 2024 р. Для кількісних обліків птахів використовували трансектний метод. Нами зареєстровано 27 зимуючих видів птахів. До переліку домінантів включено 12 видів птахів: Aegithalos caudatus, Parus major, Poecile palustris, Sitta europaea, Regulus regulus, Certhia familiaris, Cyanistes caeruleus, Poecile montanus, Dendrocopos major, Bombycilla garrulus, Corvus corax, Lophophanes cristatus. Загальна щільність змінювалася від 58,1 екз./кв.км до 350,4 екз./кв.км у соснових лісах і від 100,1 екз./кв.км до 410,9 екз./кв.км у дубових лісах. Немає достовірних відмінностей між типами лісу, національними парками та роками щодо кількості видів, загальної щільності та структури угруповань.

Ключові слова: *угруповання зимуючих птахів, маршрутні обліки, соснові ліси, діброви, національний парк, лісостепова зона.*