

ASSESSMENT OF AVIAN SPECIES DIVERSITY ACROSS THREE PEATLAND ECOSYSTEMS OF N-W ROMANIA AND POSSIBLE INFLUENCE ON THE SURROUNDING AGRICULTURAL FIELDS

Andreea CIOBOTA^{1,2}, Marilena ONETE², Mihaela CIOBOTA², Roxana NICOARA²

¹Doctoral School of Biology, University of Bucharest, 91-95 Splaiul Independenței, District 5, Bucharest, Romania

²Institute of Biology Bucharest of Romanian Academy, 296 Splaiul Independenței, District 6, Bucharest, Romania

Corresponding author email: marilena.onete@gmail.com

Abstract

*Wetlands and their associated birdlife could impact adjacent agricultural land as they set forth synergistic interactions: wetlands provide habitat and food for birds, which in turn support agriculture through pest control and fertilization. As part of a 3-seasons restoration effort (PeatRO4 2024), we assessed the bird and plant species and described the habitats from three peatland ecosystems with different degrees of human impact, from Cluj County (NW Romania): one in the forest (Negrușul-Finciului), two in the vicinity of agricultural lands (Molhașul Călățele, Dâmbu-Negru). For the active raised bog habitats (Natura 2000 code *7111) the peatland Dâmbu-Negru bore 40% of avian diversity. Most species listed as Least Concern, with 3 on the Near Threatened National Red List and 8 under the Birds Directive Annex I. We found an increased number of insectivorous bird species correlating positively with the presence of typical bog grasses (Eriophorum-Carex associations), shrubs (Vaccinium sp.) and trees (Picea-Pinus associations). Since protected wetlands reduce pesticide dependence and enhance ecosystem resilience, biodiversity, and crop productivity, conserving these habitats is both an ecological imperative and an agricultural strategy.*

Key words: bird diversity, peatland, agricultural impact.

INTRODUCTION

Temperate peatlands cover over 3 million km² globally and store an estimated 455-547 Gt of carbon. They serve as crucial long-term carbon sinks and biodiversity hubs (Harshberger, 1909; Lachance & Lavoie, 2004; Yu et al., 2010; Pasquet et al., 2015). Characterized by acidic conditions that favour specific plant communities and taxa (*Sphagnum* mosses) (Baas Becking & Nicolai, 1934), peatlands have suffered under anthropogenic pressures leading to: altered hydrology, surface drying, and vegetation shifts (shade- and drought-tolerant species are replacing characteristic heliophilous vegetation (Foster & Wright Jr, 1990; Schouwenaars, 1993; Howie & Meerveld, 2011; Pellerin et al., 2009).

Climate change-induced changes to the hydrological regime affect Eastern European wetlands (Kracauer Hartig et al., 1997). These impacts add to drivers of bog forest reshaping, along with land-use changes and agricultural conversion (Minayeva & Sirin, 2012).

Anthropogenic pressures influence ecological interactions, ultimately affecting biodiversity and ecosystem functioning (Evans et al., 2014). Restoration efforts focusing on re-establishing hydrology (ditch blocking; pool creation) promote the recovery of peat-forming vegetation and specific faunal communities (Cuckston, 2017; Hughes et al., 2025; Nicoară et al., 2025). Given that many of these ecosystems have declined across Europe, restoring peatlands is an arduous process that requires long-term efforts, particularly to restore local bird communities, especially peatland-associated species (Alsila et al., 2021; Hughes & Bingham, 2025). Although ecosystem responses vary with microhabitat conditions and management (Mazerolle et al., 2006; Peacock et al., 2013; Beadle et al., 2015), peatlands can become avian diversity hubs. Healthy peatland ecosystems cater to the needs of a variety of species, fostering both trade-offs and synergistic interactions between bird communities and adjacent habitats (Bracken et al., 2008; Calmé et al., 2002; Yapu-Alcazar & Naoki, 2022). In turn,

birds support key ecological functions, providing a wide range of ecosystem services (nutrient cycling, pest control, pollination) (Brewer, 1967; Deng & Yimam, 2020). Moreover, wetlands in general and peatlands in particular help stabilise bird communities, consolidating the ecosystem services they provide and thereby positively impacting agricultural systems. As such, farms established in mosaic landscapes with seminatural and natural wetland ecosystems are less affected by the disservices caused by bird species traditionally considered agricultural pests (Smith et al., 2022). Some flocking species (starlings, crows) are replaced by taxa of higher conservation value (Olimpi et al., 2024), peatland bird species that help reduce crop damage and pre-harvest food safety risks (Smith et al., 2025). Since natural and semi-natural habitat islands can positively influence the farmland matrix through their bird communities (Anderle et al., 2025), protecting such areas is of high importance for preserving regional avian diversity and agricultural welfare. Furthermore, protected area networks, such as Natura2000, highlight the value of habitat-specific species as indicators of biodiversity and ecosystem services change under land-use and climate pressures (Bastian, 2013).

Within this larger framework, our study aims to explore potential outcomes for the agricultural landscape matrix of three peatland areas that network as avian stepping stones between larger conservation areas. To achieve this, we assessed the distribution of bird communities across these peatlands in NW Romania, considering several variables: (i) anthropogenic pressures, (ii) habitat heterogeneity, (iii) representative peatland plant species, (iv) water availability, and (v) land use and proximity to rural/urban areas.

MATERIALS AND METHODS

Study area

The avian and habitat surveys were carried out during the restoration project PEATRO4 (*Restoration of degraded bogs and peatlands in the North West region of Romania*), in three small peatlands with various degrees of

degradation, located in Cluj County, each assigned an identification code: one within Călățele Commune CJ-015 Molhașul Călățele (46°43'43"N, 23°01'15"E) and two within Beliș Commune CJ-020 Dâmbu Negru - Între Drumuri (46°40'52"N, 23°00'51"E) and CJ-022 Negrușul Finciului - Rovina Mare (46°40'42"N, 22°58'20"E) (Figure 1).

Situated at the crossroads of three major avian migration routes across Romania, corridors III and IV – the central-European-Bulgarian and corridor X – the Russian-Adriatic migratory route (Costică, 2011), the surveyed peatlands network as stepping stones between Natura 2000 conservation areas.

Two of the selected sites (Molhașul Călățele and Dâmbu Negru-Între Drumuri) are located outside several designated protected areas, with partially overlapping limits: Parcul Natural Apuseni, Natura 2000 ROSCI0002 Apuseni (Site of Community Interest), Natura 2000 ROSAC0002 Apuseni (Special Area of Conservation) and ROSPA0081 Munții Apuseni-Vlădeasa (Avifaunistic Special Protected Area). Negrușul Finciului-Rovina Mare (CJ-022) is the only peatland located entirely within protected areas, specifically inside the Apuseni Mountains Natural Park Complex (Table 1).

Table 1. Geographic details of the studied peatlands and distance to nearest protected areas

Peatland code	Area (ha)	Altitude (m a.s.l.)	Distance to the border of the protected area		Position relative to the protected area
			ROSPA 0081 Munții Apuseni-Vlădeasa	ROSAC 0002 Apuseni	
CJ-015	3.6	912	3800	3800	exterior
CJ-020	2.32	1122	236	73	exterior
CJ-022	2.08	1089	39	39	interior

Sites evaluation and avian surveys

Data on seasonal variations for avian communities and plant dynamics were obtained through habitat assessment and avian surveys. Both were conducted simultaneously during several outings and covered the spring-to-autumn phenological aspects of 2023, with an additional phase in April 2024 to confirm for late spring migration.

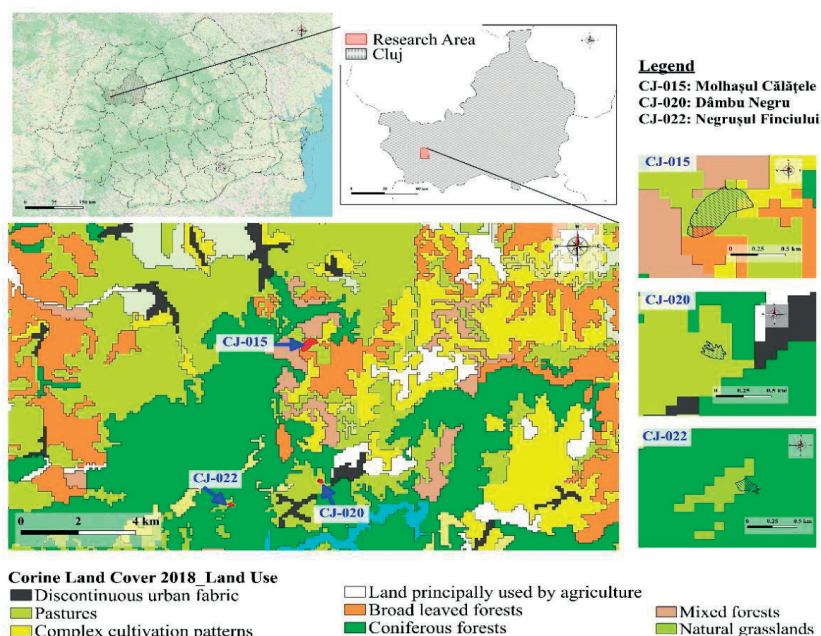


Figure 1. Location and land use for the targeted peatlands, Cluj County, Romania



Figure 2. Drone view from above Dâmbu Negru peatland

For the bird species census, we combined point counts and line transects (Bibby et al., 2000; Sutherland et al., 2004). For each peatland, we established at least five observation points and connected them with transects to ensure a comprehensive species inventory across the entire area. Avian species presence would be recorded 10 minutes/point. For transects, surveys were done every 500 m, with birds detected within 50 m on either side of the transect line recorded to minimise the likelihood of double-counting individuals in adjacent habitats. Counts were done with 10x50 Nikon binoculars, and acoustic recognition and camera

traps were used to confirm the presence of more cryptic species. Photographic documentation completed the ornithological assessment.

For habitat assessment, an initial drone survey was conducted over each site to obtain an overview of site configuration and vegetation structure (Figure 2). The aerial images helped to identify microtopographic features and guided the placement of transects.

Vegetation surveys were then conducted, and based on floristic data, plant communities were classified using the EUNIS habitat classification system (level 3) (EEA, 2012); when this was not possible, the relevant Natura 2000 type was used (Doniță et al., 2005). For each identified community, cover values of the vegetation layers were estimated. Plant species nomenclature follows POWO (2025).

Data analysis

Avian species richness and phenology patterns were processed and illustrated in Excel. To illustrate associations between bird species and key habitat variables, a focused CCA was used as an exploratory tool to visualise potential relationships under chi-square distance, within the constraints of the current model, following Gunnarson et al. (2006). The environmental variables measured on continuous scales were

subjected to z-standardisation (standardised to a mean of 0 and unit variance), prior to analysis to prevent differences in measurement units from influencing ordination results. Binary categorical variables were left untransformed. Species data (presence – ‘absence’/namely species not detected during survey effort) were not standardised, as CCA is based on chi-square distances and weighted averaging. (Legendre et al., 2011). For a more stable p-value estimation in accordance with our sample size, the statistical significance of the CCA model was assessed using a Monte Carlo permutation test with 4,999 unrestricted permutations. CCA analysis was run in PAST (Hammer et al., 2001). Bird guild dots were subsequently overlaid with detailed versions in Canva for illustrative purposes.

RESULTS AND DISCUSSIONS

Habitat assessment

The three study sites display a heterogeneous mosaic of habitats (Figure 3), including open *Sphagnum* bogs, *Carex* fens, shrub communities, conifer woodlands, and heath formations. These correspond to several EUNIS and Natura 2000 habitat types, such as D1.1 Raised bogs, 7120 Degraded raised bogs or 91D0* Bog woodland (Table 2).

Molhașul Călățele (CJ-15), described as an authentic active raised bog (Pop, 1947; 1960), was deeply affected by peat extraction carried out at the site between 1951 and 1989 and, more recently, by waste dumping related to the construction of the access road. Thus, the original ecosystem was disturbed, leading to surface drying and the loss or change of characteristic algal (Momeu et al., 2003) or bryophyte (Andrea et al., 2025) species, a phenomenon we also observed in vascular plants. Today, most of the site is occupied by *Betula* woodland, with variable coverage, classified as Natura 2000 habitat 7120 – Degraded raised bogs still capable of natural regeneration. The banks of the former exploitation are still visible and are currently undergoing regeneration, during which a characteristic vegetation of oligotrophic peatland has re-established: *Eriophorum vaginatum*, *Sphagnum* sp., *Drosera rotundifolia*

in wetter areas, and *Calluna vulgaris* in the drier portions. In the lower parts of the site, excavation ponds dominated by Cyperaceae species (*Carex rostrata*, *Carex echinata*, among the most common) have formed, along with small patches with *Typha* beds.

Table 2. Main habitat types for the studied peatlands

Site	Habitat		EUNIS/N2000 habitat type	Open water (0/1)
	ID	Plant community		
CJ-015	MC1	<i>Betula</i> swamp woodland	7120 Degraded raised bogs still capable of natural regeneration	0
	MC2	<i>Typha</i> beds	C3.23 - <i>Typha</i> beds	1
	MC3	<i>Carex</i> fen	D5.2 - Beds of large sedges normally without free-standing water	0
	MC4	<i>Eriophorum</i> lawns	D1.1112 - Bog cotton sedge-sphagnum lawns and green hummock bases	0
CJ-020	DN 1	open <i>Sphagnum</i> bog	D1.1 Raised bogs	0
	DN 2	<i>Molinia</i> & <i>Juncus</i> lawns	D2.2 <i>Carex nigra</i> , <i>Carex canescens</i> , <i>Carex echinata</i> fens	0
	DN3	<i>Carex</i> fen	D5.2 - Beds of large sedges normally without free-standing water	0
	DN4	<i>Salix</i> scrub	F9.2 - <i>Salix</i> carr and fen scrub	0
	DN5	<i>Picea</i> woodland	91D0*Bog woodland	0
CJ-022	NF1	<i>Picea</i> woodland	91D0*Bog woodland	0
	NF2	<i>Carex</i> fen	D5.2 - Beds of large sedges normally without free-standing water	0
	NF3	Springs	C2.1 Springs, spring brooks and geysers	1

Furthermore, Molhașul Călățele peatland has recently been proven home to rare bryophyte species such as *Sphagnum tenellum*, and confirms the presence of *Sphagnum papillosum* (Ștefănuț et al., 2026)

At **Dâmbu Negru-Între Drumuri** (CJ-020, due to the terrain, which features both inclines and flat areas, a mosaic of communities has developed. The largest area is covered by *Picea* woodland and *Salix* scrub, alternating with wet grasslands dominated by *Molinia caerulea*. The more oligotrophic zones are characterised by *Sphagnum* hummocks interspersed with *Vaccinium* spp. An outer lag or transition zone develops towards *Carex* fens in the more depressed areas, while the steeper and relatively drier slopes sustain dwarf shrub communities dominated by *Calluna vulgaris*.

The highest of the 3 study sites, **Negrușul Finciului**, is dominated by *Picea* bog woodland, with a lower vegetation layer composed of *Sphagnum* spp., *Vaccinium vitis-idaea* and *V. myrtillus*. The entire site is intersected by several springs, and a smaller area supports a Cyperaceae-dominated community.

Alongside structural heterogeneity, land use framing showcases the same diversity, ranging from 2 peatlands dominated and surrounded by agricultural land management (Dâmbu Negru and Molhașul Călățele) to one with little to no human management, due to its protected status (Negrușul Finciului) (Figure 3).

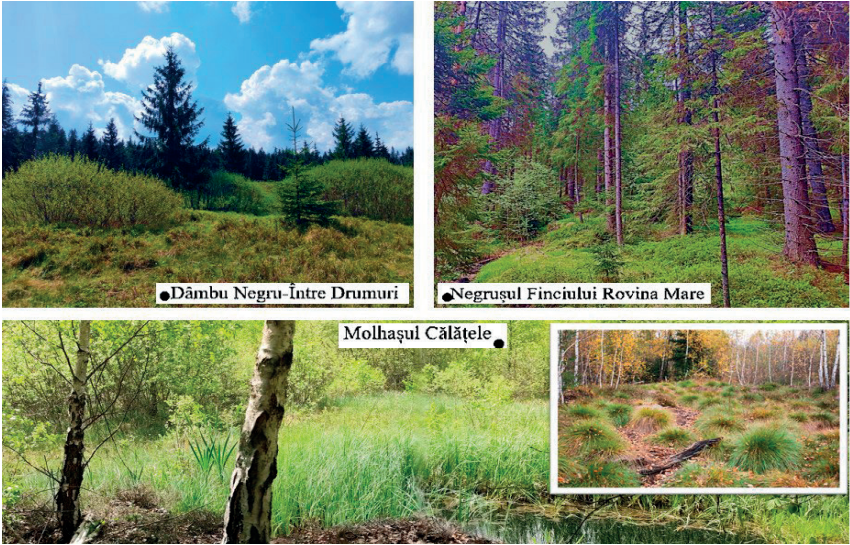


Figure 3. Habitat aspects and plant communities from the three study sites

Avian species richness and distribution

During the field surveys, a total of 39 avian taxa belonging to 17 different families (Table 3) were identified across the three studied peatlands. Out of these, three are considered Nearly Threatened at national level (*Accipiter gentilis*, *Clanga pomarina* and *Anthus trivialis*) and eight fall under the conservation guidelines of the European Birds Directive Annexe I (*Clanga pomarina*, *Falco tinnunculus*, *Dendrocopos leucotos*, *Dryocopus martius*, *Ficedula parva*, *Ficedula albicollis*, *Tetrao urogallus*, *Ciconia nigra*)

Bird communities across all sites differed in both richness and family-level composition, with insectivorous and omnivorous passerines, dominating the assemblages (flycatchers – fam. Muscicapidae at Dâmbu Negru and Molhașul Călățele and warblers – fam. Phylloscopidae for the peatland at Negrușul Finciului). Peatland CJ-020, Dâmbu Negru-Între Drumuri, presented the highest species richness (over 40% of the total avian richness value), also showcasing the most

varied taxonomic diversity at family level. By contrast, CJ-022 Negrușul Finciului counted the lowest value of taxonomic richness (Figure 5). In terms of phenology, spring migrants and summer avian taxa were more abundant in peatlands, attributed to agricultural land use frame (Figure 4).

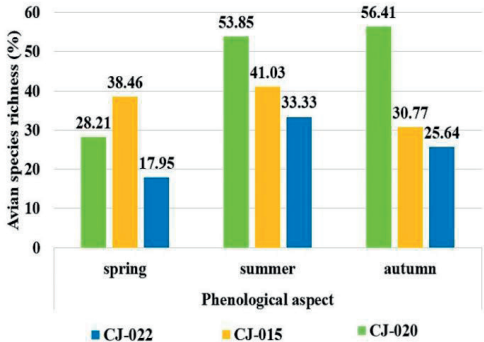


Figure 4. Phenological variability of avian species richness across 3 peatlands, Cluj, Romania

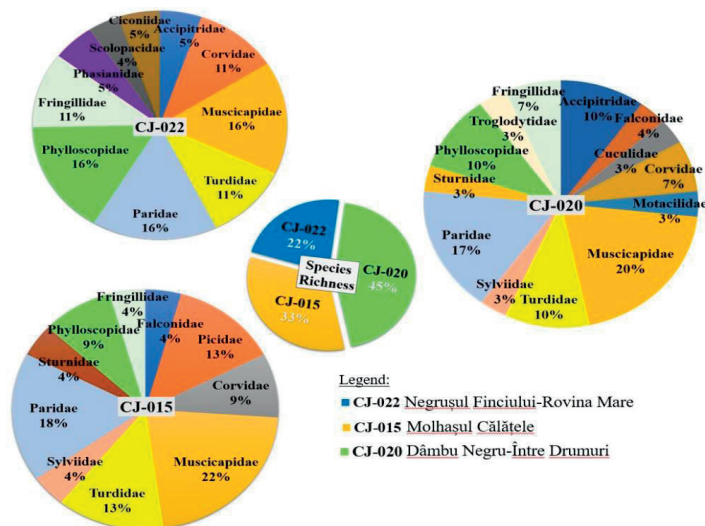


Figure 5. Avian species richness and percentage of taxonomic groups across three peatlands, Cluj, Romania

The CCA ordination (Figure 6) supports and expands on the field survey results. Variables along axis CCA2 have a stronger explanatory weight for avian guild distribution (eigenvalue=0.340). Avian community structure at Negrușul Finciului Rovina Mare (CJ-022) tends to align with the second axis CCA1, therefore it is 30% explained by habitat features (eigenvalue=0.256).

However, guild distribution is ultimately explained by the cumulative constrained variation of the two canonical axes (cumulated eigenvalue=0.595), therefore almost 60% of the matrix for bird species distribution occurs at the intersection of peatland habitat characteristics and anthropogenic variables (ranging from pollution and habitat conversion to agricultural practices).

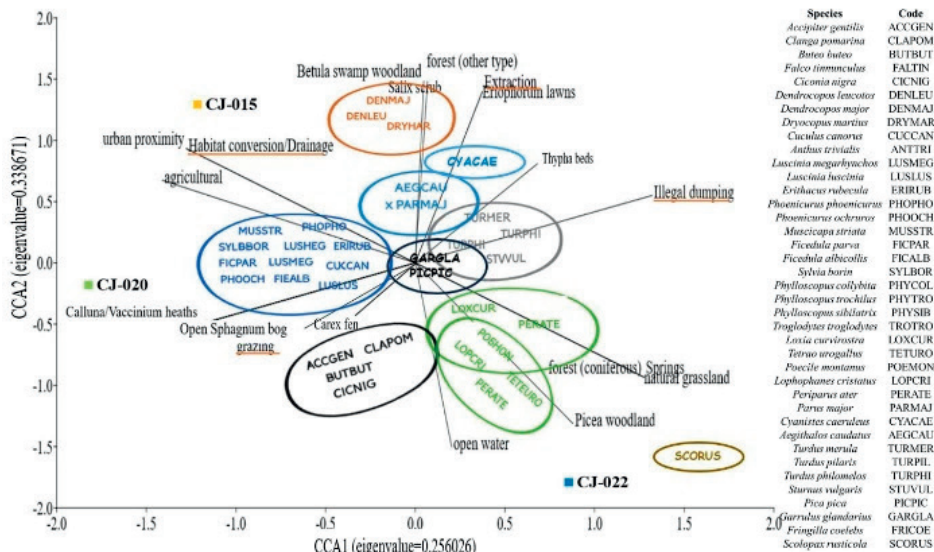


Figure 6. Canonical Correspondence Analysis (CCA triplot; scaling Type 2, amplified. Trace $p = 0.595$, p -value < 0.05) suggesting relationships between avian species composition and habitat variables across three peatland ecosystems, in Cluj, Romania. Bird species with standardised 6-letters alpha code, guild grouped on Eltonian traits – functional ecology grouping based on foraging attributes.

Wetland conservation value and agricultural implications.

The bird species richness and diversity in agricultural areas tend to be determined by the type of habitats in the surrounding area (Yaneva et al., 2020). Since species diversity in restored peatland areas tends to increase with heterogeneity in environmental conditions (Convention on Wetlands, 2021), avian species diversity across the 3 sites is an expression of the different land use categories for each particular site. Shrub coverage, humidity and higher soil moisture favour certain edaphic insect groups (Manu et al., 2020; Niculescu & Mitrea, 2018), offering foraging opportunities for numerous insectivorous birds.

At Dâmbu-Negru and Molhașul Călățele, peatland habitat heterogeneity is influenced by both habitat mosaic features and land use classification, supporting a higher variety of bird species. However, the **Molhașul Călățele** area is marked by habitat conversion, through drainage (CCA1 eigenvalue=0.62217) and overspread presence of birch tree *Betula* sp. This can lead to temperature rises and increased numbers of crop pests (Ma et al., 2025), while there is moderate bird richness and no significant diversity increase for pest control avian taxa (CCA2 eigenvalue for thrushes – 0.17312 and even lower for tits (eigenvalue=0.0207734) or specialised insectivorous species (CCA2 eigenvalue=0.0147887). Likewise, for the same peatland, considerable illegal dumping of construction and excavation waste (CCA2 eigenvalue=0.880171) favours the presence of avian taxa considered traditionally agricultural pests (generalist omnivores like starlings *Sturnus vulgaris* and corvids). Habitat restoration would moderate climate micro-regulation (Convention on Wetlands, 2025) and uphold the presence and diversity of agriculturally friendly bird taxa (Figure 7 – B), which in turn can boost productivity through pest control. (Díaz-Sieffer et al., 2021; Smith et al., 2022). This is particularly relevant for the area since land use classes at CJ-015 map broad leaf forests and pastures and are tangent to rural agricultural areas (the urban fabric of Călățele commune and adjacent complex cultivation patterns – Corine Land Cover, 2018).

CJ-020 Dâmbu-Negru is marginally under the pressure of local livestock management (CLC land use class – pastures and eigenvalue of EIONET A09 pressure grazing = 0.336191). However, peatland habitat heterogeneity supports the highest avian species diversity of all sample areas, noticeably diverse forest insectivores (flycatchers, three warbler families, bush birds such as wrens *Troglodytes troglodytes*, nightingales, thrushes – Figure 3). Diversity of tit species mirrors the habitat matrix and foraging opportunities of the area and can have implications for local pest caterpillar suppression in orchards, consequently increasing fruit yield. (Molls & Viser, 2002). In the case of raptors, with the exception of *Clanga pomarina* recorded at Negrușul Finciului during passage, raptor species presence was also dominant at Dâmbu-Negru.

This can be partially explained by cumulative eigenvalues for variables such as coniferous forest (*Picea* woodland habitat type), open water sources and *Carex* fen – *Sphagnum* sp. – *Vaccinium/Calluna* heath mosaic habitat (resulting value for CCA1+CCA2 = 0.671131). Raptor presence, like the ones identified (goshawks, buzzards and kestrels), was proven to reduce costs in agriculture by pest control in farmland mosaics (Machar et al., 2017)

Lastly, **Negrușul Finciului** peatland displays the characteristic features of a raised bog with coniferous forest, more isolated due to land use and protection status, and less diverse in terms of habitat matrix. As such, avian communities recorded at CJ-022 were more specific to certain habitat traits – wet woodland bird species like the woodcock *Scolopax rusticola*, game species of conservation importance falling under Annexe I, Birds' Directive, like the Western Capercaillie *Tetrao urogallus* (Figure 7) or coniferous patches associated species such as crossbills *Loxia curvirostra*. Last but not least, the area also recorded several particular species with the potential to offer agricultural regulating services during migration or dispersal (Smith et al., 2022). As such, willow and crested tits – *Poecile montanus*, *Lophophanes cristatus*, may contribute to caterpillar and other insect population control, while big waders like the black stork *Ciconia nigra* may help keep invertebrate numbers in check (Korányi, 2025).

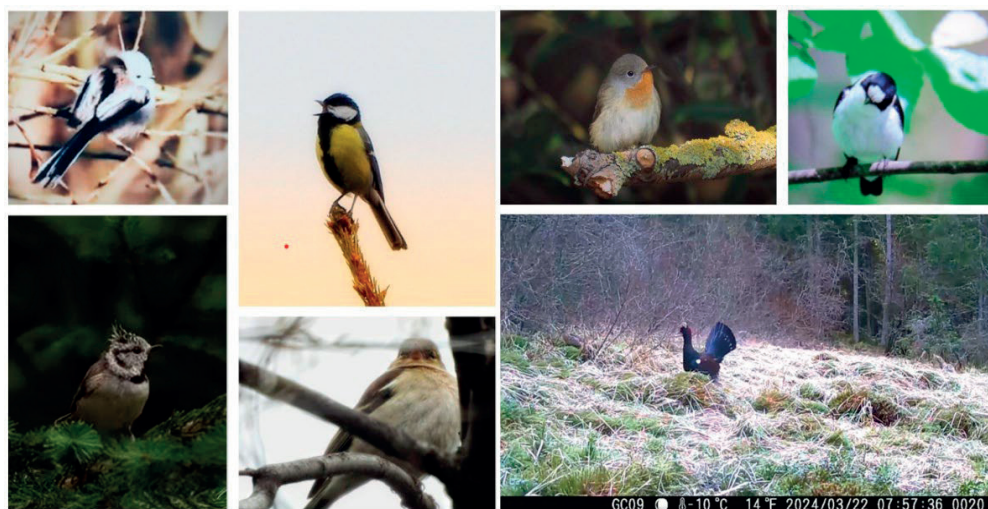


Figure 7. Selection of bird species from the three peatlands in Cluj, Romania relevant to conservation (right corner, down): *Tetrao urogallus* on camera trap at CJ-022; agriculture: insectivore bird taxa (upper row): *Aegitalos caudatus* – CJ-015, *Parus major* – all three areas, *Ficedula parva* – CJ-015/020 (Annexe 1, Birds Directive), *Ficedula albicollis* CJ-020 (Annexe 1 species); (lower row): *Fringilla coelebs* – all three areas & *Lophophanes cristatus*– CJ-022

Table 3. Avian species identified in three peatlands in NW Romania and their conservation status

Avian species			Peatland			Conservation status		
						RL IUCN	B D A I	RL RO
Family	Scientific name	Common name	(CJ-020)	(CJ-015)	(CJ-022)			
Accipitridae	<i>Accipiter gentilis</i>	Northern Goshawk	x			LC		NT
	<i>Clanga pomarina</i>	Lesser Spotted Eagle	x		x	LC	x	NT
	<i>Buteo buteo</i>	Common Buzzard				LC		LC
Falconidae	<i>Falco tinnunculus</i>	Common Kestrel	x	x		LC	x	LC
Picidae	<i>Dendrocopos leucotos</i>	White-backed Woodpecker		x		LC	x	LC
	<i>Dryocopus martius</i>	Black Woodpecker		x		LC	x	LC
	<i>Dendrocopos major</i>	Great Spotted Woodpecker		x		LC	x	LC
Cuculidae	<i>Cuculus canorus</i>	Common Cuckoo	x			LC		LC
Corvidae	<i>Pica pica</i>	Eurasian Magpie	x	x	x	LC		LC
	<i>Garrulus glandarius</i>	Eurasian Jay	x	x	x	LC		LC
Motacilidae	<i>Anthus trivialis</i>	Tree Pipit	x			LC		NT
Muscicapidae	<i>Luscinia megarhynchos</i>	Common Nightingale	x		x	LC		LC
	<i>Luscinia luscinia</i>	Thrush Nightingale		x		LC		LC
	<i>Erithacus rubecula</i>	European Robin	x	x	x	LC		LC
	<i>Phoenicurus phoenicurus</i>	Common Redstart	x	x		LC		LC
	<i>Phoenicurus ochruros</i>	Black Redstart		x	x	LC		LC
	<i>Muscicapa striata</i>	Spotted Flycatcher	x			LC		LC
	<i>Ficedula parva</i>	Red-breasted Flycatcher	x	x		LC	x	LC
Turdidae	<i>Ficedula albicollis</i>	Collared Flycatcher	x			LC	x	LC
	<i>Turdus merula</i>	Common Blackbird	x	x	x	LC		LC
	<i>Turdus pilaris</i>	Fieldfare	x	x	x	LC		LC
Sylviidae	<i>Turdus philomelos</i>	Song Thrush	x	x		LC		LC
	<i>Sylvia borin</i>	Garden Warbler	x	x		LC		LC
Paridae	<i>Parus major</i>	Great Tit	x	x	x	LC		LC
	<i>Periparus ater</i>	Coal Tit	x		x	LC		LC
	<i>Cyanistes caeruleus</i>	Eurasian Blue Tit	x	x	x	LC		LC
	<i>Poecile montanus</i>	Willow Tit	x	x		LC		LC
	<i>Lophophanes cristatus</i>	Crested Tit	x			LC		LC

Avian species			Peatland			Conservation status		
Family	Scientific name	Common name	(CJ-020)	(CJ-015)	(CJ-022)	RL IUCN	BDAI	RL RO
	<i>Aegialos caudatus</i>	Long-tailed Tit		x		LC		LC
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling	x	x		LC		LC
Phylloscopidae	<i>Phylloscopus collybita</i>	Common Chiffchaff	x	x	x	LC		LC
	<i>Phylloscopus trochilus</i>	Willow Warbler	x	x	x	LC		LC
	<i>Phylloscopus sibilatrix</i>	Wood Warbler	x		x	LC		LC
Troglodytidae	<i>Troglodytes troglodytes</i>	Eurasian Wren	x			LC		LC
Fringillidae	<i>Loxia curvirostra</i>	Red Crossbill	x		x	LC		LC
	<i>Fringilla coelebs</i>	Common Chaffinch	x	x	x	LC		LC
Phasianidae	<i>Tetrao urogallus</i>	Western Capercaillie			x	LC	x	LC
Scolopacidae	<i>Scolopax rusticola</i>	Eurasian Woodcock			x	LC		LC
Ciconiidae	<i>Ciconia nigra</i>	Black Stork			x	LC	x	LC

Legend: RL IUCN – The International Union for Conservation of Nature Red List of Threatened Species (LC – Least Concern), BDAI –European Birds' Directive Annex I, RORL Romanian Red species list (NT – Near Threatened) x – mark for species presence. Species protection status sources: Atlas al speciilor de păsări de interes comunitar din România, (SOR, 2022), Romanian Red List for Bird Species (1991, Monitorul Oficial, online - <https://www.sor.ro/wp-content/uploads/1991/01/Lista-Rosie-Monitorul-Oficial-Partea-I-nr.-798Bis.pdf>)

CONCLUSIONS

Temperate peatlands construct into vulnerable ecosystems requiring monitoring and integrated restoration approaches in order to maintain their ecosystem services that go beyond carbon trapping.

Two of the three sites sampled for this study displayed higher heterogeneity of the habitat matrix and bird species composition due to differences in land use classification and variance in the shape and amplitude of anthropogenic pressures.

The presence of Annexe I avian taxa and Near Threatened bird species confirms the conservation value of small-sized peatlands as stepping stones, particularly between larger Natura 2000 protected areas.

Furthermore, our pilot assessment supports the idea that sustainable agriculture stems from nature-based solutions.

This can lead to mutually beneficial cooperative associations with avian guilds from peatland areas embedded in the farmland matrix.

Understanding bird communities and their dynamics in these habitats becomes vital to further conservation policies.

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