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## ORNITHOCENOSIS STRUCTURE IN FRESH AND WET SUDUBRAVAS OF KYIV POLISSYA DURING THE BREEDING PERIOD

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### **Ornithocenosis Structure in Fresh and Wet Sudubravas of Kyiv Polissya During the Breeding Period.**

**Plyha, A. V.** — This research was carried out in Kyiv Polissya geobotanical province, in one of most common woods type — fresh and wet sudubravas. Its purpose is to determine ornithocenosis structure in different age groups of this type of forest. To achieve that, forest bird species lists were composed, their population density and that of ecological groups of birds were calculated. In the course of the research in the breeding periods of 2013–2014, two-time surveys were carried out on 12 survey routes of total length 33 km. For further analysis, forests were divided into age groups: 0–20 years, 20–40 years, 40–60 years, 60–80 years, 80–100 years and forests over 100 years. Altogether 53 bird species were found. Species lists were poorest in the forests of 0–20 years (18 species), and richest in the forests over 100 years (39 species). Minimal population density was 473 individuals per square kilometer in the youngest forest age group of 0–20 years, maximal — 2155 individuals per square kilometer in pine forests aged over 100 years. Analysis of different population densities of ecological groups reveals steadily growing numbers of hollow-nesting birds and tree-nesting birds in accordance with aging of the forests. In older forests hollow-nesting birds constitute an absolute majority. Population density of another ecological group shows no such direct tendency.

**Key words:** Kyiv Polissya, ornithocenosis, bird populations, population density.

### **Introduction**

Kyiv Polissya is the geobotanical province that covers the northern right bank of Kyiv Region (Andriyenko et al., 2006). There are all types of forests as classed by conventional forest typology: pure pine forests, pine-oak forests, Quercus–Carpinus–Pineta (sudubravas) and deciduous forests (gruds) (Vorobiev, 1953). Sudubravas are second in area after pinetum compositions.

Previously to our study, quantitative and qualitative composition of avifauna in different types of forests (following aforementioned classification) in this region at varying stages of reforestation wasn't analyzed. Knowledge of this composition will enable modeling of bird populations in conditions of clear-cutting of different forest types.

Present work is in the same vein as the research of A. I. Guzy in forests of the Carpathian region in 1984–1988 (Guzy, 1992), and Yu. I. Vergeles in Kharkiv Region in 1988–1991 (Vergeles, 1993) and is continuation of own research in Kyiv Polissya fresh pine–oak Quercus–Pinetum compositum (unpublished data).

A. I. Guzy laid out more than 120 routes in various types of Carpathian forests and found 130 of 250 species of regional avifauna. In his calculations of birds' densities, he used M. A. Holubets' geobotanical classification as a basis for forest typifying.

Yu. I. Vergeles conducted bird surveys in the forests of watershed and basins of tributaries of the Dnipro river and the Siversky Donets river. Habitat classification in his studies was based on widely accepted forest typology classification by D. V. Vorobyov. He found altogether 90 species of birds.

Own research took place in the fresh pine–oak Quercus roboris–Pinetum forests in Kyiv Polissya. Altogether 12 survey routes of total length 29.6 km were laid in major forests of Kyiv Region in 2013–2014. Fifty bird species were observed on the surveys, excluding encountered outside distance bands. For many of those bird species, populations' densities at different stages of Quercus roboris–Pinetum compositum forests reforestation were ascertained.

The present work is an attempt to fill a gap in studies of other types of forests avifauna of central Ukrainian Polissya. Purpose of research is to determine ornithocenosis' structure of fresh and wet sudubravas in Kyiv Polissya at different stages of reforestation. Counts of birds were conducted in breeding period on routes designed for most complete possible coverage of Kyiv Polissya, species lists compiled and population density calculated for different bird species and their ecological groups.

## Material and methods

Major factor influencing the choice of accounting method was the ability to accurately determine the presence of birds in a given forest location with certain forest characteristics. Thus, methods based on the maximum range for determining bird voice were rejected because in this case, given the high fragmentation of forest locations, it is often not possible to say exactly where the bird is (Guzy, 1997).

Method of point counts was rejected due to time constraints of data collection, because a lot of time is spent on transitions between locations.

The only acceptable method was the method of accounting on transects with stable width of distance band (Blagosklonov et al., 1952). The width of distance band was established as 30 m on either side of the direction of motion. So a compromise was found between the need to cover the largest possible area in least possible time and, on the other hand, to register birds most accurately corresponding to a particular type of forest.

Counts were conducted in the morning, in the early hours after sunrise. Visual checks and voices of birds were both noted. Nests, singing males or birds that expressed territorial behavior were considered signs of breeding pairs. If the registration of species was outside the distance bands but in the same habitat, it was noted in the respective age groups in the tables, but its numbers were taken as zero and not analyzed further.

To determine the density of bird population, their numbers were divided by the area covered by distance band. Thus, estimates of birds' density per square kilometer were obtained. For the density calculations, the sudubravas were divided into several age groups: 0–20 years, 20–40 years, 40–60 years, 60–80 years old and forests older than 100 years. Coniferous and deciduous stands aged up to 60 years were considered together, the older age groups — separately.

The underestimation that is inherent in surveys was taken into account in data analysis, and the highest data rates were taken (Berman et al., 1952; Dobrokhotoy, 1952).

In the analysis, bird species were characterized as “very numerous” “numerous”, “normal” or “rare” (Kuzyakin, 1962).

Twelve survey routes were chosen: one in each of Radomyshl, Ivankiv, Dymer, Kyiv, Makariv forest farms and Boyarka forest research stations, and two in each of Teteriv, Klavdieve, and Dnipro–Teteriv forest farms. Survey routes covered almost all the major forests of Kyiv Polissya. Forest in the Chernobyl exclusion zone and Kyiv–Puscha–Vodytsa forests were not included into survey routes.

Counts were conducted in May–June in 2013–2014. On seven survey routes counts were conducted twice in 2014, on other five routes they were carried out in 2013 and 2014. This frequency is considered sufficient in research that covers large areas (Blagosklonov et al., 1952; Korolkova, 1952; Merkallio, 1946).

The total length of survey routes in fresh sudubravas is 16.3 km, and in wet sudubravas it is 16.39 km. Analysis of avifaunas largely was performed on merged data from these forest types due to their phytocoenotic similarity.

Latin names are annotated by the Annotated List of the Ukrainian Scientific Names of the Bird Species Belonging to the Fauna of Ukraine (Fesenko et al., 2007).

**Table 1. Avifauna of 0–20 yrs old fresh and wet hornbeam–oak–pine and hornbeam sudubravas**

Species	Density, individual per sq. km	%
<i>Parus major</i> Linnaeus, 1758	96	20.3
<i>Sylvia atricapilla</i> Linnaeus, 1758	83	17.5
<i>Phylloscopus collybita</i> Vieillot, 1817	71	15
<i>Turdus merula</i> Linnaeus, 1758	58	12.3
<i>Erithacus rubecula</i> Linnaeus, 1758	32	6.8
<i>Anthus trivialis</i> Linnaeus, 1758	26	5.5
<i>Sturnus vulgaris</i> Linnaeus, 1758	26	5.5
<i>Ficedula coelebs</i> Linnaeus, 1758	19	4
<i>Garrulus glandarius</i> Linnaeus, 1758	19	4
<i>Lanius collurio</i> Linnaeus, 1758	13	2.7
<i>Luscinia luscinia</i> Linnaeus, 1758	6	1.3
<i>Dryocopus martius</i> Linnaeus, 1758	6	1.3
<i>Picus canus</i> Gmelin, 1788	6	1.3
<i>Parus palustris</i> Linnaeus, 1758 / <i>Parus montanus</i> Baldenstein, 1827*	6	1.3
<i>Sitta europaea</i> Linnaeus, 1758	6	1.3
<i>Columba palumbus</i> Linnaeus, 1758	0	0
<i>Sylvia nisoria</i> Bechstein, 1795	0	0
<i>Streptopelia turtur</i> Linnaeus, 1758	0	0
Total	473	100

Note. Here and below: due to the complexity of the visual determination of these species, they were shown together.

## Discussion

53 bird species were found in fresh and wet sudubravas in general (excluding species encountered outside the distance band in another habitat or if the habitat cannot be specified — for example, registered in flight predators or owls).

The first forest age group of 0–20 years comprised of plantations with open as well as with closed canopies. This group includes fresh and wet sudubrava areas that include both hornbeam–oak–pine forest and hornbeam sudubrava. Vegetative cover of sudubravas of this group was represented by young artificial pine plantations (mostly in fresh sudubravas) or deciduous mostly natu-

ral plantations consisting of birch, aspen, alder and oak (especially in wet sudubravas), in rare cases there were spruce forests of artificial origin. Surveys in this age group covered a total length of 4360 m, with coverage area of 15.6 ha in Potashnya and Mircha forestry of Teteriv forest farm, Plesetsk forestry of Boyarka forest research station, Nizhylovichy forestry of Makariv forest farm, Shybene forestry of Klavdievo forest farm and Obukhovychy forestry in Ivankiv forest farm (table 1).

18 bird species are present in this age group, 10 of them are numerous, 5 were normal and 3 rare. The dominant species are the Great Tit (*P. major*), Blackcap (*S. atricapilla*), Chiffchaff (*Ph. collybita*) and Blackbird (*T. merula*). The most numerous group is hollow-nest birds (31 %), the group of ground-nesting birds the second most numerous (29 %). Shrub-nesting birds constitute 20 %, tree-nesting birds 16 % and birds of the crowns 4 % of all species. This unusually high number of hollow-nesting birds in the lowest age forest type is obviously related to the importance of these habitats in feeding and corresponds with results obtained in fresh *Quercus robur*-Pinetum compositum forests in Kyiv Polissya.

The area of fresh and wet sudubravas of age category 20–40 years was 14.25 hectares, the length of the route 3330 meters. This age group was represented mainly by wet hornbeam-pine-oak sudubravas represented by deciduous stands consisting of birch, aspen, beech and oak, of both natural and artificial origin. The composition of survey routes included areas of Nizhylovichy forestry of Makariv forest farm, Obukhovychy forestry in Ivankiv forest farm, Shybene forestry in Klavdievo forest farm (table 2).

There are 19 bird species in this age group, including 2 very numerous, 10 numerous, 3 normal and 4 rare species. The dominant species is the Great Tit, subdominant species are the Chaffinch (*F. coelebs*), Robin (*E. rubecula*) and Common Chiffchaff. The hollow-nesting birds still lead in numbers (33 %), followed by ground-nesting birds (31 %), tree-nesting

**Table 2. Avifauna of 20–40 yrs old wet hornbeam–oak–pine and hornbeam sudubravas**

Species	Density, individual per sq., km	%
<i>Parus major</i>	196	27.5
<i>Ficedula coelebs</i>	147	20.6
<i>Erithacus rubecula</i>	91	12.7
<i>Phylloscopus collybita</i>	84	11.8
<i>Sylvia atricapilla</i>	56	7.8
<i>Turdus philomelos</i> C. L. Brehm, 1831	28	3.9
<i>Phylloscopus sibilatrix</i> Bechstein, 1793	21	2.9
<i>Dendrocopos major</i> Linnaeus, 1758	14	2
<i>Sitta europaea</i>	14	2
<i>Anthus trivialis</i>	14	2
<i>Emberiza citrinella</i> Linnaeus, 1758	14	2
<i>Turdus merula</i>	14	2
<i>Parus palustris/montanus</i>	7	1
<i>Garrulus glandarius</i>	7	1
<i>Parus caeruleus</i> Linnaeus, 1758	7	1
<i>Cuculus canorus</i> Linnaeus, 1758	0	0
<i>Columba palumbus</i>	0	0
<i>Oriolus oriolus</i> Linnaeus, 1758	0	0
<i>Troglodytes troglodytes</i> Linnaeus, 1758	0	0
Total	714	100

**Table 3. Avifauna of 40–60 yrs old wet hornbeam–oak–pine and hornbeam sudubravas**

Species	Density, individual per sq., km	%
<i>Fringilla coelebs</i>	248	18.8
<i>Parus major</i>	209	15.8
<i>Sylvia atricapilla</i>	147	11.1
<i>Phylloscopus sibilatrix</i>	108	8.2
<i>Dendrocopos major</i>	108	8.2
<i>Erithacus rubecula</i>	70	5.3
<i>Sitta europaea</i>	70	5.3
<i>Oriolus oriolus</i>	62	4.7
<i>Ficedula albicollis</i> Temminck, 1815	54	4.1
<i>Phylloscopus collybita</i>	54	4.1
<i>Sturnus vulgaris</i>	39	3
<i>Anthus trivialis</i>	31	2.3
<i>Coccothraustes coccothraustes</i> Linnaeus, 1758	23	1.7
<i>Muscicapa striata</i> Pallas, 1764	23	1.7
<i>Turdus philomelos</i>	23	1.7
<i>Hippolais icterina</i> Vieillot, 1817	15	1.1
<i>Turdus merula</i>	15	1.1
<i>Parus palustris/montanus</i>	15	1.1
<i>Turdus viscivorus</i> Linnaeus, 1758	8	0.6
<i>Dryocopus martius</i>	0	0
<i>Ficedula parva</i> Scopoli, 1769	0	0
<i>Columba palumbus</i>	0	0
Total	1322	100

**Table 4. Avifauna of 60–80 yrs old deciduous fresh and wet hornbeam–oak–pine sudubravas and hornbeam sudubravas**

Species	Density, individual per sq., km	%
<i>Fringilla coelebs</i>	293	20.4
<i>Parus major</i>	283	19.7
<i>Erithacus rubecula</i>	189	13.2
<i>Ficedula albicollis</i>	89	6.2
<i>Sylvia atricapilla</i>	79	5.5
<i>Phylloscopus collybita</i>	50	3.5
<i>Parus palustris/montanus</i>	50	3.5
<i>Sitta europaea</i>	45	3.1
<i>Phylloscopus sibilatrix</i>	40	2.8
<i>Troglodytes troglodytes</i>	40	2.8
<i>Turdus merula</i>	40	2.8
<i>Coccothraustes coccothraustes</i>	35	2.4
<i>Garrulus glandarius</i>	25	1.7
<i>Picus canus</i>	25	1.7
<i>Anthus trivialis</i>	20	1.4
<i>Hippolais icterina</i>	20	1.4
<i>Sturnus vulgaris</i>	20	1.4
<i>Dendrocopos major</i>	20	1.4
<i>Dendrocopos minor</i> Linnaeus, 1758	20	1.4
<i>Columba palumbus</i>	15	1
<i>Dryocopus martius</i>	15	1
<i>Streptopelia turtur</i>	10	0.7
<i>Phylloscopus trochilus</i> Linnaeus, 1758	5	0.3
<i>Turdus philomelos</i>	5	0.3
<i>Cuculus canorus</i>	0	0
<i>Oriolus oriolus</i>	0	0
Total	1433	100

**Table 5. Avifauna of 60–80 yrs old coniferous fresh and wet hornbeam–oak–pine sudubravas**

Species	Density, individual per sq., km	%
<i>Fringilla coelebs</i>	360	19
<i>Parus major</i>	323	17.1
<i>Erithacus rubecula</i>	194	10.3
<i>Phylloscopus sibilatrix</i>	194	10.3
<i>Phylloscopus collybita</i>	120	6.3
<i>Sylvia atricapilla</i>	111	5.9
<i>Ficedula albicollis</i>	92	4.9
<i>Anthus trivialis</i>	74	3.9
<i>Dendrocopos major</i>	65	3.4
<i>Parus cristatus</i> Linnaeus, 1758	55	2.9
<i>Phoenicurus phoenicurus</i> Linnaeus, 1758	46	2.4
<i>Sitta europaea</i>	46	2.4
<i>Cuculus canorus</i>	37	2
<i>Sturnus vulgaris</i>	28	1.5
<i>Turdus merula</i>	28	1.5
<i>Carduelis carduelis</i> Linnaeus, 1758	18	1
<i>Certhia familiaris</i> Linnaeus, 1758	18	1
<i>Garrulus glandarius</i>	18	1
<i>Parus palustris/montanus</i>	18	1
<i>Dendrocopos syriacus</i> Hemprich et Ehrenberg, 1833	18	1
<i>Dryocopus martius</i>	9	0.5
<i>Lanius collurio</i>	9	0.5
<i>Parus caeruleus</i>	9	0.5
<i>Corvus corax</i> Linnaeus, 1758	0	0
<i>Columba oenas</i> Linnaeus, 1758	0	0
<i>Columba palumbus</i>	0	0
<i>Oriolus oriolus</i>	0	0
Total	1890	100

birds (27 %), shrub-nesting birds (8 %) and birds of the crowns (1 %). Compared with the previous forest age group, the proportion of tree-nesting birds is increased due to the presence of subdominant the Chaffinch in nesting fauna, and reduced numbers of the Blackcap.

Survey routes in fresh and wet sudubravas aged 40–60 years were of total length of 4525 meters, survey area of 12.91 ha. Surveys in this forest age group were laid out in Nizhylovichy forestry in Makariv forest farm, Plesetsk Forestry in Boyarka Forest Research Station, Irpin forestry in Kyiv forest farm, Potashnya forestry in Teteriv forest farm, Obukhovychy forestry in Ivankiv forest farm, Shybene forestry in Klavdievo forest farm. The forests of this group consist mainly of fresh hornbeam–oak–pine sudubravas of artificial origin, dominated by pine and deciduous stands of natural and artificial origin consisting of oak, birch, aspen, etc. (table 3).

In this age group, the number of species increases to 22: five very numerous, 13 numerous, one normal and three rare. The Chaffinch becomes dominant and the Great Tit and Blackcap subdominant species.

The table excluded the Sparrowhawk (*Accipiter nisus* Linnaeus, 1758) seen in Plesetsk forestry of Boyarka forest research station.

Hollow-nesting birds still prevail (39 %) but among them there are territorial breeding pairs. The second place belongs to tree-nesting birds (23 %), followed by ground-nesting birds (20 %), shrub-nesting birds (11 %) and birds of crowns (6 %). Tree-nesting species become more prominent while the

**Table 6. Avifauna of 60–80 yrs old fresh and wet hornbeam–oak–pine sudubravas**

Species	Density, individual per sq. km	%
<i>Fringilla coelebs</i>	317	19.8
<i>Parus major</i>	307	19.2
<i>Erithacus rubecula</i>	191	11.9
<i>Phylloscopus sibilatrix</i>	94	5.9
<i>Sylvia atricapilla</i>	90	5.6
<i>Ficedula albicolis</i>	90	5.6
<i>Phylloscopus collybita</i>	74	4.6
<i>Sitta europaea</i>	45	2.8
<i>Parus palustris / montanus</i>	42	2.6
<i>Anthus trivialis</i>	39	2.4
<i>Turdus merula</i>	36	2.2
<i>Dendrocopos major</i>	36	2.2
<i>Troglodytes troglodytes</i>	26	1.6
<i>Garrulus glandarius</i>	23	1.4
<i>Coccothraustes coccothraustes</i>	23	1.4
<i>Sturnus vulgaris</i>	23	1.4
<i>Picus canus</i>	16	1
<i>Parus cristatus</i>	16	1
<i>Phoenicurus phoenicurus</i>	16	1
<i>Dendrocopos minor</i>	16	1
<i>Cuculus canorus</i>	13	0.8
<i>Dryocopus martius</i>	13	0.8
<i>Hippolais icterina</i>	13	0.8
<i>Columba palumbus</i>	10	0.6
<i>Streptopelia turtur</i>	6	0.4
<i>Carduelis carduelis</i>	6	0.4
<i>Certhia familiaris</i>	6	0.4
<i>Dendrocopos syriacus</i>	3	0.2
<i>Lanius collurio</i>	3	0.2
<i>Parus caeruleus</i>	3	0.2
<i>Phylloscopus trochilus</i>	3	0.2
<i>Turdus philomelos</i>	3	0.2
<i>Oriolus oriolus</i>	0	0
<i>Corvus corax</i>	0	0
<i>Columba oenas</i>	0	0
Total	1602	100

cies of birds, 3 of them very numerous, 18 numerous, 3 normal and 2 rare.

The table does not include the Tawny Owl (*Strix aluco* Linnaeus, 1758) whose brood with three young birds was found in an oak forest in Plesetsk forestry in Boyarka forest research station. The Chaffinch continues to dominate, subdominant species are the Great Tit and Robin.

The proportion of hollow-nesting birds is 40 %, tree-nesting 25 %, ground-nesting 24 %, birds of crowns 6 % and shrub-nesting birds 5 %.

Coniferous plantations are fresh and moist hornbeam–oak–pine sudubravas, represented by the natural and mostly artificial pine stands, and occasionally by artificial fir stands. The length of survey routes here equaled 2595 meters, cover-

role of ground-nesting and shrub-nesting birds reduces.

Fresh and wet deciduous and conifer plantations of 60–80 years are considered separately.

Deciduous plantations of wet hornbeam–oak–pine and hornbeam sudubravas were primarily of natural origin, formed by small-leaved species and fresh hornbeam–oak–pine sudubravas with oak of natural origin. Length of survey route in these plantations was 4920 meters, covering 20.14 ha. Count sites were located within Potashnya and Mircha forestry in Teteriv forest farm, Shybene forestry in Klavdievo forest farm, Nizhylovichy forestry in Makariv forest farm, Obukhovychy and Zherev forestry in Ivankiv forest farm, Plesetsk Forestry in Boyarka forest research station (table 4). In deciduous forest stands of this age there are 26 spe-

**Table 7. Avifauna of deciduous stands of fresh and wet hornbeam–oak–pine sudubravas and hornbeam sudubravas aged 80–100 yrs**

Species	Density, individual per sq. km	%
<i>Fringilla coelebs</i>	266	16.7
<i>Parus major</i>	205	12.9
<i>Sturnus vulgaris</i>	152	9.5
<i>Dendrocopos major</i>	144	9
<i>Sylvia atricapilla</i>	91	5.7
<i>Sitta europaea</i>	91	5.7
<i>Erithacus rubecula</i>	84	5.3
<i>Ficedula albicolis</i>	76	4.8
<i>Phylloscopus collybita</i>	46	2.9
<i>Coccothraustes coccothraustes</i>	38	2.4
<i>Parus palustris/montanus</i>	38	2.4
<i>Turdus philomelos</i>	38	2.4
<i>Oriolus oriolus</i>	30	1.9
<i>Phylloscopus sibilatrix</i>	30	1.9
<i>Phylloscopus trochilus</i>	30	1.9
<i>Troglodytes troglodytes</i>	30	1.9
<i>Certhia familiaris</i>	23	1.4
<i>Turdus viscivorus</i>	23	1.4
<i>Parus caeruleus</i>	23	1.4
<i>Cuculus canorus</i>	15	0.9
<i>Chloris chloris</i> Linnaeus, 1758	15	0.9
<i>Emberiza citrinella</i>	15	0.9
<i>Jynx torquilla</i> Linnaeus, 1758	15	0.9
<i>Lanius collurio</i>	15	0.9
<i>Luscinia luscinia</i>	15	0.9
<i>Upupa epops</i> Linnaeus, 1758	15	0.9
<i>Ficedula parva</i>	15	0.9
<i>Dryocopus martius</i>	8	0.5
<i>Turdus merula</i>	8	0.5
<i>Corvus corax</i>	0	0
<i>Columba palumbus</i>	0	0
Total	1594	100



**Table 8. Avifauna of forest stands of fresh and wet hornbeam–oak–pine sudubravas and hornbeam sudubravas aged 80–100 yrs**

Species	Density, individual per sq. km	%
<i>Fringilla coelebs</i>	326	20.2
<i>Parus major</i>	187	11.6
<i>Sturnus vulgaris</i>	121	7.5
<i>Dendrocopos major</i>	121	7.5
<i>Sylvia atricapilla</i>	109	6.8
<i>Erithacus rubecula</i>	78	4.8
<i>Ficedula albicollis</i>	72	4.5
<i>Sitta europaea</i>	72	4.5
<i>Phylloscopus collybita</i>	54	3.3
<i>Parus palustris/montanus</i>	54	3.3
<i>Turdus philomelos</i>	48	3
<i>Phylloscopus sibilatrix</i>	36	2.2
<i>Coccyzus coccyzus</i>	30	1.9
<i>Turdus merula</i>	30	1.9
<i>Anthus trivialis</i>	24	1.5
<i>Oriolus oriolus</i>	24	1.5
<i>Phylloscopus trochilus</i>	24	1.5
<i>Troglodytes troglodytes</i>	24	1.5
<i>Certhia familiaris</i>	18	1.1
<i>Phoenicurus phoenicurus</i>	18	1.1
<i>Cuculus canorus</i>	12	0.7
<i>Chloris chloris</i>	12	0.7
<i>Corvus corax</i>	12	0.7
<i>Emberiza citrinella</i>	12	0.7
<i>Jynx torquilla</i>	12	0.7
<i>Lanius collurio</i>	12	0.7
<i>Luscinia luscinia</i>	12	0.7
<i>Turdus viscivorus</i>	12	0.7
<i>Upupa epops</i>	12	0.7
<i>Ficedula parva</i>	12	0.7
<i>Parus caeruleus</i>	12	0.7
<i>Dryocopus martius</i>	6	0.4
<i>Garrulus glandarius</i>	6	0.4
<i>Columba palumbus</i>	0	0
Total	1614	100

If we combine the data from deciduous and coniferous stands aged 60–80 years, the results would be as seen in table 6.

There are 35 species altogether, three of them very numerous, 21 numerous, eight normal and three rare. The Chaffinch, Great tit and Robin remain dominant.

Hollow-nesting birds make up 40 % of population, ground-nesting are 27 % of all, followed by tree-nesting (23 %) and shrub-nesting (6 %) birds, and birds of crowns comprise 4 % of all.

Deciduous plantations of 80–100 years old will be analyzed at first separately and then in group with coniferous.

Route length of surveys conducted in deciduous stands was 3920 meters, covering 13.5 ha. Routes were laid out in Plesetsk For-

ing area of 10.82 ha. The plots were located in the Plesetsk forestry of Boyarka forest research station, Irpin forestry in Kyiv forest farm, Nizhylovichy forestry in Makariv forest farm, Potashnya forestry in Teteriv forest farm (table 5).

This age group of coniferous stands hosts more species (27), six of them very numerous, 14 numerous, three normal and four rare. The dominant species remain the same, with addition of Wood Warbler (*Ph. sibilatrix*) to subdominants.

The list does not include the Honey Buzzard (*Pernis apivorus* Linnaeus, 1758), seen in Potashnya forestry in Teteriv forest farm.

Hollow-nesting birds prevail (39 %), followed by ground-nesting birds (31 %). Tree-nesting birds make up 21 %, shrub-nesting 7 % and birds of crowns 2 % of all.

**Table 9. Avifauna of deciduous stands of fresh and wet hornbeam–oak–pine sudubravas and hornbeam sudubravas aged more than 100 yrs**

Species	Density, individual per sq. km	%
<i>Fringilla coelebs</i>	218	17.7
<i>Parus major</i>	185	15
<i>Phylloscopus sibilatrix</i>	139	11.3
<i>Erithacus rubecula</i>	100	8.1
<i>Ficedula albicollis</i>	91	7.4
<i>Sylvia atricapilla</i>	48	3.9
<i>Phylloscopus collybita</i>	48	3.9
<i>Sitta europaea</i>	42	3.4
<i>Turdus philomelos</i>	42	3.4
<i>Sturnus vulgaris</i>	36	2.9
<i>Oriolus oriolus</i>	30	2.4
<i>Dendrocopos major</i>	30	2.4
<i>Parus caeruleus</i>	30	2.4
<i>Certhia familiaris</i>	24	1.9
<i>Columba palumbus</i>	18	1.5
<i>Ficedula hypoleuca</i> Pallas, 1764	18	1.5
<i>Phylloscopus trochilus</i>	18	1.5
<i>Coccyzus coccyzus</i>	15	1.2
<i>Parus palustris/montanus</i>	15	1.2
<i>Ficedula parva</i>	12	1
<i>Cuculus canorus</i>	12	1
<i>Turdus merula</i>	12	1
<i>Dendrocopos medius</i>	12	1
<i>Dryocopus martius</i>	9	0.7
<i>Garrulus glandarius</i>	9	0.7
<i>Troglodytes troglodytes</i>	6	0.5
<i>Anthus trivialis</i>	6	0.5
<i>Streptopelia turtur</i>	6	0.5
<i>Dendrocopos minor</i>	3	0.2
<i>Jynx torquilla</i>	0	0
<i>Phylloscopus trochiloides</i>	0	0
Sundevall, 1837		
Total	1234	100

estry in Boyarka forest research station, Nizhylovichy forestry in Makariv forest farm, Shybene forestry in Klavdievo forest farm, Obukhovychy and Zherev forestries in Ivankiv forest farm. Surveyed habitats included hornbeam–oak–pine sudubravas and hornbeam sudubravas, of both natural and artificial origin (table 7).

In deciduous forest of this age category there are 31 bird species, four of them very numerous, 23 numerous, two normal and two rare. Dominant species is the Chaffinch, subdominant is the Great Tit. The proportion for hollow-nesting birds is 50 %, for tree-nesting birds it is 22 %, 16 % for ground-nesting birds, 7 % for shrub-nesting and 5 % for birds of crowns.

Coniferous forest stands of this age group were presented by artificial forest plantations in Plesetsk forestry of Boyarka forest research station and natural forests in Mircha forestry of Teteriv forest farm. Total length of survey routs in these plantations was 1055 meters and covered area of 3.4 ha. Combination of data from these surveys with data from deciduous forests is shown in table 8.

34 species of birds are found in the forests of this age group, among them 5 very numerous, 26 numerous, 2 normal and 1 rare species. The 2 dominant and subdominant species remain same.

**Table 10.** Avifauna pine stands of fresh and wet hornbeam–oak–pine sudubravas aged more than 100 yrs old

Species	Density, individual per sq., km	%
<i>Fringilla coelebs</i>	670	31.1
<i>Parus major</i>	234	10.9
<i>Ficedula albicollis</i>	203	9.4
<i>Sylvia atricapilla</i>	187	8.7
<i>Dendrocopos major</i>	171	7.9
<i>Eriythacus rubecula</i>	78	3.6
<i>Sitta europaea</i>	70	3.2
<i>Oriolus oriolus</i>	62	2.9
<i>Phylloscopus collybita</i>	62	2.9
<i>Garrulus glandarius</i>	55	2.6
<i>Sturnus vulgaris</i>	39	1.8
<i>Parus palustris/montanus</i>	39	1.8
<i>Chloris chloris</i>	31	1.4
<i>Columba palumbus</i>	31	1.4
<i>Troglodytes troglodytes</i>	31	1.4
<i>Anthus trivialis</i>	16	0.7
<i>Cuculus canorus</i>	16	0.7
<i>Coccyzus coccyzus</i>	16	0.7
<i>Dryocopus martius</i>	16	0.7
<i>Dendrocopos minor</i>	16	0.7
<i>Emberiza citrinella</i>	16	0.7
<i>Ficedula hypoleuca</i>	16	0.7
<i>Lullula arborea</i> Linnaeus, 1758	16	0.7
<i>Muscicapa striata</i>	16	0.7
<i>Phoenicurus phoenicurus</i>	16	0.7
<i>Turdus philomelos</i>	16	0.7
<i>Certhia familiaris</i>	8	0.4
<i>Lanius collurio</i>	8	0.4
<i>Columba oenas</i>	0	0
<i>Upupa epops</i>	0	0
Total	2155	100

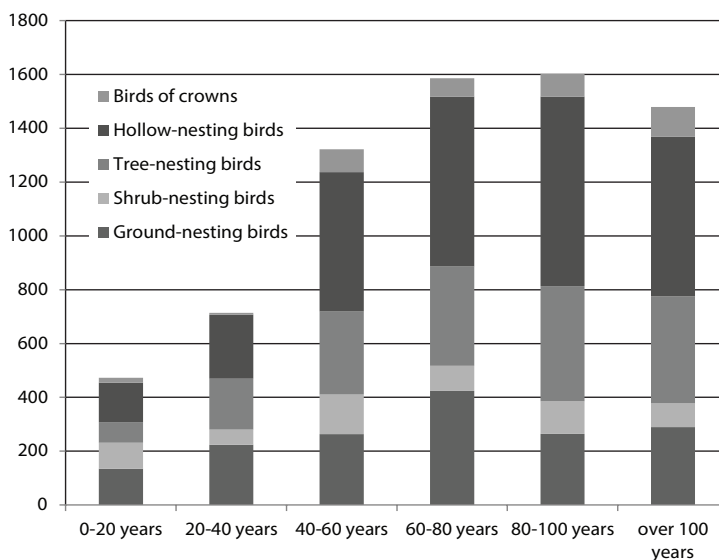


Fig. 1. Distribution of environmental groups by age categories of fresh and wet sudubravas.

**Table 11. Avifauna of forest stands of fresh and wet hornbeam–oak–pine sudubravas and hornbeam sudubravas aged over 100 yrs old**

Species	Density, individual per sq, km	%
<i>Fringilla coelebs</i>	344	23.1
<i>Parus major</i>	198	13.3
<i>Ficedula albicollis</i>	122	8.2
<i>Phylloscopus sibilatrix</i>	100	6.7
<i>Erithacus rubecula</i>	94	6.3
<i>Sylvia atricapilla</i>	87	5.8
<i>Dendrocopos major</i>	70	4.7
<i>Phylloscopus collybita</i>	52	3.5
<i>Sitta europaea</i>	50	3.4
<i>Oriolus oriolus</i>	39	2.6
<i>Sturnus vulgaris</i>	37	2.5
<i>Turdus philomelos</i>	35	2.3
<i>Garrulus glandarius</i>	22	1.5
<i>Columba palumbus</i>	22	1.5
<i>Parus caeruleus</i>	22	1.5
<i>Parus palustris / montanus</i>	22	1.5
<i>Certhia familiaris</i>	20	1.3
<i>Ficedula hypoleuca</i>	17	1.1
<i>Coccothraustes coccothraustes</i>	15	1
<i>Troglodytes troglodytes</i>	13	0.9
<i>Cuculus canorus</i>	13	0.9
<i>Phylloscopus trochilus</i>	13	0.9
<i>Dryocopus martius</i>	11	0.7
<i>Chloris chloris</i>	9	0.6
<i>Anthus trivialis</i>	9	0.6
<i>Ficedula parva</i>	9	0.6
<i>Turdus merula</i>	9	0.6
<i>Dendrocopos medius</i> Linnaeus, 1758	9	0.6
<i>Dendrocopos minor</i>	7	0.5
<i>Emberiza citrinella</i>	4	0.3
<i>Lullula arborea</i>	4	0.3
<i>Muscicapa striata</i>	4	0.3
<i>Phoenicurus phoenicurus</i>	4	0.3
<i>Streptopelia turtur</i>	4	0.3
<i>Lanius collurio</i>	2	0.1
<i>Columba oenas</i>	0	0
<i>Upupa epops</i>	0	0
<i>Jynx torquilla</i>	0	0
<i>Phylloscopus trochiloides</i>	0	0
Total	1492	100

up 41% of total density, ground-nesting birds 26 %, tree-nesting 23 %, birds of crowns 6 % and shrub-nesting birds 4 %.

Coniferous plantations over 100 years are fresh hornbeam-pine-oak sudubravas in Plesetsk forestry of Boyarka forest research station. These forest areas are old-age pine forests of natural origin, aged over 180 years. Survey route length here was 3380 m, covering 12.835 ha (table 10).

30 bird species were found in these coniferous plantations, among them five very numerous, 21 numerous, two normal and two rare. Dominant species is Chaffinch, subdominant species is the Great Tit.

The table does not include meeting of the Common Buzzard (*Buteo buteo* Linnaeus, 1758) in Plesetsk forestry of Boyarka forest research station.

The dominant group is hollow-nesting birds (40 %), tree-nesting species are on the second place (32 %). Ground-nesting birds make up 10 %, and birds of crowns and shrub-nesting birds both amount to 9 % of all avian population.

The hollow-nesting birds make up 44 % of total density while tree-nesting species account for its 27 %, ground-nesting for 16 %, shrub-nesting for 8 % and birds of crowns for 5 %.

The oldest age group of forests (older than 100 years) was divided into deciduous and coniferous forests in analysis.

Deciduous forest stands older than 100 years were fresh and wet hornbeam sudubravas and hornbeam–pine–oak sudubravas of natural origin. Length of survey routes was 5965 m covering area of 33.035 ha. This age group consisted of oak old-age forests, some of them more than 230 years old. Survey routes were laid out in Irpin Forestry in Kyiv forest farm, Nizhylovychy forestry in Makariv forest farm, Shybene forestry in Klavdievo forest farm, Mircha forestry in Teteriv forest farm, Katyuzhanka forestry in Dymer forest farm (table 9).

The deciduous forest stands of the oldest age group have 31 species of birds, four of them very numerous, 19 numerous, six normal and two rare. The dominant species was the Chaffinch, subdominant were the Great Tit and Wood Warbler.

This list does not include the Black Stork (*Ciconia nigra* Linnaeus, 1758), whose nest was found on survey route in Katyuzhanka forestry of Dymer forest farm.

The hollow-nesting birds make



Combination of data obtained in deciduous and coniferous old-age forests is given in table 11.

Surveys in the oldest forests revealed 39 avian species, 4 of them very numerous, 19 numerous, 12 normal and four rare species. The Chaffinch was the dominant and the Great Tit was subdominant species.

Hollow-nesting birds continue to dominate the population (40 %) followed by tree-nesting (27 %), ground-nesting (20 %) species, birds of crowns (7 %) and shrub-nesting birds (6 %).

The trends of the results obtained are shown in figure 1 (fig. 1).

There is a trend of direct increase of avian population density, observed in forest age groups younger than 60 years. In older forests, stabilization of density occurs, characterized by fluctuations around 1400–1600 in/km sq. The densities of hollow-nesting and tree-nesting species increase in each successive forest age group except for the last age group, where their densities are lower. The proportion of ground-nesting birds reaches maximum in forests aged 60–80 years and greatly reduces in older stands. The proportion of shrub-nesting birds reaches maximum in the 40–60 years old forest stands. The proportion of birds of crowns increases mostly in oldest forest age group (over 100 years). Overall, though, proportions of these two ecological groups are consistently low at all stages of reforestation.

## Conclusion

The research in different age groups of fresh and wet sudubravas in Kyiv Polissya revealed the structure and density of local avifauna population and of some of bird species in particular. It was found that the main trends in the population density of various ecological groups observed during reforestation. Altogether 53 bird species were found. The old-age forest (over 100 years) is richest (39 species) of all age groups. Considering the type of forest stand, the deciduous forest stands aged 80–100 years and over 100 years are the most rich (each with 31 species of birds). The highest bird population density was in the forest age group of 80–100 years (1614 in/km sq.) and in pine forests older than 100 years (2155 in/ km sq.).

## References

- Andriyenko, T. L., Onishchenko, V. A., Pryadko, O. I. et al. 2006. *Phytodiversity of Ukrainian Polissya and its protection*. Ukrainian phytosociological center, Kyiv, 316 [In Ukrainian].
- Berman, D. L., Gibet, L. A. 1952. To the method of census of small forest birds on large areas. *Methods of census and geographical distribution of terrestrial vertebrates*. Moscow [In Russian].
- Blagosklonov, K. N., Osmolovskaya, V. I., Formozov, A. N. 1952. Counts of Passerines, Piciformes and Coraciiformes. *Methods of census and geographical distribution of terrestrial vertebrates*. Moscow [In Russian].
- Dobrokhoto, B. P. 1952. Method of bird counts in breeding period using a linear transect and its possible errors. *Methods of census and geographical distribution of terrestrial vertebrates*. Moscow [In Russian].
- Fesenko, H. V., Bokotej, A. A. 2007. The Annotated List of the Ukrainian Scientific Names of the Bird Species Belonging to the Fauna of Ukraine (with Characteristics of Status of the Species). Kyiv, Lviv, 111 [In Ukrainian].
- Guzy, A. I. 1992. *Ornithological complexes of forest ecosystems of the Ukrainian Carpathians, their ecology, practical value and protection*. Ph.D thesis, Voronezh [In Russian].
- Guzy, A. I. 1997. Methods of bird counts in forests. *Bird Counts: approaches, methods, results*. Materials of school about unification of methods of bird counts in Ukraine reserves. Ivano-Frankove, 26–28 April 1995, Lviv, Kyiv, 18–48 [In Russian].
- Korolkova, G. E. 1952. Experience in accounting insectivorous birds in the oak forests of the European forest-steppe. *Methods of census and geographical distribution of terrestrial vertebrates*. Moscow [In Russian].
- Kuzyakin, A.P. 1962. Zoogeography of USSR. *Scientific notes of Moscow Regional Pedagogical Institute named after Krupskaya. Biogeography*, 109 (3), 99–101 [In Russian].
- Merkallio, E. 1946. Über regional verbreitung der Land Vogel in sud-und Mittelfinland, besonders in deren Ostlichen Teilen, im Lichte von quantitativen untershuchungen. *Ann. Zool. Soc. Zool.-Bot. Fenn. "Vanama"*, 12.

- Vergeles, Yu. I. 1993. General traits of bird population of the forest biogeocenoses in the Kharkov Region. *Berkut*, 2, 14–15 [In Ukrainian].
- Vorobiev, D. V. 1953. *Types of forests in European part of USSR*. Ukrainian Academy of Sciences, Kyiv, 1–448 [In Russian].

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