

ORIGINAL ARTICLE

## Ecological-coenotic features of rare flora species of pine-oak stands of Volyn Polissya

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Anthropogenic influence on the natural vegetation of Volyn Polissya threatens the existence of habitats of rare and endangered species of flora. Therefore, the region, unique in botanical and geographical terms, is gradually losing its specific vegetation characteristics. Having analyzed the literature data, herbarium data and materials of our own field studies in 2016-2019, we have compiled a list of rare and endangered species of pine-oak stands. In the habitat of pine-oak stands 89 rare species were found, 29 of which are listed in the Red Data Book of Ukraine, while *Silene lithuanica* is included in the European Red List. 3 species (*Cypripedium calceolus*, *Trapa natans* та *Caldesia parnassifolia*) are included into appendices of "The Convention on International Trade in Endangered Species of Wild Fauna and Flora". 10 species are subject to protection according to the appendix of "Convention on the Conservation of European Wildlife and Natural Habitats" 56 species are regionally rare species for the flora of the Volyn region, 4 species are rare species of pine-oak stands. In our research we have analyzed the age range, density and recovery index for the species studied. The study found that for 63 rare species the dynamics of species abundance and distribution are satisfactory. The area of distribution and the number of 7 species is increasing: *Allium ursinum*, *Galanthus nivalis*, *Platanthera chlorantha*, *Anemone sylvestris*, *Campanula persicifolia*, *Corydalis cava*, *Isopyrum thalictroides* In the study area 14 species grow sporadically: *Juniperus communis*, *Potentilla alba*, *Digitalis grandiflora*, *Gymnocarpium dryopteris*, *Daphne mezereum*, *Neottia nidus-avis*, *Epipactis helleborine*, *Scorzonera purpurea*, *Asparagus officinalis*, *Iris sibirica*, *Adonis vernalis*, *Cephalanthera damasonium*, *Gentiana cruciate*, *Gentiana pneumonanthe*. Dissemination information for *Caldesia parnassifolia*, *Succisella inflexa*, *Genistella sagittalis*, *Salix myrtilloides*, *Ophioglossum vulgatum* is insufficient for establishing species dynamics and needs further investigation. The conservation of pine-oak stands in Volyn Polissya will help to create the conditions for the growth of rare and endangered species of flora.

**Keywords:** Rare species; Population; Age spectrum of the population

### Introduction

Anthropogenic influence on the natural vegetation of Volyn Polissya threatens the existence of habitats of rare and endangered species of flora. Therefore, the region, unique in botanical and geographical terms, is gradually losing its specific vegetation characteristics. Information about the rare species of the flora of Volyn Polissya is given in the works of researchers, which mainly covered information about their geographical distribution (Vandas, 1986; Pachoski, 1900; Macko, 1937; Andrienko, et al., 2004, 2009). The current status of rare flora species of pine-oak stands of Volyn Polissya has not been sufficiently investigated, there are no satisfactory data on the geographical location of the localities and the state of the populations of the species, there is no general analysis of the horological patterns. The purpose of the research is to establish ecological-coenotic features of rare flora species of pine-oak stands of Volyn Polissya.

To achieve this goal, the following objectives were set:

- To compile a list of rare and endangered species of flora;
- To conduct a zoological analysis of rare species;
- To establish dynamic trends in the geographical distribution of rare flora species.

Therefore, studying the features of the current distribution of rare flora species, monitoring their status and population structure is an urgent and important task, without which there are risks of the extinction of some rare species from the natural flora of the region.

### Objectives and Research Methods

Field studies of rare and endangered species were conducted from 2016 to 2019. During this time, locations known for literary and herbarium data were checked and new rare species were found. Field surveys were carried out annually using forwarding methods in the territory of the Lopatyn, Ozersk, and Zviriv Nature Conservation Departments of Kivertsi National Natural Park "Tsumanska Pushcha".

For each botanical permanent sampling area (BA) a passport was established, a geobotanical description was made, and the age spectrum of the population was analyzed. Phytocoenotic descriptions were performed by the method (Rabotnov, 1978). Population age structure and their types by age composition have been studied by methods (Uranov, 1975; Rabotnov, 1978). The analysis of

the coenopopulations of rare species of flora was carried out on the basis of the quantitative ratio of plants of different ontogenetic states in permanent sampling areas. The study identified four age groups: juvenile (j), immature (im), virginal (v) and generative (g). For the analysis of the dynamics of self-sustaining population, the RI - renewal index was used as the ratio of the number of preregenerative specimens to the number of generative plants.

## Results of the research

Information on the distribution of rare species of flora is given in the works of researchers of Volyn Polissya.

For the outskirts of the Tsuman village four rare species are listed as habitats: *Betula humilis* Schrank., *Anemone sylvestris* L., *Cimicifuga europaea* Schipcz., *Clematis recta* L. (Vandas, 1886). By studying the flora of Polissya, the author points at seven habitats of rare species of the studied area: *Cypripedium calceolus* L., *Platanthera bifolia* (L.) Rich., *Betula humilis*, *Anemone sylvestris*, *Melittis sarmatica* L., *Cimicifuga europaea*, *Clematis recta* (Paczoski, 1900). In describing the vegetation cover of the projected reserve "Yulana Area" in the vicinity of Lutsk are given *Gladiolus imbricatus* L., *Lilium martagon* L., *Anemone sylvestris*, *Campanula cervicaria* L., *Clematis recta* (Macko, 1937). 21 species of vascular plants from the Red Data Book of Ukraine were found within the Kivertsi National Nature Park "Tsumanska Pushcha" (*Caldesia parnassifolia* (L.) Parl., *Allium ursinum* L., *Galanthus nivalis* L., *Gladiolus imbricatus*, *Carex umbrosa* Host., *Lilium martagon*, *Cephalanthera longifolia* (L.) Fritsch., *Cypripedium calceolus*, *Dactylorhiza incarnata* (L.) Soo., *Dactylorhiza fuchsii* (Druce) Soo., *Epipactis helleborine* (L.) Crantz., *Epipactis atrorubens* (Hoffm. ex Bernh.) Besser., *Neottia nidus-avis* (L.) Rich., *Platanthera bifolia*, *Platanthera chlorantha* (Cust.) Rchb., *Betula humilis* Schrank., *Genistella sagittalis* (L.) Gams., *Salix myrtilloides* L., *Iris sibirica* L., *Succisella inflexa* (Kluk) G. Beck., *Silene lithuanica* Zapal.); 9 regionally rare species (*Astrantia major* L., *Polypodium vulgare* L., *Ophioglossum vulgatum* L., *Gymnocarpium dryopteris* (L.) Newm., *Cimicifuga europaea*, *Nimphaea candida* C. Presl., *Campanula persicifolia* L., *Melittis sarmatica*, *Trollius europaeus* L.); 3 rare species (*Aquilegia vulgaris* L., *Nimphaea alba* L., *Lonicera xylosteum* L.) (Andrienko, et al., 2004). During the study of flora of the Volyn region, the habitat of rare species for Kivertsi National Nature Park "Tsumanska Pushcha" is given for: *Lycopodium annotinum* L., *Allium ursinum*, *Galanthus nivalis*, *Carex umbrosa*, *Lilium martagon*, *Cephalanthera longifolia*, *Cypripedium calceolus*, *Dactylorhiza incarnata* (L.) Soo., *Dactylorhiza fuchsii*, *Epipactis helleborine*, *Epipactis atrorubens*, *Neottia nidus-avis*, *Platanthera bifolia*, *Platanthera chlorantha*, *Betula humilis*, *Genistella sagittalis*, *Salix myrtilloides*, *Astrantia major* (Andrienko, et al., 2009).

The Red Data Book of Ukraine provides information on the protection of the following species in the study area: *Caldesia parnassifolia* (the reserve of the national value "Kormin" and the general zoological reserve of the local value "Devil's Swamp"); *Succisella inflexa* (landscape reserve "Kormin"); *Genistella sagittalis* (local reserve "Lopatynska Dibrova").

Having analyzed the literature, herbarium data and materials of our own field studies (Glinska et al. 2017, 2018; Shtokalo et al. 2017, 2018), we have compiled a list of rare and endangered species of pine-oak stands. The list was based on the species listed in the "Red Data Book of Ukraine" and the dominant species of the "Green Data Book of Ukraine", in the Appendices of "The Convention on International Trade in Endangered Species of Wild Fauna and Flora", "Convention on the Conservation of European Wildlife and Natural Habitats" and other international rare plant lists, at "List of rare and endangered plant species in the Volyn region" (Table 1).

**Table 1.** Rare and endangered species of flora in the lists of species in need of protection.

№	Flora species	Red Data Book of Ukraine	Regional Red List	Rare on territory of national nature parks	Berne Convention, Appendix	CITES, Appendix	European Red List, category
	<i>Diphasiastrum camplanatum</i> (L.) Holub	+					
	<i>Lycopodium annotinum</i> L.	+					
	<i>Caldesia parnassifolia</i> (L.) Parl.	+			+		
	<i>Adonis vernalis</i> L.	+					
	<i>Allium ursinum</i> L.	+					
	<i>Galanthus nivalis</i> L.	+					
	<i>Carex umbrosa</i> Host	+					
	<i>Gladiolus imbricatus</i> L.	+					
	<i>Iris sibirica</i> L.	+					
	<i>Lilium martagon</i> L.	+					
	<i>Cephalanthera damasonium</i> (Mill.) Druce	+					
	<i>Cephalanthera longifolia</i> (L.) Fritsch.	+					
	<i>Cephalanthera rubra</i> (L.) Rich.	+					
	<i>Cypripedium calceolus</i> L.	+			+	+	
	<i>Dactylorhiza incarnata</i> (L.) Soo	+				+	
	<i>Dactylorhiza fuchsii</i> (Druce) Soo	+				+	

<i>Dactylorhiza majalis</i> (Rich.) P.F. Hunt et Summerhayes	+		+
<i>Epipactis palustris</i> (L.) Crantz	+		+
<i>Epipactis helleborine</i> (L.) Crantz	+		+
<i>Epipactis atrorubens</i> (Hoffm. ex Bernh.) Besser	+		+
<i>Neottia nidus-avis</i> (L.) Rich.	+		+
<i>Platanthera bifolia</i> (L.) Rich.	+		+
<i>Platanthera chlorantha</i> (Cust.) Rchb.	+		+
<i>Betula humilis</i> Schrank	+		
<i>Silene lithuanica</i> Zapal.	+		+
<i>Succisella inflexa</i> (Kluk) G. Beck	+		
<i>Genistella sagittalis</i> (L.) Gams	+		
<i>Salix myrtilloides</i> L.	+		
<i>Trapa natans</i> L.	+		+
<i>Aconitum variegatum</i> L.		+	
<i>Astrantia major</i> L.		+	
<i>Anemone sylvestris</i> L.		+	
<i>Polypodium vulgare</i> L.		+	
<i>Vinca minor</i> L.		+	
<i>Lerchenfeldia flexuosa</i> (L.) Schur		+	
<i>Daphne mezereum</i> L.		+	
<i>Wolffia arrhiza</i> (L.) Horkel ex Wimmer		+	
<i>Ophioglossum vulgatum</i> L.		+	
<i>Actaea spicata</i> L.		+	
<i>Gymnocarpium dryopteris</i> (L.) Newm.		+	
<i>Campanula cervicaria</i> L.		+	
<i>Campanula sibirica</i> L.		+	
<i>Genista germanica</i> L.		+	
<i>Chimaphylla umbellata</i> (L.) W. Barton		+	
<i>Dentaria glandulosa</i> Waldst. et Kit.		+	
<i>Melittis sarmatica</i> L.		+	
<i>Polygala amarella</i> Crantz		+	
<i>Trifolium alpestre</i> L.		+	
<i>Thfolium montanum</i> L.		+	
<i>Acer pseudoplatanus</i> L.		+	
<i>Cimicifuga europaea</i> Schipcz.		+	
<i>Trollius europaeus</i> L.		+	
<i>Ceratophyllum submersum</i> L.		+	
<i>Digitalis grandiflora</i> Mill.		+	
<i>Aquilegia vulgaris</i> L.		+	
<i>Potentilla alba</i> L.		+	
<i>Hepatica nobilis</i> Mill.		+	
<i>Hedera helix</i> L.		+	
<i>Primula elatior</i> (L.) Hill.		+	
<i>Dentaria bulbifera</i> L.		+	
<i>Nimphaea alba</i> L.		+	
<i>Nimphaea candida</i> C. Presl.		+	
<i>Gypsophilla paniculata</i> L.		+	
<i>Clematis recta</i> L.		+	
<i>Thesium linifolium</i> L.		+	
<i>Pyrethrum corymbosum</i> (L.) Scop.		+	
<i>Eryngium planum</i> L.		+	
<i>Sempervivum ruthenicum</i> Schnittsp. et C.B. Lehm.		+	
<i>Inula helenium</i> L.		+	
<i>Melampyrum arvense</i> L.		+	
<i>Campanula persicifolia</i> L.		+	
<i>Lonicera xylosteuma</i> L.		+	
<i>Isopyrum thalictroides</i> L.		+	
<i>Corydalis cava</i> (L.) Schweigg et Koerte		+	
<i>Spergula morisonii</i> Boreau		+	
<i>Scorzonera humilis</i> L.		+	
<i>Scorzonera purpurea</i> L.		+	
<i>Prunella grandiflora</i> Scholl.		+	
<i>Gentiana cruciata</i> L.		+	
<i>Gentiana pneumonanthe</i> L.		+	
<i>Asparagus officinalis</i> L.		+	
<i>Allium vineale</i> L.		+	
<i>Circaea intermedia</i> Ehrh.		+	
<i>Stachys recta</i> L.		+	
<i>Dryopteris austriaca</i> (Jacq.)Woyнар ex Schinz et Thell.		+	
<i>Andromeda polifolia</i> L.			+

<i>Dianthus pseudosquarrossus</i> (Novak) Klok.						+
<i>Pulmonaria angustifolia</i> L.						+
<i>Juniperus communis</i> L.						+
<b>Total</b>	29	56	4	3	10	1

As shown in Table 1, 89 rare species habitats have been found in pine-oak stands, 29 of them are in the Red Data Book of Ukraine, and *Silene lithuanica* is listed in the European Red List. 3 species (*Cypripedium calceolus*, *Trapa natans* та *Caldesia parnassifolia*) are included into Appendix of "The Convention on International Trade in Endangered Species of Wild Fauna and Flora". 10 species are subject to protection according to the Appendix of "Convention on the Conservation of European Wildlife and Natural Habitats" 56 species are regionally rare species for the flora of the Volyn region, 4 species are rare species for pine-oak stands. To monitor the status of populations of rare flora species, Botanical Permanent Sampling Areas (BA) have been established in the

Nature conservation Research Branches (NCRB) of Kivertsi National Nature Park "Tsumanska Pushcha":

BA – 1 – Lopatyn NCRB SE "Tsuman Forestry" Partisan Forestry, quarter 11, section 1, with an area of 22 hectares

BA – 2 – Lopatyn NCRB Berestyane Forestry, quarter 9, section 24, 3.0 hectares.

BA – 3 – Lopatyn NCRB SE "Tsuman Forestry", quarter 6, section 34, 2.8 hectares.

BA – 4 – Lopatyn NCRB SE "Tsuman Forestry", quarter 2, section 5, 4.1 hectares.

BA – 5 – Lopatyn NCRB SE "Tsuman Forestry", quarter 41, section 6, 1.3 hectares.

BA – 6 – Zviriv NCRB SE "Tsuman Forestry" Moshchanytsia forestry, quarter 74.

BA – 7 – Ozersk NCRB Volyn Forestry of SE "Lviv Military Forest Multi-unit Enterprise", quarter 38, section 15, 3.0 hectares.

BA – 8 – Ozersk NCRB Volyn Forestry of SE "Lviv Military Forest Multi-unit Enterprise", quarter 38, section 13, 3.0 hectares.

BA – 9 – Zviriv NCRB SE "Tsuman Forestry" Horyn forestry, quarter 49.

BA – 10 – Lopatyn NCRB Berestyane Forestry, Kormin area, quarter 25, section 6, 5.7 hectares.

BA – 11 – Lopatyn NCRB Berestyane Forestry, Kormin area, quarter 44, section 26.

BA – 12 – Lopatyn NCRB Berestyane Forestry, Kormin area, quarter 25, section 20, 2.2 hectares.

BA – 13 – Lopatyn NCRB SE "Tsuman Forestry" Partisan Forestry, quarter 26, section 3, with an area of 25.5 hectares.

BA – 14 – Lopatyn NCRB SE "Tsuman Forestry" Partisan Forestry, quarter 26, section 3, with an area of 25.5 hectares.

BA – 15 – Ozersk NCRB Volyn Forestry of SE "Lviv Military Forest Multi-unit Enterprise", quarter 38, section 15, with an area of 3.0 hectares.

BA – 17 – Ozersk NCRB SE "Kivertsi Forestry" Trostianets forestry, quarter 58.

Population age range, density, and renewal index (RI) were analyzed for the species studied (Table 2).

**Table 2.** Age range of populations of rare flora species in permanent sampling areas.

Permanent test area	Year of examination	Age groups								Density, specimens/100 m <sup>2</sup>	Renewal index, %
		J		Im		V		G			
		oc.	%	oc.	%	oc.	%	oc.	%		
<b><i>Galanthus nivalis</i> L.</b>											
BA-1	2016	27	3,5	87	11,3	153	19,8	504	65,4	771	53
	2017	48	4,4	143	13,3	231	21,4	657	60,9	1079	64,2
	2018	41	3,8	137	12,6	267	24,5	643	59,1	1088	69,2
	2019	44	4,7	123	13,0	169	17,9	610	64,5	946	0,55
BA-2	2016	37	4,4	73	8,8	232	27,9	491	58,9	833	0,70
	2017	59	5,9	114	11,3	270	26,8	563	56,0	1006	0,79
	2018	41	4,1	98	9,8	283	28,2	582	58,0	1004	0,73
	2019	48	5,0	107	11,1	275	28,6	533	55,3	963	0,81
<b><i>Allium ursinum</i> L.</b>											
BA-3	2016	7	10,8	11	16,9	17	26,2	30	46,2	65	1,17
	2017	10	11,4	21	23,9	23	26,1	34	38,6	88	1,59
	2018	12	15,0	15	18,8	16	20,0	37	46,3	80	1,16
	2019	12	15,0	17	21,3	21	26,3	30	37,5	80	1,67
BA-4	2016	277	10,3	812	30,1	786	29,1	823	30,5	2698	2,28
	2017	249	9,3	783	29,2	814	30,4	836	31,2	2682	2,21
	2018	283	10,4	796	29,3	795	29,3	843	31,0	2717	2,22

	2019	261	9,9	754	28,5	801	30,3	831	31,4	2647	2,19
	2016	373	9,4	2536	63,7	719	18,0	356	8,9	3984	10,19
BA-5	2017	389	9,6	2448	60,4	746	18,4	469	11,6	4052	7,64
	2018	253	6,5	2359	60,9	783	20,2	476	12,3	3871	7,13
	2019	271	7,1	2275	59,7	802	21,0	465	12,2	3813	7,20

***Dentaria glandulosa Waldst. et Kit.***

	2016	17	2,9	21	3,6	225	38,6	320	54,9	583	0,82
BA - 4	2017	21	3,5	23	3,8	235	38,8	327	54,0	606	0,85
	2018	12	2,0	26	4,4	253	42,9	299	50,7	590	0,97
	2019	16	2,7	29	4,8	251	41,8	305	50,7	601	0,97

***Dentaria bulbifera L.***

	2016	16	1,3	21	1,7	759	61,9	430	35,1	1226	1,85
BA-3	2017	21	1,6	34	2,7	783	61,2	441	34,5	1279	1,90
	2018	11	0,9	42	3,3	753	58,4	483	37,5	1289	1,67
	2019	7	0,6	28	2,2	742	58,5	491	38,7	1268	1,58
	2016	5	2,3	14	6,3	56	25,3	146	66,1	221	0,51
BA-4	2017	4	1,8	9	3,9	61	26,8	154	67,5	228	0,48
	2018	9	4,1	12	5,5	73	33,2	126	57,3	220	0,75
	2019	15	6,1	14	5,7	54	22,1	161	66,0	244	0,52

***Isopyrum thalictroides L.***

	2016	2	1,3	3	1,9	14	9,1	135	87,7	154	0,14
BA - 3	2017	3	1,8	6	3,6	17	10,2	141	84,4	167	0,18
	2018	6	3,4	5	2,8	14	7,9	153	86,0	178	0,16
	2019	7	4,0	6	3,4	18	10,2	146	82,5	177	0,21
	2016	8	3,4	11	4,7	57	24,3	159	67,7	235	0,48
BA - 4	2017	3	1,3	9	4,0	46	20,4	167	74,2	225	0,35
	2018	1	0,4	5	2,1	59	25,0	171	72,5	236	0,38
	2019	5	2,3	7	3,3	48	22,4	154	72,0	214	0,39
	2016	8	3,3	12	5,0	38	15,8	182	75,8	240	0,32
BA - 5	2017	5	1,9	10	3,8	47	18,1	198	76,2	260	0,31
	2018	3	1,1	7	2,5	51	18,5	214	77,8	275	0,29
	2019	4	1,5	15	5,5	46	17,0	206	76,0	271	0,32

***Anemone sylvestris L.***

	2017		0,0	217	15,1	813	56,6	407	28,3	1437	2,53
BA - 6	2018	15	0,9	243	15,1	897	55,9	451	28,1	1606	2,56
	2019	21	1,4	267	18,0	805	54,2	393	26,4	1486	2,78

***Cephalanthera damasonium (Mill.) Druce***

	2017		0,0	1	2,4	8	19,0	33	78,6	42	0,27
BA - 7	2018		0,0	1	2,4	6	14,3	35	83,3	42	0,20
	2019		0,0		0,0	4	22,2	14	77,8	18	0,29

***Epipactis helleborine (L.) Crantz.***

	2017		0,0	1	12,5	2	25,0	5	62,5	8	0,60
BA - 7	2018		0,0		0,0	1	12,5	7	87,5	8	0,14
	2019		0,0		0,0	2	28,6	5	71,4	7	0,40
	2017		0,0	1	3,1	4	12,5	27	84,4	32	0,19
"At Panas's"	2018		0,0		0,0	2	7,4	25	92,6	27	0,08
	2019		0,0		0,0	1	3,3	29	96,7	30	0,03

***Lilium martagon* L.**

	2017	0,0	8	8,4	51	53,7	36	37,9	95	1,64
BA – 8	2018	0,0	3	3,1	57	58,8	37	38,1	97	1,62
	2019	0,0		0,0	9	90,0	1	10,0	10	9,00

***Dactylorhiza majalis* (Rchb.) Hult. et Summerhayer**

BA – 9	2018	0,0	5	11,1	12	26,7	28	62,2	45	0,61
	2019	0,0	1	3,6	11	39,3	16	57,1	28	0,75
BA – 10	2018	0,0	2	14,3	5	35,7	7	50,0	14	1,00
	2019	0,0		0,0	6	60,0	4	40,0	10	1,50
BA – 11	2018	0,0	1	8,3	3	25,0	8	66,7	12	0,50
	2019	0,0		0,0	5	50,0	5	50,0	10	1,00

***Dactylorhiza incarnata* (L.) Soo'**

BA – 11	2018	0,0	1	12,5	2	25,0	5	62,5	8	0,60
	2019	0,0		0,0	1	16,7	5	83,3	6	0,20

***Iris sibirica* L.**

BA – 12	2018	0,0		0,0	1	20,0	4	80,0	5	0,25
	2019	0,0		0,0	2	25,0	6	75,0	8	0,33

***Betula obscura* A. Kotula**

BA – 13	2018	0,0		0,0		0,0	4	100,0	4	0,00
	2019	0,0		0,0		0,0	1	100,0	1	0,00

***Platanthera bifolia* (L.) Rich.**

BA – 14	2018	0,0	3	11,5	7	26,9	16	61,5	26	0,63
	2019	0,0	5	14,3	12	34,3	18	51,4	35	0,94

***Astrantia major* L.**

	2016	5	7,8	8	12,5	34	53,1	17	26,6	64	2,76
BA – 15	2017	2	3,1	4	6,3	39	60,9	19	29,7	64	2,37
	2018	6	8,1	10	13,5	32	43,2	26	35,1	74	1,85
	2019	4	5,6	7	9,7	38	52,8	23	31,9	72	2,13

***Silene lithuanica* Zapal.**

BA – 17	2018	1	3,3	4	13,3	4	13,3	21	70,0	30	0,43
	2019	3	7,0	5	11,6	6	14,0	29	67,4	43	0,48

Studies have found that the highest population density recorded was the following: *Allium ursinum* – 4052 specimens/100 m<sup>2</sup>; *Anemone sylvestris* – 1606 specimens/100 m<sup>2</sup>; *Dentaria bulbifera* – 1289 specimens/100 m<sup>2</sup>; *Galanthus nivalis* – 1088 specimens/100 m<sup>2</sup>; *Dentaria glandulosa* – 606 specimens/100 m<sup>2</sup>. Populations of Orchidaceae have low quantity and density, right-sided spectra of ontogenetic states dominated by generative individuals: *Cephalanthera damasonium* – 18-42 specimens/100 m<sup>2</sup>; *Epipactis helleborine* – 7-32 specimens/100 m<sup>2</sup>; *Dactylorhiza majalis* – 10-45 specimens/100 m<sup>2</sup>; *Dactylorhiza incarnata* – 6-8 specimens/100 m<sup>2</sup>; *Platanthera bifolia* – 26-35 specimens/100 m<sup>2</sup>. Population *Betula obscura* consist of 1 tree about 80 years old, seed reproduction is not observed. In January 2019, three trees were killed as a result of the storm.

**Conclusion**

Having analyzed the literary information, herbarium data and materials of our own field research, we have compiled a list of rare and endangered species of pine-oak tree stands of 89 species. The study found that for 63 rare species population dynamics and distribution of species is satisfactory. The area of distribution and the quantity of 7 species is increasing: *Allium ursinum*, *Galanthus nivalis*, *Platanthera chlorantha*, *Anemone sylvestris*, *Campanula persicifolia*, *Corydalis cava*, *Isopyrum thalictroides*. In the study area 14 species grow sporadically: *Juniperus communis*, *Potentilla alba*, *Digitalis grandiflora*, *Gymnocarpium dryopteris*, *Daphne mezereum*, *Neottia nidus-avis*, *Epipactis helleborine*, *Scorzonera purpurea*, *Asparagus officinalis*, *Iris sibirica*, *Adonis vernalis*, *Cephalanthera damasonium*, *Gentiana cruciate*, *Gentiana pneumonanthe*. Distribution information on *Caldesia parnassifolia*, *Succisella inflexa*, *Genistella sagittalis*, *Salix myrtilloides*, *Ophioglossum vulgatum* is insufficient to establish the species dynamics and needs further investigation. The importance of preserving the species in this area is difficult to quantify. It is extremely important to preserve species that are confined to meadows and wetlands specific to the study area: *Gladiolus imbricatus*, *Iris sibirica*, *Dactylorhiza incarnata*, *Dactylorhiza fuchsii*, *Dactylorhiza majalis*, *Epipactis palustris*, *Betula humilis*, *Succisella inflexa*, *Genistella sagittalis*, *Salix myrtilloides*, *Trapa natans*. Preservation of pine-oak stands of Volyn Polissya will help to create conditions for growth: *Diphysastrum camplanatum*, *Cephalanthera damasonium*, *Cephalanthera longifolia*, *Cephalanthera rubra*, *Epipactis*

*helleborine, Epipactis atrorubens, Neottia nidus-avis, Platanthera bifolia, Platanthera chlorantha, Silene lithuanica, Dianthus pseudosquarrosus, Cimicifuga europaea, Primula elatior*

## References

- Andriienko, T. L., Konishchuk, V. V. & Priadko, O. I. (2009). Ridkisini vydy sudynnykh roslyn Volynskoi oblasti [Rare species of vascular plants of Volyn Region]. Zapovidna sprava v Ukraini [Nature Conservation in Ukraine]. 15(2), 20-26. [in Ukrainian].
- Andriienko, T. L., Klietov, M. L., Khymyn, M. V., Priadko, O. I., Onyshchenko, V. A., Kot, A.S. & Hryhorenko, S.O. (2004). Bioriznomanittia Tsumanskoi pushchi ta pytannia yoho zberezhenia [The biodiversity of Tsumanska Pushcha and its conservation issues]. Kyiv: Fitosotsiologichnyi tsentr [in Ukrainian].
- Glinska, S., Shvets, H., Shtokalo, S. & Nykytiuk, T. (2017). Rarytetni vydy flory Kivertsivskoho natsionalnoho pryrodnoho parku "Tsumanska pushcha" [Rare species of flora of Kiverts National Nature Park "Tsumanska Pushcha"]. Mynule i suchasne Volyni ta Polissia. Kivertsivshchyna ta Olyka v istorii Ukrainy ta Volyni [Past and present of Volhynia and Polissia. Kiverts district and Olyka in the history of Ukraine and Volyn]. 62, 439 – 443. [in Ukrainian].
- Glinska, S.O., Shvets, H.I. & Shtokalo, S.S. (2018). Poshyrennia rehionalno-ridkisnykh vydiv u Volynskii oblasti [The distribution of regionally rare species in Volyn region] The 2d International Scientific and Practical Conference "Problemy ekolohii ta evoliutsii ekosystem v umovakh transformovanoho seredovyscha" [Problems of Ecology and Evolution of Ecosystems in Transformed Environment] (11-12.10.2018, Chernihiv). Chernihiv : Desna Polihraf. 185–188. [in Ukrainian].
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (1999). Kyiv. [in Ukrainian].
- Convention on the Conservation of European Wildlife and Natural Habitats (1998). Kyiv. [in Ukrainian].
- Pachoskii, I.K. (1897; 1899; 1900) Flora Polesia i prilezhashchikh mestnostei [Flora Polesia and surrounding areas]. Trudy Sankt-Peterburgskogo obshchestva estestvoispytatelei [Transactions of St. Petersburg Naturalist Society]. 27 (2); 29 (3); 30 (3). [in Russian].
- Rabotnov, T. A. (1978). Fitocenologiya [Phytocoenology]. – Moscow: Izdatelstvo MGU [in Russian].
- Spysok rehionalno ridkisnykh, znykaiuchykh vydiv roslyn, hrybiv i tvaryn, yaki potrebuut okhorony u Volynskii oblasti [The list of regionally rare, endangered species of plants, fungi and animals in need of protection in Volyn region] Retrieved from <http://volynrada.gov.ua/session/29/30>
- Uranov, A. A. (1975). Vozrastnoi spektr fitocenopopuliatcii kak funktsiia vremeni i energeticheskikh volnovykh protsessov [The age spectrum of the phytocenopopulation as a function of time and energy wave processes]. Biologicheskie nauki [Biological Sciences]. 2, 7 – 34. [in Russian].
- Didukh, Ya. P. (Ed.). (2009). Chervona knyha Ukrainy. Roslynniyi svit [The Red Book of Ukraine. Flora]. K. : Hlobalkonsaltnykh [in Ukrainian].
- Shtokalo, S. S., Glinska, S. O., Rozman, M. V., Ohorodnyk, O. V. & Shvets, H. I. (2018). Monitorynh rarytetnykh vydiv flory Kivertsivskoho natsionalnoho pryrodnoho parku "Tsumanska pushcha" [Monitoring of rare flora species of Kiverts National Natural Park "Tsumanska Pushcha"]. International Scientific and Practical Conference "Pryrodookhoronni, ekoosvitni, rekreatsiino-turystychni ta istoryko-kulturni aspekty staoloho rozvytku Roztochchia" [Environmental, eco-educational, recreational, tourist and historical-cultural aspects of sustainable development of Roztochchia] (4.07.2018, Ivano-Frankove). 209 – 212. [in Ukrainian].
- Shtokalo, S. S., Ralo, V. M. & Glinska S. O. (2017). Ridkisini ta znykaiuchi vydy pryrodnoi flory Kivertsivskoho natsionalnoho pryrodnoho parku "Tsumanska pushcha" [Rare and endangered species of the natural flora of Kiverts National Nature Park "Tsumanska Pushcha"]. Scientific and Practical Conference with International Participation "Voda: Problemy ta shliakhy vyrishennia" [Water: Problems and Solutions]. (05-08.07. 2017, Rivne). Zhytomyr: Vyd-vo ETs "Ukrekobiokon". [in Ukrainian].
- Macko, S. (1937). Roślinność projektowanych rezerwatów na Wołyniu. Ochrona Przyrody. 18, 111–185. [in Polish].
- Vandas, K. (1886). Ein Beitrag zur Kenntnis der Flora Wolhynien. Öester. Bot. Z. 34, 34, 155–157, 192 – 195. [in German].

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