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FLORISTIC AND PHYTOSOCIOLOGICAL VALUES OF WATER RESERVOIRS NEAR PAWŁÓW, LIPÓWKA AND KROWICA (PAGÓRY CHEŁMSKIE REGION)

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Summary. The research involved water reservoirs (ponds, pools, and peat-pits) situated near Pawłów, Lipówka, and Krowica in the Pagóry Chełmskie region (CE Poland). The study aimed at recording the plant communities as well as plant species that are rare and under legal protection. Discussed objects are characterised by great differentiation of plant communities. Occurrence of 33 complexes and 4 communities from classes: *Charetea, Lemnetea, Potametea, Phragmitetea, Scheuchzerio-Caricetea fuscae*, and *Alnetea glutinosae* was found. Single and two-layer underwater charale meadows with dominating *Chara vulgaris,* growing in peats situated near Pawłów (Poczekajka) and Krowica, were counted among the most valuable phytocenoses. Among protected plant species, stands of *Utricularia vulgaris, Ranunculus circinatus, Nymphaea alba, Carex davalla, Dactylorhiza incarnata*, and *Menyanthes trifoliata* were recorded in studied water reservoirs.

Key words: water reservoirs, pond, pool, peat-bogs, plant community, Pagóry Chełmskie

INTRODUCTION

In the opinion of many authors, post-bog dumps and their nearest neighbourhood are characterised by a variety of plant communities and presence of rare plant species that are under legal protection [Podbielkowski 1960, Ilnicki 1996, Iwaniuk 1999, Mosek and Miazga 1999, Trąba *et al.* 2004, Urban 2007]. The process of their spontaneous reclamation was observed in many exploited peat-bogs [Podbielkowski 1960, Jasnowska and Markowski 1995, Ilnicki 1996, Iwaniuk 1999, Mosek and Miazga 1999, Trąba *et al.* 2004, Sugier 2006, Urban 2007]. Small water reservoirs (ponds, pools, peat-bog dumps) also play important natural and economic roles in an environment (water storage for farms, recreation

functions, water purification) [Tomaszewicz 1979, Kowalewski 1997, Mioduszewski 1997, 2006, Falkowski and Nowicka-Falkowska 2004].

The principal aim of the present study was to record the plant complexes as well as rare plant species growing in aqueous reservoirs near the village of Pawłów. Collected materials would make it possible to monitor further changes in plant communities in those objects in future.

STUDY AREA, MATERIALS AND METHODS

Pagóry Chełmskie is a physiographic region classified among areas extremely abundant in peat-bogs [Borowiec 1990]. Most of these objects are characterised by excellent natural virtues. The most precious peat-bogs are under legal protection as natural reserves (Serebryskie Swamp, Brzeźno, Roskosz, and Sobowice), as well as Nature 2000 areas (Chełm Carbonate Peat-bogs, Julianów, and Sobowice).

Studied objects are located in Rejowiec Fabryczny commune, Chełm district, Lublin region. According to physico-geographical division by Kondracki [1981], they are situated on Pagóry Chełmskie being the meso-region of Polesie Wołyńskie. Short peats occur near Pawłów, Lipówka, and Krowica; they are in majority meliorated and turned into meadows and pastures. Peat exploitation was performed on some of them (namely on the area of projected Poczekajka reservoir and peat-bog located west of Pawłów near Krowica) as well as Pawłówski Stream, in 19th and 20th centuries. The peat was used mainly as fuel. Different-shape and size peat spots are the remains at present. Small pools have been recently dug in the flow valley and large pond complex has been built west of Pawłów.

In 2007–2008, studies on plant communities in post-bog dumps, ponds, and pools located near Pawłów, Lipówka, and Krowica, were carried out. The phytosociological classification and plant communities nomenclature was based on works of Matuszkiewicz [2005]; vascular plants names were given after Mirek *et al.* [2002]. Also observations of the occurrence and distribution of rare and protected plant species were made.

RESULTS

Phytosociological records taken in 2007–2008 made it possible to identify 33 plant complexes and 4 communities (Table 1) from the following classes: *Lemnetea minoris, Charetea, Potametea, Phragmitetea, Molinio-Arrhenatheretea*, and *Alnetea glutinosae*.

Achieved study results indicate that aqueous plants were represented by 11 complexes. *Lemnetum minoris* and *Lemnetum trisulcae* phytocenoses were often

Table 1. List of complexes and communities present in studied peat bogs at Pawłów, Poczekajka, Lipówki, Krowica (Pagóry Chehnskie)

(occurrence frequency: + - rare, ++ - frequent, +++ - very frequent

			Occurre	nce frequency		
Association/Community	Pond in Pawłów	Peat-pits Poczekajka	Peat-pits Lipówki	Peat-pits Krowica	Peat-pits in Pawów	Small peat-pits in the valley Dorohucki- brook
Lemnetum minoris (Oberd. 1957) Müller et Görs 1960 2. Spirodeletum polyrhizae (Kelhofer 1915) W.Koch 1954 em. R.Tx. et A.Schwabe 1974 in R.Tx. 1974	. 1955, Lemn	etalia minori. ++ +	s R.Tx. 1955 +++++++++++++++++++++++++++++++++++	‡ · ·	‡ · ·	‡ ·
3. Lemnetum trisulcae (Kelhofer 1915) Knapp et Stotfers 1962 A. Charveles (Fukarek 1961 n.n.) Krausch 1964, (haretalia fro	igilis Sauer 16	937, Charion	<i>fragilis</i> Krausch ++	1 964 ⁺	
Potametean Science 8.Tx	et Prsg. <i>Pota</i> Koch 1926 en	metalia Koch	1926		_	
 Elodeetum canadensis (Pign. 1953) Pass. 1964 Ceratophylletum demersi Hild. 1956 Potametum lucentis Hueck 1931 Movionbhylletum spicai Soe 1927 	· ‡ + +	+ .++		+ + + ‡		·+ ·+
9. Nupharo-Nymphaetum albae Tomasz. 1977 10. Eydrochartiettum mozus-range Langendonck 1935 11. Potametum natatis Soo 1923	<i>phaeion</i> Ober + +	d. 1953	+ ·	+‡		+ · ·
12. Hottonietum palustris R.Tx. 1937 Phragmi	ttonion Segal tetea R.Tx. et igmition Koc	$\frac{1964}{1926}$	+		+	+
LI 3. Scirpetum tacustris (Allorge 1922) Chouard 1924	÷	+	-	÷		
 Typhetum angustifoliae (Allorge 1922) Soó 1927 Sparganietum erécii Roll 1938 Leconarietum palustris Seminicov 1919 Equisetum fuviatilis (Equal 1927) Schmale 1939 Phragmietum australis (Gams 1927) Schmale 1939 	+++ ·+	·+ · ·+	·+ · ·‡	·‡ · ·‡	· ·+ ·‡	· · ·+‡

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19. Typhetum latifoliae Soó 1927 20. Giycerietum maximae Hueck 1931	· · ·	+ 20	+ + +	+ . +	 ‡ .	++
21. <i>Cicuto-Caricetum pseudocyperi</i> Boer et Siss. in Boer 1942 22. <i>Vider</i> 22. <i>Videtum pseudocor</i> , Eglic, 1933 (n.n.)	nocaricion No	cn 1920		+ ·	•+	•+
25. Caricetium ripariae Soo 1928 25. Caricetum paniculatae Wangerin 1916 25. Caricetum rotaredae Rubel 1912	+ • •	++ •	+++	·+ ·	·++	·‡+
26. Caricetum elatae Koch 1926 27. Caricetum gracilis (Graebn. et Hueck 1931) R.T., 1937,	• •-	.+- +-		+ •	‡ .	‡ .
28. Phalaridetum arundinaceae (Kocn 1920 n.n.) 1. Jubo. 1931 Scheuchzerio-Caricetea nigrae (Nordh. 1	<u>937) R. Tx. 15</u>	$\frac{++}{37, Scheuch}$	+ zerietalia pal	ustris Nordh. 1937		÷
29. Zbiorowisko Carex davalla 30. Zbiorowisko Carex lepidocarna	•	++		•		
31. Zpiorowisko <i>Menyanthes trifoliata</i> 32. Zpiorowisko <i>Contarum palustre</i>			• •+		++	++
Alnion ohtinosae (Male 1929) Mether Thees 1936	et R.Tx. 1943	Alnetea gluti	nosae R.Tx.	1937		
33. Salicetum nentandro-cinereae (Alma, 1929) Pass, 1961		+	+++++	‡	+	

recorded in small peat-bog spots and pools, and rarely in ponds. In larger and deeper water reservoirs, communities from the following classes dominated: *Potametum lucentis*, *P. natantis*, *Ceratophylletum demersi*, *Myriophylletum spicati*, and *Elodeetum canadensis*. Small spots of *Hottonietum palustris* were formed in several shallow post-bogs and some water holes. *Nypharo-Nymphaeetum albae* complex with dominating, *Nymphaea alba* was very rare (a single spot in a small pool in Pawłów). Single and two-layer underwater charale meadows with dominating *Chara vulgaris*, occurring in peat-bogs near Pawłów (Poczekajka) and Krowica, were the most valuable aqueous phytocenoses.

The reed communities of *Phragmitetea* class (16 complexes) formed a numerous group. These phytocenoses grew in ponds and pools, as well as at the edge of deeper post-bog dumps and shallow and mudded peats. Groups of *Phragmition* complex, namely *Phragmitetum australis* and *Typhetum latifoliae*, occupied the largest area. Other reed communities, such as: *Typhetum angustifoliae*, *Scirpetum lacustris*, and *Sparganietum erecti*, were present most often in large ponds and peat-bogs. Small spots of *Eleocharitetum palustris* and *Equisetetum fluviatilis* phytocenoses were found in several pools and post-bog dumps. *Magnocaricion* group was represented by 8 complexes. *Phalaridetum arundinaceae* association grew at the shores, and much more frequently at the bottom of some dried ponds. Phytocenoses like *Iridetum pseudacori*, *Cicuto-Caricetum pseudocyperi*, *Caricetum paniculatae*, *Caricetum rostratae*, *Caricetum ripariae*, and *Caricetum elatae* were present in the form of small spots.

The area of some old post-bogs (e.g. post-bog dumps in Pawłów and near Lipówki) was covered by a loose sod formed by *Comarum palustre* and *Menyanthes trifoliata* with addition of reed species from *Phragmitetea* class. These communities were classified in the *Scheuchzerio-Caricetea fuscae* class. Communities of transitional peats from *Scheuchzerio-Caricetea fuscae* class with high percentage (70%) of *Carex davalla* and *Carex lepidocarpa* grew at the wet bottom of a pond dug in the 90's of the twentieth century. Due to the lack of characteristic combination of typical species [Matuszkiewicz 2005], these communities were called after two the most dominating ones. In the first case, *Carex davalla* was the surplus, and the remaining species of *Scheuchzerio-Caricetea fuscae* class made up a negligible quantity, while the second community was characterised by domination of *Carex lepidocarpa* (40 to 70% density) with a small percentage of species from *Phragmitetea* class, and in some spots, also meadow species from *Arrhenatheretea* class were present.

Meadow communities from *Molinio-Arrhenatheretea* class were present on dikes between post-bog dumps. There were spots of *Filipendulo-Geranietum*, *Molinietum caeruleae*, *Scirpetum silvatici* complexes and *Deschampsia caespitosa*, *Poa pratensis-Festuca rubra*, and *Holcus lanatus* communities. The shrub communities from *Alnetea glutinosae* class (*Salicetum pentandro-cineraeae* complex) were formed in old post-bogs and at the edge of several post-bog dumps. Small dikes between some post-bogs were grown by trees: *Betula pu*-

bescens and *B. pendula*, *Alnus glutinosa*, as well as shrubs: *Frangula alnus*, *Salix cinerea*, and rarely *Salix pentandra*.

In studied water reservoirs, stands of protected plant species such as *Carex davalla*, *Dactylorhiza incarnata*, *Utricularia intermedia Nymphaea alba*, *Menyanthes trifoliata*, and *Frangula alnus* were found. *Veratrum lobelianum*, *Dianthus superbus*, *Trollius europaeus*, and *Ostericum palustre* occurred in their nearest neighbourhood. *Cyperus fuscus*, among rare species, was also present.

DISCUSSION

Performed study revealed that water reservoirs (ponds, pools, and postbogs) near Pawłów were characterised by great phytosociological diversity, and the occurring plant communities were at different development stages. Similar to other objects [Podbielkowski 1960, Mosek and Miazga 1999, Trąba *et al.* 2004, Urban 2007] being in the initial stage, communities of *Potametea* and sometimes *Lemnetea* classes dominated. So-called charale meadows were present in some studied post-bogs. In the opinion of Podbielkowski [1968], *Charetea* class phytocenoses may play an important role in water reservoir overgrowing, because they produce large amounts of organic matter. In subsequent stage (transitional stage), communities of *Phragmitetea*, or much rarely *Scheuchzerio-Caricetea fuscae*, and then meadow of *Molinio-Arrhenatheretrea* and shrub of *Alnetea glutinosae* classes, appeared in examined post-bogs.

Numerous works reveal that many fish pond complexes contain diverse and abundant plant communities [Podbielkowski 1968, Falkowski and Nowicka--Falkowska 2004, Urban et al. 2007, Grzywna and Urban 2008]. The results of the present study indicate that 14 plant communities were present in analysed ponds and pools. Among aqueous plants, spots of Potametea class communities dominated, while Ceratophylletum demersi, Potametum lucentis, and Myriophylletum spicati were the most frequently met complexes. Among the reed communities, Phragmitetum australis and Typhetum angustifoliae occupied large areas, with domination of species characteristic for these complexes. Human activity exerted a significant influence on development of plant communities. Constant interference (letting water off, re-flooding a reservoir, bottom cleaning) is a reason for complex transformations of plants in fish ponds, which is difficult to record and often leads to degradation of reed communities, elimination of aqueous and mud plants [Podbielkowski 1968, Falkowski and Nowicka-Falkowska 2004]. Different genetic and development communities often co-exist and overlap one another [Podbielkowski 1968, Lorens 2006]. Podbielkowski [1968] reported that plant succession lines in ponds can be lined up in two series: aqueous and land. Similar schemes of plant communities succession in pond complexes located near Pawłów were also indicated in studies made in 1998–2002 [Urban and Sławiński 2008] and 2007–2008.

Performed studies indicate negative changes in sod peat-bog communities from *Scheuchzerio-Caricetea fuscae* class. At the end of 20th century, phytocenoses of that class occurred in old shallow peat-bog dumps (e.g. near Pawłów). Stands of protected plant species such as *Dactylorhiza incarnata, Carex davalla, Lipar-is loeselii*, and *Menyanthes trifoliata* were recorded there [Urban and Sławiński 2003, 2008]. Examinations carried out in 2007–2008 revealed that most (70%) of these species stands were damaged, which was the consequence of dehydration and post-bog and water hole overgrowing, and on the other hand – transformation of large peat-bogs into ponds. Some old post-bogs (with communities of *Scheuchzerio-Caricetea fuscae* class) were dried and grown with alder (*Alnus glutinosa*), birch (*Betula pubescens*) and willow (*Salix sp*).

CONCLUSIONS

- 1. Studied objects are characterised by great differentiation of plant communities from the following phytosociological classes: *Lemnetea*, *Charetea*, *Potametea*, *Phragmitetea*, *Scheuchzerio-Caricetea fuscae*, and *Alnetea glutinosae*.
- As compared to 1998–2004, significant changes in the share of aqueous and reed communities in water reservoirs near Pawłów were found. The area percentage of aqueous communities from *Lemnetea* and *Potametea* classes, as well as reed from *Phragmitetea* class, considerably increased. Also new phytocenoses such as *Nupharo-Nymphaeetum* appeared.
- 3. The disappearance of charale meadows in post-bogs near Pawłów (Poczekajka), as well as near Krowica, was observed. Negative changes refer also to sod peat-bog communities. Range of *Scheuchzerio-Caricetea fuscae* class phytocenoses occurring in the 90's of the 20th century decreased in old post-bogs. Some stands of protected plants such as *Carex davalla*, *Dactylorhiza incarnata* and *Liparis loeselii* (species from Appendix II to Habitat Directive Nature 2000), as well as *Menyanthes trifoliate* were damaged.
- 4. Plant communities representing different development stages were found in peat-bog dumps, which was associated with their age, depth, and size, as well as the type of peat bedding. The process of peat-forming communities regeneration, initiated mainly by reed communities from *Phragmitetea* class, was also observed.
- 5. Species being under legal protection with stands of *Ostericum palustre* (species from the Appendix II to Habitat Directive Nature 2000) were found in peat-bog dumps and their nearest neighbourhood.

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WALORY FLORYSTYCZNE I FITOSOCJOLOGICZNE ZBIORNIKÓW WODNYCH W OKOLICACH PAWŁOWA, LIPÓWKI I KROWICY (PAGÓRY CHEŁMSKIE)

Streszczenie. Badaniami objęto zbiorniki wodne (stawy, sadzawki i torfianki) leżące w pobliżu miejscowości Pawłów, Lipówki i Krowica. Celem badań było zarejestrowanie występujących tu zespołów roślinnych oraz rzadkich i objętych ochroną prawną gatunków roślin. Omawiane obiekty charakteryzowały się dużym zróżnicowaniem zbiorowisk roślinnych. Stwierdzono tu występowanie 33 zespołów i 4 zbiorowisk roślinnych z klas *Charetea*, *Lemnetea*, *Potametea*, *Phragmitetea*, *Scheuchzerio-Caricetea fuscae* i *Alnetea glutinosae*. Do najcenniejszych fitocenoz wodnych zaliczono jedno- i dwuwarstwowe podwodne łąki ramienicowe z dominującą *Chara vulgaris*, występujące w torfiankach leżących w pobliżu Pawłowa (torfianki-stawy Poczekajka) i Krowicy. Spośród gatunków roślin objętych ochroną prawną stwierdzono w badanych zbiornikach wodnych stanowiska Utricularia vulgaris, Ranunculus circinatus, Nymphaea alba, Carex davalla, Dactylorhiza incarnata i Menyanthes trifoliata.

Słowa kluczowe: zbiorniki wodne (stawy, sadzawki, torfianki), zbiorowiska roślinne, Pagóry Chełmskie