

FLORISTIC AND PHYTOSOCIOLOGICAL VALUES
OF MIDFIELD AND MIDFOREST PEATBOGS
(ŁĘCZNA-WŁODAWA PLAIN,
DOROHUCZA DEPRESSION)¹

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Summary. The midfield and midforest peatbogs analysed are located on the Łęczna-Włodawa Plain (West Polesie) and Dorohusk Depression (Vollhynian Polesie). The aim of the research was to record plant associations as well as rare and legally protected plant species occurring in the area. The objects analysed were characterised by high diversity of plant communities. In total, 35 associations and 8 syntaxa ranked as plant communities from the classes *Lemnetea*, *Potametea*, *Utricularietea intermedio-minoris*, *Phragmitetea*, *Scheuchzerio-Caricetea fuscae*, *Oxycocco-Sphagnetea*, *Alnetea glutinosae*, and *Vaccinio-Piceetea* were recorded. The most valuable phytocoenoses included communities from the classes *Scheuchzerio-Caricetea fuscae* (e.g. *Caricetum limosae* and *Rhynchosporium albae*) and *Oxycocco-Sphagnetea*. Localities of legally protected plant species, e.g. *Dactylorhiza incarnata*, *Drosera intermedia*, *Drosera rotundifolia*, *Ledum palustre*, *Scheuchzeria palustris*, *Utricularia minor*, *U. australis*, and *U. vulgaris*, were found.

Key words: plant communities of midfield and midforest transitional moors, Łęczna-Włodawa Plain

INTRODUCTION

The Łęczna-Włodawa Lakeland is one of regions that are extremely rich in peatbogs. A majority of them have great natural values, and the most valuable ones are under legal protection. Fens are the predominant peat bog type, whereas transitional moors and raised bog constitute a smaller proportion. In the recent years, more attention has been placed on midfield and midforest wetlands, including peatbogs. Their role in maintenance and enrichment of biodiversity in agricultural and

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forest areas has been appreciated [Łachacz and Olesiński 2000, Tobolski 2003, Grootjans and Wołejko (red.) 2007, Lamentowicz 2007]. Small peatbogs located in the closed depressions of the Łęczna-Włodawa Plain and Dorohusk Depression have been described by e.g. Wawer and Urban [1995], Fijałkowski *et al.* [1997], Łuczycza-Popiel [1999], Wójciak *et al.* [2000], Urban [2002, 2007], Urban and Wójcikowska-Kapusta [2003] and Wójciak and Urban [2012].

STUDY AREA, MATERIALS AND METHODS

The study was conducted in 8 objects – 3 midfield and 5 midforest peatbogs (Fig. 1). They are situated on the Łęczna-Włodawa Plain, a mezoregion of West Polesie, and Dorohusk Depression, a part of Volhynian Polesie [Kondracki 2001]. In terms of administration, they are located in the Lublin Province. The peatbogs studied are briefly characterised below:

1. Krasne – near Krasne village, Ludwin County, Łęczna-Włodawa Plain, Łęczna Lakeland Landscape Park, Parczew Forestry, midforest peatbog, transitional moor, raised bog, and fen, area: 3.5 ha;

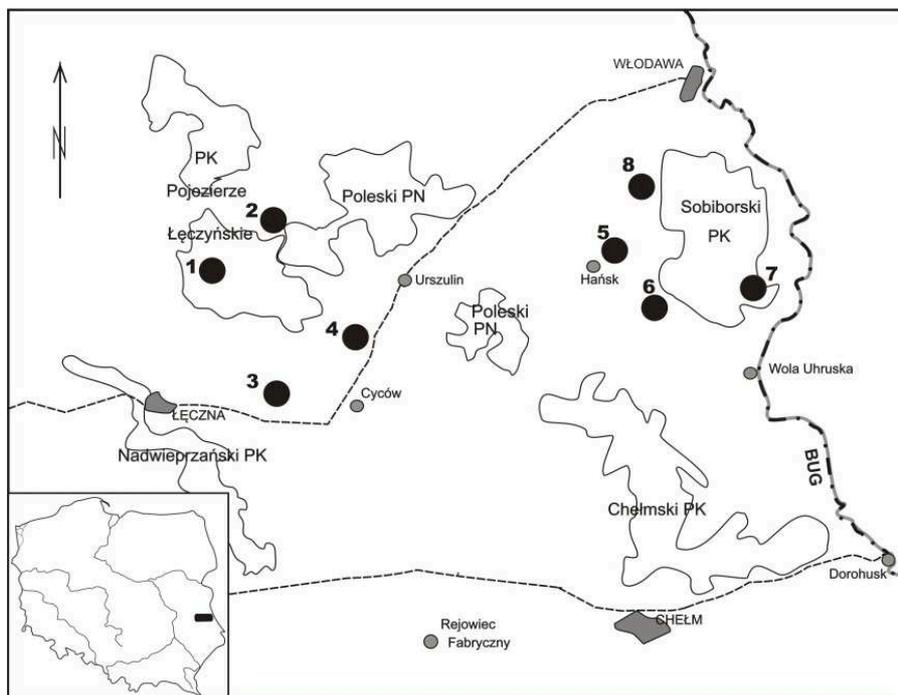


Fig. 1. Location of the peatbogs studied: 1 – Krasne, 2 – Jelino, 3 – Albertów, 4 – Ostrówek Podyski, 5 – Podlaski, 6 – Macoszyn, 7 – Stulno, 8 – Luta

2. Jelino – near Zagłębobcze village, Sosnowica County, Łęczna-Włodawa Plain, Natura 2000 area, midfield peatbog, transitional moor and raised bog, area: 8.9 ha;

3. Albertów (Bagno Wytrzeszczone) – the village of Albertów, Puchaczów County, Dorohusk Depression, designed ecological land, midfield peatbog, transitional moor, small fragments of fen, area: 7.10 ha;

4. Ostrówek Podyski – near Cyców village, Cyców County, Łęczna-Włodawa Plain, Natura 2000 area „Jeziora Uściwierskie”, midfield peatbog, transitional moor and raised bog, area: 44.0 ha;

5. Podlaski – w near the village of Hańsk, Hańsk County, Łęczna-Włodawa Plain, Sobibór Forestry, Poleski Protected Landscape Area, midforest peatbog, transitional moor, raised bog, and fen, area: 1.9 ha;

6. Macoszyn – near the village of Macoszyn, Hańsk County, Łęczna-Włodawa Plain, Natura 2000 „Sobibór Forests”, Sobibór Forestry, Poleski Protected Landscape Area, midforest peatbog, transitional moor and raised bog, area: 2.0 ha;

7. Stulno – near the village of Stulno, Wola Uhruska County, Łęczna-Włodawa Plain, Natura 2000 „Sobibór Forests”, Sobibór Forestry, Sobibór Landscape Park, midforest peatbog, transitional moor and raised bog, area: 3.8 ha;

8. Luta – near the village of Luta, Włodawa County, Łęczna-Włodawa Plain, Sobibór Forestry, Poleski Protected Landscape Area, midforest peatbog, degraded peatbog (transitional moor, raised bog, fen), area: 26.8 ha.

In 2010–2012, 220 photosociological relevés were recorded in the objects using the Braun-Blanquet method [1951]. The phytosociological classification and nomenclature of plant communities were based on the paper by Matuszkiewicz [2005], the nomenclature for vascular plants followed Mirek *et al.* [2002], and for bryophytes – Ochyra *et al.* [2003].

The major aim of the investigations was to make a record of plant communities and rare and legally protected plant species inhabiting small midforest and midfield peatbogs. The collected material will contribute to monitoring of further changes in the vegetation cover in the objects.

RESULTS

The analysed objects exhibited high diversity of plant communities. 35 associations and 8 syntaxa ranked as plant communities from the classes *Lemnetea*, *Potametea*, *Utricularietea intermedio-minoris*, *Phragmitetea*, *Scheuchzerio-Caricetea fuscae*, *Oxycocco-Sphagnetea*, *Alnetea glutinosae*, and *Vaccinio-Piceetea* were recorded (Tab. 1).

The investigation results show that aquatic vegetation was represented by 7 associations. Two associations from the class *Lemnetea*, i.e. *Lemnetum minoris* and *Riccietum fluitantis*, were noted. The former association was found in some peat pits and ditches as well as drainage canals. The latter deserves particular

Table 1. Plant associations and communities inhabiting the analysed peatbogs: 1 – Krasne, 2 – Jelino, 3 – Albertów, 4 – Ostrówek Podyski, 5 – Podlaski, 6 – Macoszyn, 7 – Stulno, 8 – Luta
Frequency of occurrence: 1 – rare, 2 – frequent, 3 – very frequent

ASSOCIATION/COMMUNITY	Objects							
	1	2	3	4	5	6	7	8
<i>Lemnetea minoris</i> R. Tx. 1955. <i>Lemnetalia minoris</i> R. Tx. 1955								
1. <i>Lemnetum minoris</i> (Oberd. 1957) Muller et Gors 1960	1	1	2	2	1	.	.	.
2. <i>Riccietum fluitantis</i> SLAVNIĆ 1956 em. R.Tx. 1974	.	.	1	.	.	.	.	.
<i>Potametea</i> R.Tx. et Prsg, <i>Potametalia</i> Koch 1962, 1957, <i>Nymphaeion</i> Oberd. 1953								
3. <i>Hydrocharitetum morsus-ranae</i> Langendonck 1935	1	.	.	.	.	.	.	.
4. <i>Potametum natantis</i> Soó 1923	.	.	.	.	.	1	.	.
5. <i>Nupharo-Nymphaetum albae</i> Tomasz. 1977	.	1	.	1	.	.	.	.
6. <i>Polygonetum natantis</i> Soo	.	.	1	.	.	.	.	.
7. <i>Hottonietum palustris</i> R.Tx. 1937	.	.	.	.	1	.	.	.
<i>Utricularietea intermedio-minoris</i> Den Hartog et Segal 1964 em. Pietrch 1965, <i>Utricularietalia intermedio minoris</i> Pietsch 1965								
8. <i>Sphagnetum cuspidato-obesi</i> R.Tx. et Hüb. 1958	.	3	.	2	.	2	.	2
9. <i>Warnstorfiatum exannulatae</i> Szańkowski 1988 n.n.	.	1	.	.	.	.	.	2
10. <i>Sphagno-Utricularietum ochroleucae</i> (Schum. 1937) Oberd. 1957	.	2	.	.	.	.	.	.
11. Zb. <i>Utricularia vulgaris</i>	.	.	2	1	.	.	.	.
<i>Phragmitetea</i> R.Tx. et Prsg 1942, <i>Phragmition</i> Koch 1926								
12. <i>Eleocharitetum palustris</i> Šennikov 1919	.	.	1	.	.	.	.	.
13. <i>Equisetetum fluviatilis</i> Steffen 1931	.	.	1	.	.	.	.	.
14. <i>Phragmitetum australis</i> (Gams 1927) Schmale 1939	1	.	1	1	.	.	.	.
15. <i>Typhetum latifoliae</i> Soó 1927	1	.	2	1	.	.	.	.
16. <i>Acoretum calami</i> Kobendza 1948	.	.	2	.	.	.	.	.
<i>Magnocaricion</i> Koch 1926								
17. <i>Thelypteridi-Phragmitetum</i> Kuiper 1957	1	.	.	1	.	.	.	.
18. <i>Cicuto-Caricetum pseudocyperi</i> Boer et Siss. in Boer 1942	1	.	.	.	.	1	.	.
19. <i>Iridetum pseudacori</i> Eggler 1933	1	.	1	.	.	.	.	.
20. <i>Caricetum rostratae</i> Rubel 1912	1	1	1	2	1	1	.	1
21. <i>Caricetum vesicariae</i> Br.-Bl. et Denis 1926	1	.	.	.	1	.	.	.
22. <i>Phalaridetum arundinaceae</i> (Koch 1926) Soó 1938	.	.	1	.	.	.	.	.
23. Zb. <i>Lysimachia thyrsiflora</i>	1	1	1	.	.	1	.	.
<i>Sparganio-Glycerion fluitantis</i> Br.-Bl. et Siss. in Boer 1942								
24. <i>Sparganio-Glycerietum fluitantis</i> Br.-Bl. 1925 n.n.	.	.	1	.	.	.	.	.
<i>Scheuchzerio-Caricetea nigrae</i> (Nordh. 1937) R.Tx. 1937, <i>Scheuchzerietalia palustris</i> Nordh. 1937, <i>Rhynchosporion albae</i> Koch 1926								
25. <i>Caricetum limosae</i> Br.-Bl. 1921	.	.	.	.	1	.	.	.
26. <i>Rhynchosporion albae</i> Koch 1926	1	1	1	.	.	1	1	.
<i>Caricion lasiocarpae</i> Vanden Bergh. ap. Lebrunt et all. 1949								
27. <i>Sphagno-Caricetum rostratae</i>	3	3	3	3	3	3	3	.
28. <i>Caricetum lasiocarpae</i> Koch 1926	2	1	2	2	3	2	1	.
29. <i>Caricetum diandrae</i> Jon. 1932 em. Oberd. 1157	.	1	.	1	.	1	.	.
30. <i>Calamagrostietum neglectae</i> Steff. 1931	2	1	1	1	1	.	.	.
31. Zb. <i>Comarum palustre</i>	2	1	2	2	1	1	.	.
32. Zb. <i>Menyanthes trifoliata</i>	1	2	1	2	.	1	.	.
33. Zb. <i>Calla palustris</i>	2	3	2	3	2	2	1	.

34. Zb. <i>Eriophorum angustifolium</i>	2	1	.	1	2	.	3	.
35. Zb. <i>Juncus effusus</i>	1	1	2	.	1	2	2	2
<i>Caricetalia nigrae</i> Koch 1926 em. Nordh. 1937, <i>Caricion nigrae</i> Koch 1926 em. Nordh. 1937								
36. <i>Carici canescentis-Agrostietum caninae</i> R.Tx. 1937	1	.	1	1	.	.	.	.
<i>Oxycocco-Sphagnetum</i> Br.-Bl. et R.Tx. 1943, <i>Sphagnetalia magellanici</i> (Pawł. 1928) Moore (1964), <i>Sphagnion magellanici</i> Kastner et Flossner 1933 em. Dierss. 1975								
37. <i>Sphagnetum magellanici</i> (Malc. 1929) Kastner et Flossner 1933	.	.	1	1	.	.	.	.
38. Zb. <i>Eriophorum vaginatum-Sphagnum fallax</i> Hueck 1928 (<i>Eriophoro-Sphagnetum</i>)	3	3	1	3	2	3	.	1
39. <i>Ledo-Sphagnetum magellanici</i> Sukopp 1959 em. Neuhausl. 1969	1	.	.	1	.	.	.	.
<i>Alnetea glutinosae</i> Br.-Bl. et R.Tx. 1943, <i>Alnetea glutinosae</i> R.Tx. 1937, <i>Alnion glutinosae</i> (Malc. 1929) Meijer Dress 1936								
40. <i>Salicetum pentandro-cinereae</i> (Almq. 1929) Pass. 1961	2	1	1	1	1	1	.	.
41. <i>Ribeso nigri-Alnetum</i> Sol.-Górn. (1975) 1987	1	1	.	1	1	1	.	.
42. <i>Sphagno squarrosi-Alnetum</i> Sol.-Górn. (1975) 1987	.	1	.	.	.	.	.	.
<i>Vaccinio-Piceetea</i> Br.-Bl. 1939								
43. <i>Vaccinio uliginosi-Pinetum</i> Libbert 1933	.	1	.	.	1	1	.	.

attention. *Riccietum fluitantis* patches were found in girdling ditches surrounding the Albertów peatbog in the north and south. The underwater layer of vegetation was composed of two species, i.e. *Riccia fluitans* and *Lemna trisulca*, and the loose surface layer was formed by *Lemna minor*. In larger and deeper reservoirs, there were communities from the class *Potametea*, e.g. *Hydrocharitetum morsus-ranae*, *Potametum natantis*, *Nypharo-Nymphaeetum albae*, and *Polygonetum natantis*. Several shallow depressions (in the Macoszyn object) contained small patches of the *Hottonietum palustris* association. Among the associations mentioned above, the highest diversity was noted in the association *Hydrocharitetum morsus-ranae*, which comprised *Lemna minor*, *Lemna trisulca*, and *Utricularia vulgaris* besides the predominant *Hydrocharis morsus-ranae*. The marginal part of this phytocoenosis was inhabited by a few rush species from the class *Phragmitetea*. The lowest number of species was recorded in the associations *Potametum natantis*, *Polygonetum natantis*, *Nypharo-Nymphaeetum albae*, and *Hottonietum palustris*.

The most interesting phytocoenoses formed in pools and depressions in the complex of bryales-sedge peatbogs and in the waterlogged Luta peatbog included communities from the class *Utricularietea intermedio-minoris*. These were patches of associations *Sphagno-Utricularietum minoris*, *Sphagno-Utricularietum ochroleucaae*, *Sphagnetum cuspidato-obesi*, and *Warnstorfiatum exannulatae*, as well as *Utricularia australis* communities. The first association mentioned was dominated by the characteristic *Utricularia minor* species most commonly accompanied by various sphagnum moss species. This community was recorded in small depressions of the Ostrówek Podyski and Macoszyn peatbogs. Patches of the association *Sphagno cuspidato-obesi* were dominated by aquatic sphagnum species, e.g. *Sphagnum cuspidatum*. Additionally, *Warnstorfia fluitans* and *Utricularia minor* were noted. An interesting phytocoenosis was formed by large patches of the

Warnstorfia exannulata moss community in waters with slightly acidic or neutral reaction. Associations *Sphagnetum cuspidato-obesi* and *Warnstorfiatum exannulatae* were found in the Luta and Jelino objects. The association *Sphagno-Utricularietum ochroleucae* dominated by *Utricularia ochroleuca* was formed in pools and depressions of bryales-sedge peatbog complexes.

Rush communities from the class *Phragmitetea* formed an abundant group. In the Albertów, Ostrówek Podyski, and Krasne objects, associations *Phragmitetum australis* and *Typhetum latifoliae* occurred in the form of small patches mainly in the marginal zone of the peatbogs and some peat pits. Other rush phytocoenoses, e.g. *Eleocharitetum palustris* and *Equisetetum fluviatilis*, were seldom reported, usually from local depressions. In the girdling ditch bordering the Albertów peatbog in the south, patches of the association *Acoretum calami* were found. Sedges from the association *Magnocaricion* were present in some old, shallow peat pits, at the margins of peat excavation pits, and in local terrain depressions. These communities were formed primarily on fens and in the margin zone of several transitional moors. They contained different-sized patches of *Iridetum pseudacori*, *Cicuto-Caricetum pseudocyperi*, *Caricetum rostratae*, *Caricetum vesicariae*, and *Phalaridetum arundinaceae* phytocoenoses. The association *Sparganio-Glycerion fluitantis* developed in terrain depressions at the edge of the Krasne peatbog.

Communities from the class *Scheuchzerio-Caricetea nigrae* were found in the transitional moors around overgrowing (Macoszyn and Stulno) or overgrown water reservoirs (Krasne, Albertów), as well as in some peat excavation pits (Jelino, Krasne, Podlaski, Ostrówek Podlaski). The most common communities in the transitional moors were *Sphagno-Caricetum rostratae*, *Caricetum lasiocarpae*, and *Carici-Agrostietum caninae*. Small patches of *Rhynchosporium albae* (Albertów, Jelino, Krasne, Stulno) and *Caricetum limosae* (Podlaski) occurred considerably less frequently.

The association *Sphagno-Caricetum rostratae* occurred in the form of different-sized patches. It was characterised by a high proportion of *Carex rostrata* and *Eriophorum angustifolium*, as well as *Oxycoccus palustris*. In some patches, *Andromeda polifolia* constituted a large admixture. In the bryophyte layer, *Sphagnum fallax*, *S. fuscum*, and *S. magellanicum* represented the largest proportion.

The association *Caricetum lasiocarpae* developed in permanently waterlogged sites or midforest closed depressions. It was dominated by *Carex lasiocarpa* accompanied by other sedges, e.g. *Carex canescens*, *C. vesicaria*, *C. fusca*, or less frequently *C. diandra*, and by *Eriophorum angustifolium*. In some patches, *Oxycoccus palustris*, *Peucedanum palustre*, *Andromeda polifolia*, and *Drosera rotundifolia*, as well as sphagnum species constituted a high proportion. The association *Carici-Agrostietum caninae* was formed on a mineral-organic substrate at the margins of marshes. It was characterised by great density of *Agrostis canina*, as well as *Calamagrostis neglecta* and presence of *Carex lasiocarpa* in some patches. In some sites, the community was overgrown by willows *Salix aurita* and *S. cinerea* and birches *Betula pubescens* and *B. pendula*.

The association *Rhynchosporetum albae* developed in wet peatbog depressions. It covered small areas and exhibited a mosaic arrangement with other communities of transitional moors. The predominant white beak-sedge *Rhynchospora alba* was accompanied by other species from the class *Scheuchzerio-Caricetea nigrae*. Patches of the association *Caricetum limosae* were found on overgrowing peat pits in only one object (Podlaski). Species from the class *Scheuchzerio-Caricetea nigrae* constituted an admixture in this association, likewise in the association *Rhynchosporetum albae*.

The surface of some old peat excavation pits and local depressions (less commonly, drainage ditches) was covered by loose turf comprising almost single-species aggregations of *Comarum palustre*, *Menyanthes trifoliata*, or *Calla palustris*. A slight admixture was composed of species from the classes *Phragmitetea* and *Scheuchzerio-Caricetea nigrae*. Some patches exhibited a high proportion of *Sphagnum cuspidatum*. A community dominated by *Eriophorum angustifolium* was noted in the Krasne and Podlaski peatbogs. Patches of this community were found in very wet mineral-organic depressions. In almost all the object analysed, communities dominated by *Juncus effusus* and *Sphagnum fallax* were found usually at the margins of the peatbogs. Similar patches from midforest marshes of the Łęczna-Włodawa Plain and Solska Primaeval Forest were classified by Fijałkowski and Chojnacka-Fijałkowska [1990] as the association *Juncus effusi-Sphagnetum*.

Raised-bog communities from the class *Oxycocco-Sphagnetum* inhabited the Jelino, Krasne, Ostrówek Podyski, Podlaski, Macoszyn, and Stulno peatbogs. They included association *Eriophoro-Sphagnetum* and, less frequently, *Sphagnetum magellanicum* and *Ledo-Sphagnetum*. A distinct hammock-pool structure was observed at the sites of occurrence of these communities. They were loosely overgrown by the dwarf *Pinus sylvestris* with a slight admixture of *Betula pubescens*. The hummocks were occupied by *Oxycoccus palustris*, *Eriophorum vaginatum*, and *Andromeda polifolia*, and seldom by *Ledum palustre*. Some hummocks were covered by *Sphagnum magellanicum* with a *Polytrichum strictum* admixture in some places. The pools were overgrown by sphagnum species: most frequently *Sphagnum fallax* and less often *S. cuspidatum*.

Communities from the class *Alnetea glutinosae* were represented by two associations *Sphagno squarrosi-Alnetum* and *Ribeso nigri-Alnetum* in the examined objects. Fragments of alder carr *Sphagno squarrosi-Alnetum* were noted in the Jelino and Macoszyn peatbogs. The tree stand comprised *Alnus glutinosa* sometimes accompanied by birches. The understory was most commonly formed by saplings of the above-mentioned trees as well as *Frangula alnus* and *Salix cinerea* shrubs. The groundcover was composed of species characteristic of both transitional moors and coniferous forests. Most frequently, the moss layer contained *Sphagnum squarrosum*, *Calliergonella cuspidata*, and *Drepanocladus aduncus*. *Ribeso nigri-Alnetum* carr occurred in small patches as well. The association was primarily formed by *Alnus glutinosa*, with a *Betula pubescens* admixture in some places. The understory was composed of *Salix cinerea* and

Frangula alnus. The groundcover was dominated by species from the class *Phragmitetea*. Shrub associations occurred rarely in the analysed peatbogs; they were represented by small patches of *Salicetum pentandro-cinereae*, which formed dense *Salix cinerea* shrubs (up to 90% cover). The admixture was composed of *Alnus glutinosa*, *Betula pendula*, and *B. pubescens*. The groundcover was usually formed by species from the class *Phragmitetea*. This association occurred in the Krasne and Bagno Wytrzeszczone peatbogs.

Table 2. Rare and legally protected plant species inhabiting the analysed peatbogs: 1 – Krasne, 2 – Jelino, 3 – Albertów, 4 – Ostrówek Podyski, 5 – Podlaski, 6 – Macoszyn, 7 – Stulno, 8 – Luta
Frequency of occurrence: 1 – rare, 2 – frequent, 3 – very frequent

Species	Status	Objects							
		1	2	3	4	5	6	7	8
<i>Dactylorhiza incarnata</i>	§§	.	.	1	.	.	.	.	.
<i>Drosera intermedia</i>	§§	.	.	.	.	.	.	.	1
<i>Drosera rotundifolia</i>	§§	3	3	3	3	3	3	3	1
<i>Frangula alnus</i>	§	3	2	3	3	1	1	1	1
<i>Ledum palustre</i>	§§	2	2	.	3	2	2	1	.
<i>Lemna gibba</i>	r	1	.	.	.	.	.	.	.
<i>Lemna turionifera</i>	r	.	.	.	1	.	.	.	.
<i>Menyanthes trifoliata</i>	§	2	2	2	2	.	.	.	.
<i>Nymphaea alba</i>	§	.	1	.	1	.	.	.	.
<i>Peplis portula</i>	r	1	.	1	.	.	.	.	.
<i>Rhynchospora alba</i>	r	2	2	2	.	.	1	1	.
<i>Scheuchzeria palustris</i>	§§	.	.	2	.	.	.	.	.
<i>Utricularia minor</i>	§§	.	1	.	1	.	.	.	1
<i>Utricularia australis</i>	§§	.	2	.	.	.	.	.	.
<i>Utricularia vulgaris</i>	§§	2	2	3	2	.	.	.	3
<i>Riccia fluitans</i>	r	.	.	1	.	.	.	.	.
<i>Aulacomium palustre</i>	§	2	2	1	2	1	1	1	.
<i>Sphagnum cuspidatum</i>	§§	2	.	.	3	3	2	.	3
<i>Sphagnum magellanicum</i>	§§	1	.	2	.	1	1	.	.
<i>Sphagnum fallax</i>	§	2	.	.	.	3	2	2	.
<i>Sphagnum fuscum</i>	§§	2	.	1	.	1	2	2	.
<i>Sphagnum fimbriatum</i>	§§	.	.	2	2	.	2	2	.
<i>Sphagnum flexuosum</i>	§§	2	.	.	2	.	.	.	.
<i>Sphagnum squarrosum</i>	§	.	.	.	1	.	.	.	.
<i>Pleurozium schreberi</i>	§	1	.	.	1	1	.	.	1
<i>Polytrichum strictum</i>	§	1	.	.	.	1	.	.	.
<i>Polytrichum commune</i>	§	1	.	.	.	1	.	1	1

The continental marshy coniferous forest *Vaccinio uliginosi-Pinetum* from the class *Vaccinio-Piceetea* covered the largest area in the Ostrówek Podyski peatbog. Small patches of this phytocoenosis occurred in the Podlaski, Jelino, Macoszyn, and Stulno peatbogs as well. The groundcover was composed of shrublet species *Vaccinium uliginosum* and *Ledum palustre* and, more seldom, *Oxycoccus palustris* and *Andromeda polifolia*. Some patches displayed higher density of *Vaccinium myrtillus* and *V. vitis-idaea* in some places. The moss layer comprised *Polytrichum commune* and sphagnum species – *Sphagnum squarro-*

sum, *S. capillifolium*, *S. compactum*, and *S. palustre*. The abundance of a rare lichen species *Cladonia incrassata* in the Ostrówek Podyski peatbog should be emphasised.

Legally protected vascular plant species, e.g. *Dactylorhiza incarnata*, *Drosera intermedia*, *Drosera rotundifolia*, *Ledum palustre*, *Scheuchzeria palustris*, *Utricularia vulgaris*, *Utricularia minor*, *Utricularia ochroleuca*, *Nymphaea alba*, *Menyanthes trifoliata*, and *Frangula alnus*, and rare species *Lemna gibba*, *Lemna turionifera*, and *Peplis portula* were reported from the investigated peatbogs (Tab. 2).

DISCUSSION

The floristic-phytosociological investigations of the selected midfield and midforest peatbogs indicate high diversity of plant communities. 35 associations and 8 syntaxa ranked as plant communities representing 7 phytosociological classes were found in the examined objects. The greatest number of phytocoenoses was noted in the Bagno Wytrzeszczone peatbog (26 communities), and the lowest in the Luta peatbog (5 communities). The order of the objects according to the number of the communities is presented below:

Albertów > Krasne > Ostrówek Podyski > Jelino > Macoszyn > Podlaski > Stulno > Luta.

Phytocoenoses that occurred most frequently and covered the largest surface in the examined peatbogs included *Sphagno-Caricetum rostratae*, community *Eriophorum vaginatum-Sphagnum fallax*, *Caricetum lasiocarpae*, and community *Calla palustris*. *Riccietum fluitantis* was an uncommon aquatic community, and *Caricetum limosae*, *Sphagnetum magellanicum*, and *Ledo-Sphagnetum magellanicum* were rare peatbog communities. Phytocoenoses from the class *Utricularietea intermedio-minoris* occurring in the Jelino, Ostrówek Podyski, Macoszyn, and Luta peatbogs deserve special attention. According to Matuszkiewicz [2008], they are still poorly investigated in Poland.

The inventory of plant species and communities showed that a majority of the examined midfield and midforest peatbogs could be regarded as representative of the Łęczna-Włodawa Plain. Similar results of field studies conducted in this area were presented by, e.g. Fijałkowski *et al.* [1995], Wawer and Urban [1995], Wójciak *et al.* [1999] and Urban [2002, 2007].

The plant communities occurring in the described peatbogs undergo dynamic changes depending on both the quantity and the quality of water. Interesting processes related to succession of plant communities can be observed in the Luta peatbog, which at the beginning of the 21st century was strongly desiccated and its surface layers underwent the rotting process. Communities of raised bogs and transitional moors were only preserved in local depressions and a few very small peat pits. Since 2006, water (reaching a height of 70–80 cm) has been stagnating over the entire surface of this peatbog. This was caused by a dam

built by beavers in a ditch neighbouring the peatbog. In 2009–2012, restoration of peatbog communities (*Eriophorum vaginatum-Sphagnum fallax*) was reported. In the waters of the peatbog, communities from the class *Utricularietea intermedio-minoris*, e.g. *Sphagnetum cuspidato-obesi* and *Warnstorfieta exanulatae*, were recorded.

There are many peat excavation pits in the Jelino, Krasne, Podlaski, Macoszyn, and Ostrówek Podyski objects, and small overgrowing water reservoirs in the Stulno and Macoszyn peatbogs. The peat pits and other object of this type [Podbielkowski 1960, Fijałkowski and Urban 1995, Iwaniuk 1999, Mosek and Miazga 1999, Trąba *et al.* 2004, Sugier 2006, Urban 2007] are characterised by great phytocoenotic and floristic diversity. They also provide a habitat for rare plant species, which is related to the age, depth, and size of the peat pits, and the type of the peat deposit. The process of spontaneous renaturalisation of many depleted peatlands has been reported [Podbielkowski 1960, Jasnowska and Markowski 1995, Ilnicki 1996, Iwaniuk 1999, Mosek and Miazga 1999, Trąba *et al.* 2004, Sugier 2006, Urban 2007]. Plant communities inhabiting the examined post-excavation pits represent the initial, transitional, and final stages of development. According to Podbielkowski [1960], water is one of the factors determining the type of vegetation inhabiting post-excavation pits. In many of the analysed peat pits (water with acidic pH), species from the class *Scheuchzerio-Caricetea nigrae* exhibited in the initial developmental stage, e.g. *Comarum palustre*, *Menyanthes trifoliata* or *Calla palustris*, as well as *Sphagnum cuspidatum*. Species from the classes *Scheuchzerio-Caricetea nigrae* and *Oxycocco-Sphagnetetea* were reported to enter the successive stages of development. The process of regeneration of peat-forming communities progressing from the margins of the peat pits and, less frequently, occurring simultaneously over their entire surface was observed in a majority of the investigated objects. These were moss communities emerging as quaking bog along the water table (e.g., peat pits in the Podlaski, Ostrówek Podyski, and Jelino objects). Similar cases of peatland regeneration in the Łęczna-Włodawa Lakeland were reported by Iwaniuk [1999], Mosek and Miazga [1999], Sugier [2006], Urban [2007], and Urban *et al.* [2007].

CONCLUSIONS

1. The objects analysed were characterised by high diversity of plant communities from the phytosociological classes *Lemnetea*, *Potametea*, *Phragmitetea*, *Utricularietea intermedio-minoris*, *Molinio-Arrhenatheretea*, *Scheuchzerio-Caricetea fuscae*, *Oxycocco-Sphagnetetea*, *Alnetea glutinosae*, *Vaccinio-Piceetea*, and *Artemisietea*.

2. The peat pits in the objects exhibited different developmental stages, depending on their age, depth, and size and the type of the peat deposit. Aquatic and rush communities dominated in the post-excavation pits in the area of the

peatbogs. Plant communities from various phytosociological classes developed in the peat pits of the raised bogs and transitional moors.

3. Rare (5) and legally protected (strict protection – 13, partial protection – 9) plant species were found in the area of the analysed objects and in their immediate vicinity (Tab. 2).

4. Particularly noteworthy is the presence of habitats listed in Annex I of Habitats Directive for the Ecological Network Natura 2000, e.g. raised bogs with peat-forming vegetation (*Sphagnetalia magellanici*), degraded raised bogs capable of natural and stimulated regeneration (degraded *Sphagnetalia magellanici*), transitional moors and quaking bogs (*Caricion lasiocarpae*), pool depressions and moss floating bogs (*Rhynchosporion albae*), and bog pine forests (*Vaccinio uliginosi-Pinetum*).

5. The peatbogs examined should be legally protected as ecologically usable lands.

REFERENCES

- Braun-Blanquet J., 1951. Pflanzensoziologie. Springer Verlag, Wien, 631 pp.
- Fijałkowski D., Chojnacka-Fijałkowska E., 1990. Zbiorowiska z klas *Phragmitetea*, *Molinio-Arrhenatheretea* i *Scheuchzerio-Caricetea fuscae* w makroregionie lubelskim. Roczn. Nauk Roln., s. D, Monografie, 217, 414 ss.
- Fijałkowski D., Urban D., Baryła R., 1997. Szata roślinna obiektu leśno-torfowiskowego Rogóżno. Annales UMCS, Lublin, sec. C, 52, 145–168.
- Grootjans A., Wolejko L. (red.), 2007. Ochrona mokradel w rolniczych krajobrazach Polski. Wyd. Oficyna, Szczecin, 110 ss.
- Kondracki J., 2002. Geografia regionalna Polski. Wyd. Nauk. PWN, Warszawa.
- Lamentowicz M., 2006. Identyfikacja torfowisk naturalnych w lasach na przykładzie Nadleśnictwa Tuchola. Studia i Materiały Centrum Edukacji Przyr.-Leśnej, 9, 2/3 (36), 571–583.
- Łachacz A., Olesiński L., 2000. Flora i roślinność trzęsawiskowego torfowiska Jezioro na Pojezierzu Mazurskim. Fragm. Flor. Geobot. Polonica, 7, 129–143.
- Ilnicki P., 1996. Spontaneous renaturalisation of vegetation on cut-over raised bogs. Przeg. Przyrod., 7, 3–4, 113–127
- Iwaniuk A., 1999. Peat pit – the encouraging exception. Aura, 4, 17–18.
- Łuczycka-Popiel A., 1999. Pomnik przyrody „Biesiadki” na Polesiu Lubelskim. Annales UMCS, sec. C, 54, 73–91
- Matuszkiewicz W., 2005. A guide for marking Poland's plant communities (in Polish). Wyd. Naukowe PWN, 536 pp.
- Mirek Z., Piękoś-Mirkowa H., Zając A., Zając M., 2002. Flowering plants and pteridophytes of Poland a checklist. W. Szafer Inst. of Botany, Polish Academy of Sciences, Kraków, 442 pp.
- Mirek Z., Zarzycki K., Wojewoda W., Szelaż Z., 2006. Red list of plants and fungi in Poland. W. Szafer Inst. of Botany, Polish Academy of Sciences, Kraków, 99 pp.
- Ochyra R., Żarnowiec J., Bednarek-Ochyra H., 2003. Census catalogue of Polish mosses. PAN, Inst. Bot., 372 pp.
- Mosek B., Miazga S., 1999: Flora of peat pits on Pojezierze Łęczyńsko-Włodawskie (in Polish). Fol. Univ. Stetin. 197, Agricultura (75), 233–238.

- Podbielkowski Z., 1960. The development of vegetation in peat pits. *Monogr. Bot.* 10(1), 1–144.
- Sugier P., 2006. Peat pits vegetation of peatlands in the Polesie National Park and its protected zone. *Teka Kom. Ochr. Środ. Przyr.*, 3, 203–208.
- Tobolski K., 2003. Torfowiska, na przykładzie Ziemi Świeckiej. *Towarzystwo Przyjaciół Dolnej Wisły. Świecie.*
- Trąba Cz., Wójcikiewicz M., Wolański P., 2004. Spontaneous renaturalisation of the „Broduszurki” peatland on Dynów Plateau (in Polish). *Woda-Środowisko-Obszary Wiejskie*, 4, 263–377.
- Urban D., 2002. Soils and vegetation of small interforest bogs of Sobibór Forest Inspectorate (Wołczyńskie District). *Acta Agrophysica*, 68, 235–244.
- Urban D., 2007. Plant communities of peat pits and ponds in the area of Sobibór Forests (Łęczyńsko-Włodawskie Lakeland). *Teka Kom. Ochr. Środ. Przyr.*, 4, 285–292.
- Urban D., Mikosz A., I., Jendrzewska J., 2007. Floristic and phytosociological diversity of peat pits in planned ecological land near Krasne (Łęczyńsko-Włodawskie Lakeland). *Teka Kom. Ochr. Środ. Przyr.*, 4, 293–299.
- Urban D., Wójcikowska-Kapusta A., 2003. Wpływ zlewni na zawartość makroelementów w glebach śródpolnego torfowiska przejściowego. *Acta Agrophysica*, 87, 1 (2), 339–348.
- Wawer M., Urban D., 1995. Użytek ekologiczny „Wielkie Błoto” w Zawieprzycach koło Lublina. *Chrońmy Przyr. Ojcz.*, 5, 84–87.
- Wójciak H., Urban D., 2012. Small mid-forest and mid-field peat bogs as a refuge of rare and protected lichen species, in: *The Lichen protection species*, Lipnicki L. (red.). University of Physical Education, Faculty of Physical Culture in Gorzów Wielkopolski, Laboratory of Biology and Nature Protection, Regional Directorate National Forests Zielona Góra, Forest Inspectorate in Lubsko, Forest Promotional Complex Bory Lubuskie, Polish Botanical Society – Lichenological Section, p. 133–141.
- Wójciak J., Urban D., Wójciak H., 2000. Walory przyrodnicze i problemy ochrony małych śródleśnych bagien Nadleśnictwa Sobibór (Pojezierze Łęczyńsko-Włodawskie), w: *Renaturyzacja obiektów przyrodniczych aspekty ekologiczne i gospodarcze*, Z. Michalczyk (red.). Wyd. UMCS, s. 89–97.

WALORY FLORYSTYCZNE I FITOSOCJOLOGICZNE ŚRÓDPOLNYCH I ŚRÓDLESNYCH TORFOWISK (RÓWNINA ŁĘCZYŃSKO-WŁODAWSKA, OBNIŻENIE DOROHUCKIE)

Streszczenie. Badane torfowiska śródpolne i śródleśne leżą na terenie Równiny Łęczyńsko-Włodawskiej (Polesie Zachodnie) i Obniżenia Dorohuckiego (Polesie Wołyńskie). 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 łącznie 35 zespołów i 8 syntaksonów w randze zbiorowisk roślinnych z klas *Lemnetea*, *Potametea*, *Utricularietea intermedio-minoris*, *Phragmitetea*, *Scheuchzerio-Caricetea fuscae*, *Oxycocco-Sphagnetetea*, *Alnetea glutinosae* i *Vaccinio-Piceetea*. Do najcenniejszych fitocenoz należały zbiorowiska z klas: *Scheuchzerio-Caricetea fuscae* (np. *Caricetum limosae* i *Rhynchosporium albae*) oraz *Oxycocco-Sphagnetetea*. Spośród gatunków roślin objętych ochroną prawną stwierdzono tu stanowiska np. *Dactylorhiza incarnata*, *Drosera intermedia*, *Drosera rotundifolia*, *Ledum palustre*, *Scheuchzeria palustris*, *Utricularia minor*, *U. australis*, *U. vulgaris*.

Key words: zbiorowiska roślinne śródpolnych i śródleśnych torfowisk przejściowych, Równina Łęczyńsko-Włodawska