

THE CONDITIONS OF OCCURRENCE OF *Equisetum telmateia* Ehrh. IN LOWLAND LOCALITY IN WESTERN POMERANIA

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Abstract

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In Poland *Equisetum telmateia* Ehrh. is a sub-mountainous species. In lowland regions it is fairly rare. A highly populated site of this species is noted near the village of Klasztorne in Western Pomerania. The investigation was carried out in the year 2006. In the investigated area giant horsetail chiefly occurs in forest phytocenoses on embankments and flood terraces of the river Kaczynka valley (*Fraxino-Alnetum* W. Mat. 1952, *Ribeso nigri-Alnetum* Sol. Gór. (1975) 1987). Very abundantly it grows in non-forest phytocenoses where on the river bank its fields are found on forest outskirts encroaching the area of a wet field (community of the *Aegopodion podagrariae* alliance). Horsetail shows different cover in the individual patches of phytocenoses. However, it does not depend on the type of the phytocenosis being directly associated with the degree of solar exposure.

Key words: nature reserve, northwestern Poland, plant communities, protected plants

Introduction

The geographical range of *Equisetum telmateia* Ehrh. distribution covers Europe, Caucasus Mts, Minor Asia, northwestern Africa, Azores, Madeira and a western part of Northern America. The border of its compact distribution crosses Poland. In Poland it is a sub-mountainous species occurring fairly often in the lower sites of the Sudety and Carpathian Mts (Piękoś-Mirkowa, Mirek, 2003). In lowland regions it is fairly rare and belongs to endangered species of Western Pomerania (Żukowski, Jackowiak, 1995). Giant horsetail grows along rivers and streams and at head-waters; on wet and rich soils of the high humus content and pH slightly acidic to basic; on humus alluvial soils; peat soils of lowland bogs; and on gley soils (Piękoś-Mirkowa, Mirek, 2003; Zarzycki et al., 2002). The species is under strict protection according to the regulation of the Polish Ministry of Environmental Protection from July 9, 2004 (Official Gazette. No. 168, p. 1764).

A highly populated site of this species is noted near the village of Klasztorne in Western Pomerania. For the protection of biocenoses with giant horsetail a nature reserve Źródliko Skrzy-

powe was founded on July 21, 1977 (Monitor Polski No. 19, p. 107, 1977) on the basis of article 13 of the Nature Conservation Act from April 7, 1949 (Official Gazette. No. 25, p. 180).

The reserve of 1.05 ha lies at the southern border of the West-Pomeranian Province near the town of Bierzwnik in the Bierzwnik Forest District (compartment 506j; Jędrychowo forest range).

According to the physical and geographical distribution by Kondracki (2000) the reserve lies in the area of the Dobiegniew Lakeland mezzo-region; the macro-region of Southwestern Pomeranian Lakeland (Sub-province Pomeranian Lakeland; the Province of Central-European Lowland). In the Matuszkiewicz's (1993) geobotanical system the reserve lies in the Kamieńsko-Pomorski sub-district of the Koszalin-Wolin district of the South-Baltic shore land and of the Pomerania division.

The reserve covers a fragment of the river Kaczynka valley with steep valley-sides and a flat flooding terrace. The relative heights of the terrain reach three meters. Head-water seepages are found in the lower and central part of the valley wall and on the flat flooding terrace. The water flows on the surface or under the ground in the direction of the river channel. In the area of the reserve all the springs have the form of helokrens with micro-limnokrens developing in their area. They are permanent, well developed head-waters which form soligenic (in places lying farther from the river) and fluvio-genic (near the river) marshes up to 0.5 m in depth.

In the zone of the sloping side and bottom of the valley the substrate is saturated with filtering water and is characterized with permanent bogginess. In the zone of the sloping side within the area of the giant horsetail vegetation a layer of wet sand reaches up to 1 m in thickness. In the zone of the valley bottom on the largest part of the area there occur organogenic soils developed on sandy soils and half-bog-mineral soils developed from strongly mineralized peat. This layer is 0.4–0.7 m in depth. The pH value of the soil is neutral. The substrate is very fertile as shown by the abundant vegetation. The fertility is additionally affected by water with a rich content of mineral salts, especially calcium and ferric ones (Markowski, 1972). Black-earth developed only in the northern part of the nature reserve.

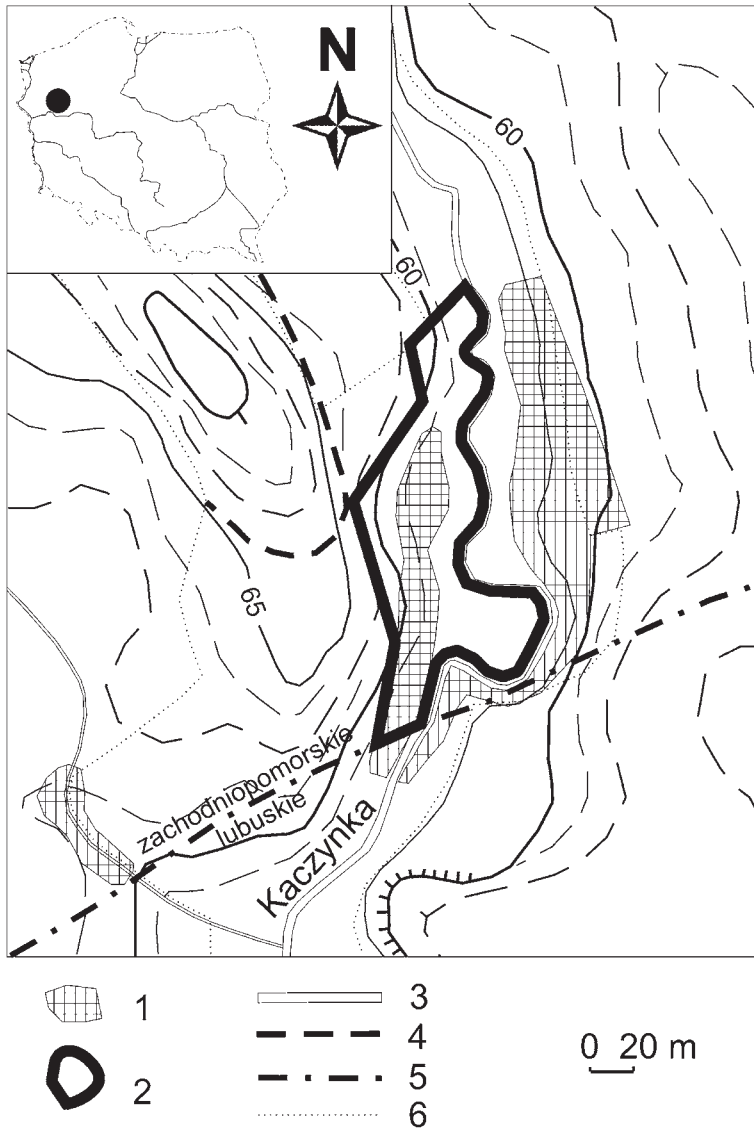
Material and methods

The investigation in the Źródliśko Skrzypowe reserve and in its nearest neighbourhood was carried out in the year 2006, all the phenological aspects being taken into consideration. Phytosociological surveys were conducted using the classic Braun-Blanquet (1964) method. The nomenclature of vascular plant species was given according to Flora Europaea (1964–1980); of bryophytes according to Ochyra et al., 2003; while the system of communities was presented according to Matuszkiewicz, 2001.

Results

In the investigated area giant horsetail chiefly occurs in forest phytocoenoses on embankments and flood terraces of the river Kaczynka valley in the central and southern part of the reserve (the western bank of the river) and also outside its area on the eastern bank of the

river. Giant horsetail very abundantly grows in non-forest phytocoenoses outside the nature reserve where on the eastern river bank its fields are found on forest outskirts encroaching the area of a wet field. The plant also very numerous appears along the ditch at a distance of about 1.40 m from the reserve (Fig.1).



Systematic list of plant communities

Class *Artemisietea vulgaris* Lohm., Prsg et R. Tx. in R. Tx. 1950

Subclass *Galio-Urticenea* (Pass. 1967)

Order *Glechometalia hederaceae* R. Tx. in R. Tx. et Brun-Hool 1975

Alliance *Aegopodion podagrariae* R. Tx. 1967

Community *Equisetum telmateia*

Class *Montio-Cardaminetea* Br.-Bl. et R. Tx. 1943

Order *Montio-Cardaminetalia* Pawł. 1928

Alliance *Cardamino-Montion* Br.-Bl. 1925

Community *Cardamine amara-Chrysosplenium alternifolium* Oberd. 1977

Class *Alnetea glutinosae* Br.-Bl. 1937

Order *Alnetalia glutinosae* R. Tx. 1937

Alliance *Alnion glutinosae* (Malc. 1929) Meijer Drees 1936

***Ribeso nigri-Alnetum* Sol. Górn. (1975) 1987**

Class *Quercu-Fagetea* Br.-Bl. et Vlieg. 1937

Order *Fagetalia sylvaticae* Pawł. in Pawł., Sokół. et Wall. 1928

Alliance *Alno-Ulmion* Br.-Bl. et R. Tx. 1943

Fraxino-Alnetum **W. Mat. 1952**

Community *Equisetum telmateia*

Community *Equisetum telmateia*

Near the eastern borderline of the nature reserve a very numerous occurrence of giant horsetail was recorded. In the patch presented below it shows a 90% cover. Next to the abundant head-waters skirt communities of the *Aegopodion podagrariae* alliance developed in the vicinity of currant swamp and ash-alder riparian forests. They were dominated by the giant horsetail which found excellent habitat conditions, particularly light conditions, in this area. Numerous horsetail individuals also grow at the outskirts of the field.

One phytosociological record was carried out here (date: 05.08.2006, area of relevé: 60 m², density of shrub layer b: 2%, cover of herb layer c: 100%, cover of moss layer d: min, no. of species in the relevé: 16): **I. Ch. *Artemisietea vulgaris et Galio-Urticenea****: *Urtica dioica* 2.2, *Galium aparine** 2.2, *Cirsium arvense* +, *Artemisia vulgaris* +; **II. Ch. et D*** *Aegopodion podagrariae*; *Lamium maculatum* 1.1, *Aegopodium podagraria** 2.1; **III. Ch. *Molinio-Arrhenatheretea et Filipendulion****: *Phleum pratense* +, *Lathyrus pratensis* +, *Filipendula ulmaria** +, *Geranium palustre**+; **IV. Ch. *Alno-Ulmion***: *Equisetum telmateia* 5.5; **V. Others**: *Alnus glutinosa* b +, *Humulus lupulus* +, *Heracleum sphondylium* subsp. *sibiricum* +, *Cirsium oleraceum* +, *Holcus mollis* +.

Community *Cardamine amara-Chrysosplenium alternifolium* Oberd. 1977

The head-water community whose patches most often cover small plots of a few meters (Table 1). The patches developed within head-water niches which formed at places of

Table 1. Community *Cardamine amara-Chrysosplenium alternifolium* Ord. 1977 in the Źródliisko Skrzypowe nature reserve.

Successive no. of relevé	1	2	3
day	05	05	05
Date month	07	07	07
year	2006	2006	2006
Area of relevé	8	8	20
Slope	5	5	min
Cover of herb layer c [%]	60	70	80
Cover of moss layer d [%]	min	min	min
No. of species in the relevé	7	6	11
I. Ch. Ass.			
<i>Cardamine amara</i> subsp. <i>amara</i>	2.2	2.2	4.3
II. Ch. <i>Cardamino-Montion</i>			
<i>Epilobium obscurum</i>	3.2	+	.
III. D. <i>Cardaminienion</i>			
<i>Chrysosplenium alternifolium</i>	1.2	1.2	1.2
<i>Impatiens noli-tangere</i>	2.1	+	.
IV. Others			
<i>Ranunculus ficaria</i>	3.2	3.2	2.2
<i>Urtica dioica</i>	2.1	.	2.1
<i>Ranunculus repens</i>	1.2	1.2	.
<i>Brachythecium rivulare</i>	+	+	+
Sporadic species: <i>Poa trivialis</i> 3 (1.1); <i>Caltha palustris</i> 3 (+); <i>Equisetum telmateia</i> 3 (+); <i>Galium aparine</i> 3 (+); <i>Myosotis palustris</i> 3 (+); <i>Stellaria nemorum</i> 3 (+); <i>Geranium robertianum</i> 3 (+); <i>Plagiomnum undulatum</i> 3 (+).			

water seepage. Owing to the constant inflow of water the substrate is always wet and in spring it is marshy with seeping out water on the surface. The patches lie in the mid-height of the slope and also at its feet where the flowing water is visible even in summer. They also occur on the slopes and in the bottom of the river valley in the eastern part of the reserve.

Cardamine amara subsp. *amara* and *Chrysosplenium alternifolium* and other outstanding species of the alliance and *Epilobium obscurum* and *Impatiens noli-tangere* of the sub-alliance constitute the framework of the community. They are accompanied by *Urtica dioica*, *Ranunculus repens*, *Ranunculus ficaria* which is particularly numerous in spring; and other species.

T a b l e 2. Association *Ribes nigrum*-*Alnetum* S o l. G ó r n. (1975) 1987 in the Źródliisko Skrzypowe nature reserve.

Successive no. of relevé day		1	2	3	4	5	6
Date	month	04	07	04	07	08	08
	year	2006	2006	2006	2006	2006	2006
Area of relevé [m ²]		150	150	150	150	150	150
Slope [°]		0	0	0	0	0	0
Density of tree layer a [%]		80	80	85	85	85	85
Density of shrub layer b [%]		10	10	45	45	7	10
Cover of herb layer c [%]		95	95	95	95	95	95
Cover of moss layer d [%]		min	3	3	3	7	25
No. of species in the relevé		15	30	19	29	23	32
I. Ch. et D* Ass.							
<i>Ribes nigrum</i>	b	2.2	2.2	2.2	2.2	2.2	1.2
<i>Prunus padus</i> *	b	1.2	1.2	1.2	1.2	+	1.2
<i>Fraxinus excelsior</i> *	a	.	.	.	.	.	1.1
<i>Fraxinus excelsior</i> *	b	+	+	+	+	+	.
Ch. et D.* <i>Alnetea glutinosae</i>							
<i>Alnus glutinosa</i> *	a	5.5	5.5	5.5	5.5	5.5	5.5
<i>Alnus glutinosa</i> *	b	1.1	1.1	1.1	1.1	+	+
<i>Alnus glutinosa</i> *	c	+	+	+	+	.	.
<i>Solanum dulcamara</i>		.	.	.	+	.	2.2
<i>Lycopus europaeus</i>		.	.	.	.	+	+
Sporadic species: <i>Thelypteris palustris</i> 4 (+)							
II. Ch. Alno-Ulmion							
<i>Ranunculus ficaria</i>		5.4	+	3.4	+	+	.
<i>Stellaria nemorum</i>		2.2	2.2	+	+	.	1.2
<i>Plagiomnium undulatum</i>		+	1.2	1.2	1.2	2.2	2.3
<i>Chrysosplenium alternifolium</i>		+	+	+	+	.	2.2
<i>Equisetum telmateia</i>		.	1.1	.	.	.	2.1
Sporadic species: <i>Festuca gigantea</i> 2 (+); <i>Gagea lutea</i> 3 (r)							
Ch. <i>Quercus-Fageteta</i> et <i>Fagetalia</i> *							
<i>Euonymus europaeus</i>	b	.	.	1.2	1.2	.	.
<i>Impatiens noli-tangere</i> *		.	1.1	.	+	+	.
<i>Aegopodium podagraria</i>		.	.	.	+	+	.
Sporadic species: <i>Anemone ranunculoides</i> * 3 (+); <i>Corylus avellana</i> b 5 (+)							
III. Ch. <i>Phragmiteteta</i> * et <i>Magnocaricion</i>							
<i>Carex acutiformis</i>		2.3	2.3	2.3	2.3	2.3	2.2
<i>Phragmites australis</i> *		.	+	2.3	2.3	.	1.2
<i>Scrophularia umbrosa</i> *		.	+	+	+	1.1	.
<i>Galium palustre</i>		+	+	.	.	.	1.2
<i>Phalaris arundinacea</i>		.	+	.	+	+	.

Table 2. (Continued)

<i>Poa palustris</i>	.	+	.	+	.	.
Sporadic species: <i>Scutellaria galericulata</i> 2 (+); <i>Berula erecta</i> 6 (+)						
IV. Others						
<i>Urtica dioica</i>	2.2	2.3	2.2	2.2	2.2	2.2
<i>Galium aparine</i>	1.2	2.3	1.2	2.3	+	1.2
<i>Lamium maculatum</i>	1.2	1.2	.	.	.	2.2
<i>Humulus lupulus</i>	.	.	+	1.2	1.2	.
<i>Brachytecium rivulare</i>	+	+	+	+	.	2.2
<i>Cardamine amara</i> subsp. <i>amara</i>	.	+	+	+	.	.
<i>Epilobium hirsutum</i>	.	+	.	+	+	.
<i>Geranium robertianum</i>	.	+	.	.	+	+
<i>Poa trivialis</i>	+	+	.	.	.	+
<i>Scirpus sylvaticus</i>	.	.	.	+	+	+
<i>Galeopsis speciosa</i>	.	.	.	r	+	+
Sporadic species: <i>Athyrium filix-femina</i> 6 (+); <i>Brachytecium rutabulum</i> 6 (1.2); <i>Caltha palustris</i> 2 (+), 5 (+); <i>Calystegia sepium</i> 6 (1.2); <i>Deschampsia caespitosa</i> 5 (+); <i>Dryopteris carthusiana</i> 6 (+); <i>Epilobium parviflorum</i> 6 (+); <i>Filipendula ulmaria</i> 2 (+), 6 (+); <i>Galeopsis bifida</i> 2 (+); <i>Geum urbanum</i> 6 (+); <i>Eupatorium cannabinum</i> 2 (+); <i>Impatiens parviflora</i> 5 (1.1), 6 (+); <i>Myosotis palustris</i> 2 (+), 4 (+); <i>Myosoton aquaticum</i> 4 (+); <i>Rubus idaeus</i> 6 (+); <i>Symphytum officinale</i> 4 (+), 6 (+).						

***Ribeso nigri-Alnetum* Sol. G ó r n . (1975) 1987 – Currant swamp forest**

Patches of this association (Table 2) chiefly developed in the bottom of the river valley reaching its bed, and also in the lower parts of the slopes. The area of these patches dominates in the reserve.

The structure of the community is untypical since no valley-clump structure occurs here. Of the characteristic and distinguished species of the community the occurrence of *Ribes nigrum* and *Prunus padus* is recorded. A great participation of species passing from the *Alno-Ulmion* alliance is also characteristic of the association; the participation of rush species of the *Phragmitetea* class is significant for the whole *Alnetea glutinosae* class. The participation of meadow species is very low.

The forest bottom is fairly uniform, however, some differences can be observed between the individual patches. Along the riverbed and at the places of seepage a high participation of rush species can be found in the forest floor vegetation; at the foot of the slope and in slightly drier places their participation is smaller. In the floor vegetation of the community *Equisetum telmateia* is chiefly noted at the base of the slopes and in the bottom of the river valley in its largest bend at places with abundant head-waters.

In the northern part of the reserve there are found fallen trees and fresh bites of beavers slightly admitting light to the stand structure. In one of the patches a fairly large cover of *Impatiens parviflora* encroached the trampled down feeding area of beavers. Apart from that no degenerative changes are observed in this phytocoenosis.

On the neighbouring bank of the river Kaczynka valley, near the eastern outskirts of the reserve, a vast patch of the association formed among exceptionally abundant head-water seepages. The alder forest with an admixture of ash is relatively young here, however, the forest floor vegetation is normally developed with a participation of giant horsetail whose cover exceeds 5% (Table 2, No. relevé 6).

***Fraxino-Alnetum*
W. M a t. 1952
– Alder-ash
riparian forest**

Patches of this community (Table 3) developed in the central parts of the slopes falling down to the River Kaczynka valley, It also covers small drier fragments in the bottom of the river valley. *Fraxino-Alnetum* has an intermediate site between poorer alder

Table 3. Association *Fraxino-Alnetum* W. M a t. 1952 in the Źródliisko Skrzypowe nature reserve.

Successive no. of relevé	1	2	3	4	5	6	7	8	9	10	11	12	13	14
day	23	5	23	5	23	5	23	5	23	5	23	5	23	5
Date month	4	7	4	7	4	7	4	7	4	7	4	7	4	8
year	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006	2006
Area of relevé [m2]	60	60	100	100	60	60	60	60	50	50	80	80	150	150
Slope [°]	25	25	25	25	5	5	15	15	15	15	17	17	10	10
Density of tree layer a [%]	10	10	85	85	85	85	70	70	65	65	80	80	85	85
Density of shrub layer b [%]	25	25	15	15	10	10	20	20	50	50	50	50	45	45
Cover of herb layer c [%]	90	95	85	85	90	95	95	95	90	95	65	70	95	80
Cover of moss layer d [%]	min	min	min	min	min	min	min	min	min	min	min	min	3	7
No. of species in the relevé	29	32	25	29	19	18	21	19	22	24	23	24	23	23
I. D. Ass.* et Ch. <i>Alnion glutinoso-incanae</i>														
<i>Alnus glutinosa</i>	1.1	+	3.3	3.3	4.4	4.4	4.4	4.4	4.4	4.4	5.5	5.5	5.5	5.5
<i>Alnus glutinosa</i>	.	+	+	+	+	.	.	.	.	.	+	+	.	.
<i>Stellaria nemorum</i>	.	+	.	2.2	1.2	2.2	2.1	2.2	1.2	2.2	.	.	.	.
<i>Chrysosplenium alternifolium</i>	1.2	.	+	.	1.2	.	1.2	.	1.2	.	.	.	2.2	.
Sporadic species: <i>Athyrium filix-femina</i> 10 (+); <i>Crepis paludosa</i> 8 (+); <i>Lysimachia vulgaris</i> * 6 (+); <i>Ranunculus repens</i> 10 (+)														
II. Ch. <i>Alno-Ulmon</i>														
<i>Prunus padus</i>	b	2.2	2.2	2.2	.	.	2.2	2.2	3.3	3.3	.	.	2.2	2.2
<i>Prunus padus</i>	c	+	.	.	.	.	.	.	.	.	.	.	+	+

Table 3. (Continued)

<i>Equisetum telmateia</i>	2.2	4.4	2.2	4.4	.	.	+	2.2	+	+	.	+	.	.	
<i>Ranunculus ficaria</i>	2.2	r	3.3	.	5.4	.	3.3	.	3.3	.	3.3	.	4.4	.	
<i>Festuca gigantea</i>	.	1.1	.	.	.	.	.	.	.	.	.	+	+	+
<i>Gagea lutea</i>	+	.	.	.	+	.	.	.	.	.	+2	.	.	.
<i>Plagiominium undulatum</i>	+	+	+	+	+	+	+	+	+	+	+	+	2.2	2.2	
III. Ch. <i>Quercus-Fagetes</i>															
<i>Aegopodium podagraria</i>	2.2	2.2	2.2	2.3	2.2	2.2	2.2	2.2	2.1	2.2	2.2	2.2	2.2	1.2	1.2
<i>Fraxinus excelsior</i>	+	+	3.1	3.1	2.1	2.1	2.1	2.1	2.1	2.1	.	.	2.1	2.1	
<i>Fraxinus excelsior</i>	.	.	.	.	+	+	.	.	.	.	1.1	1.1	1.1	1.1
<i>Fraxinus excelsior</i>	+	+	.	.	.	.	+	.	+	+	.	.	.	.
<i>Euonymus europaeus</i>	2.2	2.2	+	+	1.2	1.2	+	+	.	.	.	.	1.2	1.2
<i>Euonymus europaeus</i>	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.
<i>Corylus avellana</i>	.	.	.	.	.	.	.	.	.	.	+	+	1.2	1.2
<i>Corylus avellana</i>	2.2	2.2	2.2	2.2	.	.	.	.	.	.	.	.	+	+
Ch. <i>Carpinion betuli</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Carpinus betulus</i>	.	.	.	.	.	.	.	.	.	.	+	+	.	.
Ch. <i>Fagetalia sybaticae</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.
<i>Anemone ranunculoides</i>	2.2	+	2.3	.	2.2	.	4.4	+	2.2	.	1.2	.	.	.	
<i>Corydalis solida</i>	2.2	.	2.1	.	2.2	.	1.2	.	+	.	1.2	.	1.1	.	
<i>Adoxa moschatelina</i>	2.2	.	.	.	.	.	2.2	.	1.2	.	.	.	.	.
<i>Paris quadrifolia</i>	1.1	1.1	+	+	+	+	+	+	.	.	+	+	.	.	
<i>Impatiens noli-tangere</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Sporadic species: <i>Stachys sylvatica</i> 2 (+), 10 (+); <i>Milium effusum</i> 4 (+)															
IV. Others															
<i>Urtica dioica</i>	2.2	2.2	2.2	2.3	2.2	4.4	1.2	3.3	3.2	3.3	2.1	2.2	2.1	3.3	
<i>Galium aparine</i>	1.2	2.2	1.2	1.2	2.2	2.3	+	2.2	+	1.2	+	2.2	+	2.2	
<i>Sambucus nigra</i>	+	+	2.2	2.2	1.2	1.2	.	.	2.2	2.2	3.3	3.3	3.2	3.2	
<i>Lamium maculatum</i>	+	+	+	+	.	.	+	+	+	+	+	1.2	1.2	2.2	
<i>Ulmus laevis</i>	2.1	2.1	2.1	2.1	.	.	.	.	.	.	.	.	.	.

Equisetum telmateia occurs in the patches of the community which lie in the southern and central part of the reserve, forming fields in some places. *Corydalis intermedia* also is a very valuable species here, however, it can be only observed in the early spring season. This species is found in the Red List of Western Pomerania (Żukowski, Jackowiak 1995). In places of the giant horsetail occurrence the shrub layer and partly the tree layer were subjected to a strong light felling in order to regenerate the abundant development of horsetail populations. In the remaining part of the reserve of bushes layer is very strongly developed and shows a vast cover.

Community with *Equisetum telmateia*

A very abundant site of the giant horsetail was found west of the reserve. Horsetail grows here on the both sides of a ditch with a visible though not very abundant head-water seepage. The cover is 85–90%. The ditch is slightly shaded by trees, chiefly *Quercus petraea* and *Betula pendula*. The community cannot be classed in any definite association. On account of the occurrence of species characteristic of the *Quercus-Fagetum* class and *Alno-Ulmion* alliance this phytocoenosis shows affinity with an alder-ash riparian forest in whose habitat it had probably developed. From the east its area neighbours on a stand showing affinity with a lime-hornbeam forest (*Stellario-Carpinetum*) and from the west with meadow phytocoenoses (hence in this patch a high participation of meadow species whose number and cover increase with the growing distance from the ditch).

One phytosociological record was carried out here (date: 05.08.2006, area of relevé: 40 m², density of shrub layer b: 10%, cover of herb layer c: 95%, cover of moss layer d: min, no. of species in the relevé: 20): **I. Ch.** *Alnetea glutinosae*: *Salix cinerea* b 1.3; **II. Ch.** *Alno-Ulmion*: *Stellaria nemorum* 1.2, *Equisetum telmateia* 5.5; **III. Ch.** *Quercus-Fagetum*: *Corylus avellana* b 1.3, *Aegopodium podagraria* 1.1; **IV. Ch.** *Molinio-Arrhenatheretea*: *Holcus lanatus* 1.1, *Poa trivialis* +, *Alopecurus pratensis* +, *Vicia cracca* +; **V. Ch.** *Filipendulion*: *Filipendula ulmaria* 2.1, *Geranium palustre* +; **VI. Others**: *Urtica dioica* 2.2, *Galium aparine* 2.2, *Carex acutiformis* 2.2, *Impatiens parviflora* 1.1, *Rubus idaeus* +, *Geum rivale* +, *Anthriscus sylvestris* +, *Cirsium oleraceum* +, *Carex hirta* +.

Discussion and conclusion

In the investigated area giant horsetail occurs very abundantly. Its development is favoured by thermal conditions while the reserve and its nearest vicinity lie in an open area. The soil of a rich content of mineral constituents is constantly fed by head-waters. Horsetail shows different cover in the individual patches of phytocoenoses. However, it does not depend on the type of the phytocoenosis being directly associated with the degree of solar exposure.

The most abundant development of horsetail is noted outside the reserve in conditions of moderate to full sun exposure. The areas overgrown with horsetail fields occurring along

the ditch in compartment 506 m and at the forest border east of the reserve are only shaded on one side by the forest edge. Patches where the horsetail grows directly in the field are particularly interesting. However, the occurrence of this species in habitats of synantrophic character has been observed for a long time (Ćwikliński, 1983; Piękoś-Mirkowa, Mirek, 2003).

The half-light prevails on the terraces of the river valley. The growth of horsetail is scattered in places of intensive water seepage in patches of *Ribeso nigri-Alnetum* association. On the exposed river embankment horsetail has various covers in patches of *Fraxino-Alnetum*. In the southern part of the investigated area it grows in moderate light and forms fields. In the central part of the reserve its cover is drastically reduced along with the worsening light conditions from half-shade to moderate shade. Further, owing to trees and the compact layer of shrubs, chiefly *Sambucus nigra*, *Prunus padus*, *Euonymus europaeus* and in some places *Corylus avellana*, the deep shade prevails. In these places the occurrence of giant horsetail is no more observed.

In the area of the reserve the degree of giant horsetail cover changed with the flow of years. At the time when the first documentation of natural conditions was carried out in the object (Markowski, 1972) the author reported the mass development of this plant. The participation of horsetail gradually decreased in the individual phytocoenoses. During an on-site visit in the year 2000 single individuals of giant horsetail only were scattered among the head-waters in the bottom of the river Kaczynka valley. It was concluded that the problem lay in the excessive shading of habitats which had been previously overgrown by giant horsetail (Wiraszka, Bartkowiak, 2000). Owing to the light felling carried out in the southern part of the reserve the population of horsetail began to regenerate. Currently the stand is not overstocked and the light additionally arrives from a clearing neighbouring on the reserve. The encroachment of expansive species which appear on logged areas in the direct vicinity of the reserve – chiefly the blackberry (bramble) – is disquieting. Alien species were also observed such as archeophytes *Lactuca seriola* and *Matricaria perforata* (ruderal and segetal species) which could penetrate forest communities of the reserve exposed by forest cutting in its direct vicinity. Native cut-over species such as *Rubus idaeus*, *Calamagrostis epigejos* and *Galeopsis bifida* also appeared there. In the area of the reserve in its southern part the encroachment of *Rubus caesius* in exposed sites and an increased cover of *Rubus idaeus* were observed. In some patches (Table 3) the occurrence of *Impatiens parviflora* was recorded. This species is so expansive that it appears in phytocoenoses of semi-natural and natural character in the entire territory of Poland (Tokarska-Guzik, 2003). It seems that in the area of the reserve *Impatiens* became a constant constituent of phytocoenoses, however, in individual patches its maximum cover does not exceed 5%.

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References

- Braun-Blanquet, J., 1964: Pflanzensoziozoologie, Grundzüge der Vegetationskunde (in German). 3. Auf. Springer, Wien – New York.
- Ćwikliński, E., 1983: Localities of *Equisetum maximum* in Western Pomerania (in Polish). *Chrońmy Przyr. Ojcz.*, 39: 72–76.
- Flora Europaea, 1964: Lycopodiaceae to Platanaceae. Vol. 1. Tutin, T.G., Heywood, V.H., Burgess, N.A., Valentine, D.H., Walters, S.M. & Webb, D.A. (eds). Cambridge University Press, Cambridge, 464 pp.
- Flora Europaea, 1968: Rosaceae to Umbelliferae. Vol. 2. Tutin, T.G., Heywood, V.H., Burgess, N.A., Valentine, D.H., Walters, S.M., Webb, D.A. (eds). Cambridge University Press, Cambridge, 486 pp.
- Flora Europaea, 1972: Diapensiaceae to Myoporaceae. Vol. 3. Tutin, T.G., Heywood, V.H., Burgess, N.A., Valentine, D.H., Walters, S.M., Webb, D.A. (eds). Cambridge University Press, Cambridge, 399 pp.
- Flora Europaea, 1976: Plantaginaceae to Compositae. Vol. 4. Tutin, T.G., Heywood, V.H., Burgess, N.A., Valentine, D.H., Walters, S.M., Webb, D.A. (eds). Cambridge University Press, Cambridge – London – New York – Melbourne, 534 pp.
- Flora Europaea, 1980: Alismataceae to Orchidaceae. Vol. 5. Tutin, T.G., Heywood, V.H., Burgess, N.A., Valentine, D.H., Walters, S.M., Webb, D.A. (eds). Cambridge University Press, Cambridge – London – New York – Melbourne, 476 pp.
- Kondracki, J., 2000: Regional geography of Poland (in Polish). PWN, Warszawa.
- Markowski, S., 1972: Źródliko Skrzypowe floral natural reserve (in Polish). Prezydium Wojewódzkiej Rady Narodowej, Wydział Rolnictwa i Leśnictwa, Wojewódzki Konserwator Przyrody, Szczecin, p. 1–8.
- Matuszkiewicz, J.M., 1993: Vegetation landscape and geobotanical regions of Poland (in Polish). PAN, Inst. Geogr. i Przestrz. Zagosp. Prace Geogr., 158: 1–107.
- Matuszkiewicz, W., 2001: Polish plant communities guidebook (in Polish). Seria Vademecum Geobotanicum. PWN, Warszawa.
- Ochyra, R., Żarnowiec, J., Bednarek-Ochyra, H., 2003: Census catalogue of Polish mosses. Biodiversity of Poland, 3: 1–372.
- Piękoś-Mirkowa, H., Mirek, Z., 2003: Flora of Poland. Atlas of protected plants (in Polish). Multico Oficyna Wydawnicza, Warszawa.
- Tokarska-Guzik, B., 2003: The expansion of some alien plant species (neophytes) in Poland. In Child, L., Brock, J.H., Brundu, G., Prach, K., Pyšek, P., Wade, P.M., Williamson, M. (eds), Plant invasions: ecological threats and management solutions. Backhuys Publishers, Leiden, p. 147–161.
- Wiraszka, P., Bartkowiak, Z., 2000: Verification of Źródliko Skrzypowe nature reserve in zachodniopomorskie province (in Polish). Biuro Konserwacji Przyrody, Urząd Wojewódzki w Szczecinie (Department of Protected Environment, Voivodeship Szczecin).
- Zarzycki, K., Trzcńska-Tacik, H., Różański, W., Szeląg, Z., Wolek, J., Korzeniak, U., 2002: Ecological indicator values of vascular plants of Poland. In Mirek, Z. (eds), Biodiversity of Poland, 2: 1–183. Institute of Botany, Polish Academy of Sciences, Kraków.
- Żukowski, W., Jackowiak, B., 1995: List of endangered and threatened vascular plants in Western Pomerania and Wielkopolska (Great Poland). In Żukowski, W., Jackowiak, B. (eds), Endangered and threatened vascular plants of Western Pomerania and Wielkopolska. Publications of the Department of Plant Taxonomy of the Adam Mickiewicz University in Poznań, 3: 9–96. Bogucki Wydawnictwo Naukowe, Poznań.