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DIFFERENTIATION OF HYDROGENIC SITES AND OF THE SOIL COVER OF THE TARASINKA VALLEY (NEAR OSOWA)

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A b s t r a c t. The investigations have been conducted on a peatbog object located in the Tarasinka valley near the village of Osowa (Łęczyńsko-Włodawskie Lake District). The aim of the investigations was to determine the moisture-soil conditions of meadow sites and the content of basic macroelements in the soils there. The use of the phytoindication method allowed an identification of moist meadow sites. Three groups of sites have been distinguished: fresh and moist, highly moist and wet, and bog meadows.

K e y w o r d s: peatbog, meadows, hydrogenic sites, soil, plant community

INTRODUCTION

The water content of meadows varies both during one vegetative season as well as during the following years. A proper assessment of humidity conditions on meadow objects can be made through long term measurements and research. According to Oświt [10], there is a possibility to assess the humidity conditions, for practical reasons, directly on the spot, on the basis of the vegetation present. The assessment can be conducted with phytoindication method, which is based on the knowledge of humidity requirements of particular meadow plant species that constitute a plant community. Oświt [10] has adopted a ten-point Klapp scale, in which number 1 means that a given species has the lowest requirements as regards humidification, 10 the highest. For each phytosociological record, an average humidity indicator is calculated on the basis of the botanical composition of a plant community. On the basis of the indicators calculated, the given site can be placed in a particular category of humidification. Oświt [10] distinguished the following sites: dry (A) – indicator 3.1-3.9; dry periodically humidified (B) – 4.0-5.3; fresh (C1) – 5.4-5.9; moderately moist periodically drying up (C2) – 6.0-6.3; moist (C3)

– 6.4-6.6; highly moist (D1) – 6.7-6.9, wet (D2) – 7.0-7.3; highly wet (D3) – 7.4-7.7, bogging (D4) – 7.8-7.9 and bog (E) – 8.0-9.1.

Guz [7] was the first to use the phytoindication method on the meadow objects of the river valleys of the Lublin region, and Oświt and Soczewka [11] in the valley of the lower Rozłoga.

The research included the soil cover and plant communities which occur in the Tarasinka valley near the town of Osowa. The aim of the study was to identify moist meadow sites (with the phytoindication method), and to define the content of basic macroelements in the soils.

MATERIAL AND METHODS

The meadows in the Tarasinka valley, situated north of the village of Osowa, were the object of the research. From the south these meadows neighbour with farmlands and fallow lands, and from the north and north-east with forests and scrubs of the natural reservation "Żółwiowe Błota". The object of the research is situated inside the Sobiborski Landscape Park.

In the 50 and 60s the peatbogs in the Tarasinka valley were drained and partially or completely brought under cultivation. Mainly peat-muck soils, as well as peat-bogged soils, have developed there. On the rim, there are black earths and gley soils. The object investigated is currently partially used as horse meadows or pasture. Meadow communities of *Molinio-Arrhenatheretea* class dominate, especially the following associations: *Poo-Festucetum rubrae*, *Alopecuretum pratensis* and *Arrhenatheretum elatius*. Water vegetation of *Lemnetea* and *Potamogetonetea* class, and rush vegetation of *Phragmitetea* class, as well as low peatbog vegetation of *Scheuchzerio-Caricetea fuscae* class occur mainly in drainage ditches and local depressions. Meadows which have not been used for a longer period of time are overgrown with scrub associations (*Salicetum pentandro-cinereae* association) and sometimes herb scrubs of *Filipendulo-Geranion* order [13]. Some areas of the meadows especially those situated near the river-bed of the Tarasinka and in local depressions have been strongly flooded for a couple of years (high level of ground waters, overflows of the Tarasinka).

The research was conducted in the vegetative season of the year 1999. 30 phytosociological records were made in meadow communities, using the Braun-Blanqueta method. The terminology of plant communities was adopted after Matuszkiewicz [8] and Fijałkowski [5], the onomastics of vascular plants after Mirek *et al.* [9].

The phytoindication method after Oświt [10] was used to determine the humidity conditions of meadow sites.

Forty two soil samples were taken for analysis from 14 soil exposures. The chemical analysis of soil and plant material was carried out according to the methodology developed by Sapek A. and Sapek B. [12]. In the samples taken there was measured: pH in H_2O and in 1 M KCl, the content of organic substance and the total content of – phosphorus (with colorimetric method), calcium, potassium, sodium (on a flame photometer), magnesium, iron (on AAS).

RESULTS AND DISCUSSION

In the object investigated the occurrence has been noted of post-bog peat-muck soils which developed out of low sedge peat or sedge-reed peat, and peat bog soils which developed out of low sedge peat or sedge-reed peat. According to Borowiec [1] the deposit of low peat reaches the maximum thickness of about 4 m. The degree of decomposition of this peat varies from 14 to 35%, ash content from 4 to 21.7%. Mucky as well as proper black earths have developed on the rims of the peatbog.

The soil samples taken were generally characterised by acidic or lightly acidic pH; pH in 1 M KCl varied from 4.05 to 6.09 (Table 1).

The content of phosphorus was from 0.04 to 0.168 %. In most of the soil sections higher amounts of P were found in the surface layer, the lowest in samples taken at the depth of 30-50 cm (Table 1). The soils examined turned out to be poor in potassium. The content of this element was low in all samples examined and it amounted to 0.01-0.39%. The highest amounts of K, like in the case of phosphorus, were found in the layer 0-20 (15) cm (Table 1). The content of sodium in the soil samples examined was within the limits from 0.03 to 0.10%. No correlation between the content of sodium and the depth of sample-collection was found (Table 1). The content of calcium in the soils examined varied from 0.19 to 2.79%, magnesium from 0.030 to 0.125%. In most of the soil sections investigated the lowest amounts of Ca and Mg were found, in comparison with the layers lying deeper, in the surface layer (Table 1). The content of iron in the soils analysed reached from 0.34 to 1.80 %. Generally, the surface layers of the sections analysed (0-20 cm) were enriched with iron (Table 1).

The research conducted showed an insufficient content of magnesium, potassium and sodium in the soil, and a sufficient content of calcium and iron. Guz [6], Borowiec and Urban [2,3] found similar correlation in meadow objects of the

Table 1. Chemical characteristics of the soil studied

Soil	No. prof.	Depth (cm)	pH in		Organic substance %	Content in %					
			H_2O	KCl		P	Na	K	Ca	Mg	Fe
Post bog	I	0-20	5.32	5.04	71.20	0.160	0.06	0.04	1.51	0.035	1.05
		20-30	5.85	5.52	43.25	0.060	0.05	0.01	1.32	0.045	1.37
		30-40	6.61	6.09	3.10	0.010	0.06	0.03	0.19	0.040	0.40
	II	0-20	6.01	5.89	71.25	0.038	0.03	0.13	0.51	0.045	0.55
		20-35	6.42	6.05	75.45	0.068	0.06	0.03	2.08	0.050	1.25
		35-45	6.13	5.90	2.20	0.008	0.03	0.02	0.19	0.040	0.34
Peat muck	III	0-20	5.80	5.25	73.90	0.130	0.05	0.04	1.71	0.055	1.70
		30-40	5.30	5.05	90.25	0.040	0.06	0.01	2.60	0.035	1.20
		50-60	5.44	5,03	87.45	0.048	0.07	0.01	2.79	0.045	0.73
	IV	0-20	5.82	5,30	87.95	0.056	0.05	0.02	2.14	0.030	1.25
		20-30	5.08	4,86	82.80	0.064	0.06	0.02	1.76	0.045	1.42
		40-50	5.60	5.27	92.20	0.042	0.06	0.03	2.54	0.045	1.74
	V	0-20	6.14	5.96	65.35	0.168	0.07	0.08	1.45	0.080	1.75
		20-30	6.00	5.64	91.20	0.032	0.09	0.03	2.52	0.050	0.89
		40-50	6.03	5.54	91.65	0.038	0.06	0.10	2.12	0.045	0.55
	VI	0-20	5.68	5.22	89.75	0.064	0.06	0.03	2.34	0.035	0.10
		30-40	5.86	5.35	91.60	0.086	0.06	0.01	2.43	0.045	0.74
		50-60	5.78	5.46	89.95	0.054	0.07	0.01	2.41	0.065	0.75
	VII	0-15	5.80	5.24	83.80	0.108	0.05	0.02	1.71	0.060	1.42
		30-40	5.62	5.10	89.85	0.042	0.06	0.01	2.08	0.065	0.95
		50-60	5.95	5.19	89.25	0.076	0.09	0.07	2.40	0.095	0.95
	VIII	0-15	6.73	5.68	74.75	0.112	0.06	0.31	1.44	0.110	1.42
		30-40	6.04	5.42	90.80	0.064	0.06	0.04	2.08	0.085	0.95
		40-50	5.95	5.42	88.45	0.072	0.06	0.04	2.40	0.110	1.00
	IX	0-15	5.82	5.48	82.90	0.134	0.06	0.03	2.20	0.085	1.80
		30-40	5.72	5.43	89.75	0.048	0.06	0.02	2.26	0.090	1.17
		50-60	5.80	5.18	91.35	0.058	0.06	0.01	2.00	0.100	1.01

Table 1. Continued

Soil	No. prof.	Depth (cm)	pH in		Organic substance %	Content in %					
			H_2O	KCl		P	Na	K	Ca	Mg	Fe
		0-20	5.90	5.47	61.45	0.122	0.06	0.07	1.44	0.125	1.42
	X	30-40	6.25	5.67	88.25	0.066	0.06	0.01	2.36	0.086	0.94
		50-60	6.05	5.55	83.40	0.076	0.10	0.03	2.30	0.110	0.82
	XI	0-20	5.47	4.91	22.45	0.044	0.04	0.03	0.50	0.045	0.83
		30-40	5.15	4.61	25.45	0.034	0.04	0.05	0.28	0.060	1.30
		50-60	5.70	5.03	87.55	0.052	0.09	0.03	2.10	0.040	1.20
		0-20	4.40	4.07	89.25	0.086	0.05	0.39	1.28	0.035	0.95
	XII	20-30	5.72	5.24	91.35	0.054	0.06	0.01	2.06	0.035	0.95
Bogged		50-60	5.55	5.24	92.30	0.060	0.06	0.02	2.24	0.045	0.55
low peat		0-20	4.60	4.27	91.25	0.080	0.05	0.25	1.30	0.036	1.00
	XIII	20-30	5.90	5.35	94.35	0.050	0.05	0.01	2.10	0.035	0.95
		50-60	5.95	5.40	95.20	0.055	0.06	0.02	2.34	0.040	0.50
		0-20	4.42	4.05	91.35	0.070	0.05	0.20	1.00	0.030	1.00
	XIV	20-30	5.69	5.14	92.60	0.044	0.06	0.02	1.65	0.035	0.95
		50-60	5.50	5.20	92.70	0.050	0.06	0.02	1.90	0.045	0.55

Lublin region. According to the scale adopted by Borowiec and Urban [4] 41.7% of samples coming from the surface layer of the soils investigated showed a clear phosphorus deficiency, (<0.1% P), others were on the brink of deficiency.

In the object investigated, meadow plant communities of *Molinio-Arrhenatheretea* class and *Arrhenatheretalia* order dominated. Communities of meadows yielding one or two crops of hay per year dominated, which were counted, from the phytosociological point of view, among the associations: *Poo-Festucetum rubrae* and *Alopecuretum pratensis*. They have developed on post-bog peat-muck soils. A smaller area was occupied by associations from *Molinietalia* order, such as: *Filipendulo-Geranietum* and *Scirpetum sylvatici*, *Epilobio-Juncetum effusi* and *Deschampsietum caespitosi*, a small area by two communities: the first one with *Urtica dioica* dominating, and the second one with the preponderation of *Anthoxanthum odoratum*. Rush plants of *Phragmitetea* class have developed in local depressions, as well as in some of the drainage ditches. From the point of view of their phytosociological inclusion these were the following associations: *Caricetum gracilis*, *Caricetum acutiformis, Glycerietum maximae*, *Phalaridetum arundinaceae*.

In the area discussed there have been found fresh sites (C1), moderately moist periodically drying up (C2), moist (C3), highly moist (D1), wet (D2), highly wet (D3) and bog sites (E).

The largest area consists of fresh sites (C1), moderately moist periodically drying up sites (C2) and moist sites (C3). Meadow vegetation has developed there representing associations: *Alopecuretum pratensis*, *Poo-Festucetum rubrae*, *Deschampsietum caespitosae*, *Scirpetum sylvatici* and a community with *Urtica dioica*. Species with humidity Nos 5, 6, 7, 8 dominated (Table 2).

Highly moist sites (D1) and wet ones (D2) were characterised by the presence of species with humidity Nos 5, 7, 8, 9 (Table 2). Meadow plant associations occurred there: *Alopecuretum pratensis*, *Poo-Festucetum rubrae*, *Deschampsietum caespitosae*, *Epilobio-Juncetum effusi*, *Filipendulo-Geranietum* as well as rush ones – *Glycerietum fluitantis*. Herb scrub communities of *Filipendulo-Petasition* alliance (*Filipendulo-Geranietum* association) and rush communities (*Phalaridetum arundinaceae* association) were correlated with highly wet sites (D3).

Species with humidity Nos 10 and 9 (Table 2) predominated among the vegetation of bog sites (E). Sedges and herbs, and also hygrophilous grasses were the most important ones. In some patches there could be noticed the share of species with humidity Nos 7, 8 and 6, that is plants characterised by smaller humidity requirements. Those sites can be included as the sites which periodically dry up. The

Table 2. List of associations and meadow sites in the Tarasinka valley

No. of record	Association	Humidity numbers of species and the number of species	Humidity number of the association
		Fresh sites (C1)	
1	Alopecuretum pratensis	7*(3)**, 5(10), 0(1), 6(2), 3(1), 4(1)	5.3
2	Poo-Festucetum rubrae	5(9), 0(1), 6(4), 3(1), 4(1), 7(1), 8(1)	5.3
3	Comm. with *Urtica dioica*	5(7), 7(1), 6(2), 3(2), 9(1)	5.5
6	*Deschampsietum caespitosi*	7(3), 5(5), 2(1), 6(2), 4(1)	5.6
12	Com. with *Anthoxanthum odoratum*	8(1), 7(2), 5(4), 3(1), 6(1), 0(1)	5.7
22	*Alopecuretum pratensis*	7(3), 5(4), 0(1), 6(4), 7(2), 8(4)	5.8
28	*Poo-Festucetum rubrae*	5(5), 0(1), 6(1), 7(3)	5.8
8	*Deschampsietum caespitosi*	7(2), 5(3), 0(1), 6(3)	5.9
		Moderately moist periodically drying up sites (C2)	
25	*Alopecuretum pratensis*	0(1), 4(4), 5(4), 6(2)	6.0
14	*Poo-Festucetum rubrae*	0(1), 3(1), 5(6), 6(2), 7(5), 8(1)	6.2
		moist sites (C3)	
30	*Poo-Festucetum rubrae*	0(1), 5(3), 7(4), 8(1)	6.4
29	*Poo-Festucetum rubrae*	0(1), 5(5), 6(1), 7(2), 8(4)	6.4
4	*Scirpetum sylvatici*	6(2), 5(2), 7(2), 8(2)	6.5
26	*Deschampsietum caespitosi*	0(1), 7(5), 5(2), 6(2), 8(1)	6.5
16	*Poo-Festucetum rubrae*	0(1), 5(3), 6(2), 7(2), 8(1), 10(1)	6.5
7	*Poo-Festucetum rubrae*	0(1), 5(5), 7(2), 8(2), 9(2)	6.6
23	*Alopecuretum pratensis*	0(1), 5(4), 7(3), 8(2), 9(2)	6.6
		Highly moist sites (D1)	
24	*Alopecuretum pratensis*	9(1), 5(5), 6(1), 7(4), 8(6)	6.7
21	*Poo-Festucetum rubrae*	0(1), 5(3), 6(1), 7(4), 8(2), 9(1)	6.7
5	*Epilobio-Juncetum effusi*	5(3), 6(3), 7(6), 8(3)	6.7
27	*Com. with Anthoxanthum odoratum*	0(1), 5(3), 6(1), 7(2), 8(4)	6.7
		Wet sites (D2)	
11	*Deschampsietum caespitosi*	0(1), 5(3), 6(1), 7(4), 8(3), 9(2)	7.0
20	*Glycerietum fluitantis*	5(1), 6(2), 7(2), 8(1), 9(2)	7.1
		Highly wet sites (D3)	
18	*Filipendulo-Geranietum*	0(1), 5(1), 6(1), 7(2), 8(3), 9(2)	7.4
15	*Phalaridetum arundinaceae*	0(1), 5(1), 6(1), 7(2), 8(3), 9(1)	7.5
		Bog sites (E)	
10	*Glycerietum maximae*	7(1), 8(5), 9(1)	8.0
17	*Caricetum acutiformis*	7(3), 8(1), 9(2), 10(1)	8.0
19	*Caricetum gracilis*	7(2), 8(1), 9(2)	8.0
9	*Caricetum gracilis*	8(2), 9(1)	8.3
13	*Caricetum acutiformis*	7(2), 8(1), 9(3), 10(1)	8.4

*humidity number of species, **number of species

communities which occur in bog sites have been included as: *Caricetum gracilis, C. acutiformis,* and *Glycerietum maximae* associations.

On the basis of the analysis of the distribution of the sites distinguished in the object investigated, it was found that wet and highly wet sites, as well as bog sites dominated in the northern part. Bog sites were related with surface floods created by river waters of the Tarasinka or ground waters rising to the surface. Wet and highly wet sites, in turn, occurred in places where the level of ground waters was near the soil surface.

In the southern part of the object investigated a domination of fresh sites, moderately moist periodically drying up, and moist sites was observed. Only periodically, in the spring, was there an excess of water there (moist sites). Water deficiency occurred in this part of the object in the first part of the vegetation season, and strong deficiency in the summer seasons.

CONCLUSIONS

1. In the object investigated the occurrence of post-bog peat-muck soils, bog peat soils, and semihydrogenic black earths was surveyed. In the soil samples taken, a low content of magnesium, potassium, sodium and phosphorus, and sufficient amounts of calcium and iron were observed. The surface layer of the sections (0-20 cm), in comparison with the lower ones, was usually enriched in phosphorus, potassium and iron.

2. The use of the phytoindication method allowed an identification of meadow humidity sites. Three groups of sites were distinguished: fresh meadows (fresh, moderately moist periodically drying up) and moist (highly moist, wet and highly wet) and bog sites.

3. Peat-muck soils and black earths were correlated with fresh sites, moderately moist periodically drying up, and moist sites. Peat-muck soils occurred also in highly moist sites, and peat soils in wet, highly wet, and bog sites.

4. Meadow communities of *Molinio-Arrhenatheretea* class occurred in fresh sites, moderately moist periodically drying up, and moist sites. *Poo-Festucetum rubrae* association dominated.

5. Highly moist and wet sites were correlated with meadow communities usually from *Molinietalia* order (*Deschampsietum caespitosi, Epilobio-Juncetum effusi, Filipendulo-Geranietum*) and rush communities of *Phragmitetea* class, e.g.: *Phalaridetum arundinaceae* and *Glycerietum fluitantis*.

6. In bog sites (cultivated for hay) rush communities of *Phragmitetea* class dominated. These were associations: *Caricetum gracilis*, *Caricetum acutiformis*, *Glycerietum maximae*.

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ZRÓŻNICOWANIE SIEDLISK HYDROGENICZNYCH I POKRYWY GLEBOWEJ DOLINY TARASINKI (OKOLICE OSOWY)

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S t r e s z c z e n i e. Badania przeprowadzono na obiekcie torfowiskowym w dolinie Tarasinki (na północ od miejscowości Osowa). Przeprowadzone badania miały na celu określenie warunków wilgotnościowo-glebowych siedlisk łąkowych, a także określenie zawartości podstawowych makro i mikroelementów w glebie w zależności od panujących warunków siedliskowych. W pobranych próbkach glebowych oznaczono: pH w H_2O i 1 M KCl oraz zawartość materii organicznej i P, K, Na, Ca, Mg, Fe. Gleby badanego obiektu charakteryzowały się małą zawartością magnezu, sodu i potasu oraz manganu, duża miedzi, cynku i ołowiu. W przypadku fosforu, wapnia i żelaza zawartości okazały się optymalne.

Zastosowanie metody fitoindykacji pozwoliło na zidentyfikowanie łąkowych siedlisk wilgotnościowych. Wyróżniono trzy grupy siedlisk: łąk świeżych i wilgotnych, silnie wilgotnych i mokrych oraz bagiennych.

S ł o w a k l u c z o w e: torfowisko, łąki, siedliska hydrogeniczne, gleba, zbiorowiska roślinne