Maciej MURAWSKI[1], Mieczysław GRZELAK[1], Piotr GAJEWSKI[2], Zbigniew KACZMAREK[2], Sławomir RUNOWSKI[3], Mariusz ZALAS[1]
Poznań University of Life Sciences
[1] Department of Grasslands and Natural Landscape Sciences, ul. Dojazd 11, 60-632 Poznań, Poland
[2] Department of Soil Science and Land Protection, ul. Szydłowska 50, 50-656, Poznań, Poland
[3] Faculty of Animal Breeding and Biology, ul. Wojska Polskiego 71C 60-625, Poznań, Poland
e-mail: murawsm@up.poznan.pl; grzelak@up.poznan.pl

HABITAT EVALUATION, HABITAT CONDITIONS AND UTILITY VALUE OF SELECTED PLANT ASSOCIATIONS IN SEMINATURAL MOIST MEADOWS IN THE NOTEĆ LENIWA RIVER VALLEY

Summary

Floristic analyses were conducted in two vegetation seasons, in 2013 and 2014, on selected plant associations found in seminatural meadows in the Noteć Leniwa river valley. Selected phytocenoses are located in Białośliwie, the Wielkopolskie province, the Piła county, the Białośliwie commune. Using the Braun-Blanquet method a total of 37 relevés were prepared of well-established phytocenoses, identifying five plant associations and one plant community from the class Molinio-Arrhenatheretea as well as two plant associations from the class Phragmitetea. The specified plant associations were characterised by considerable floristic diversity, with a total of 94 classified taxa belonging to 28 families, among which the family Poaceae was the most abundant in terms of the number of species as well as most commonly represented.
Key words: habitat valuation, utility value, habitat conditions, seminatural moist meadows, biodiversity, the Noteć Leniwa river valley

WALORYZACJA PRZYRODNICZA, WARUNKI SIEDLISKOWE ORAZ WARTOŚĆ UŻYTKOWA WYBRANYCH ZESPOŁÓW ROŚLINNYCH PÓŁNATURALNYCH ŁĄK WILGOTNYCH W DOLINIE NOTECI LENIWEJ

Summary

Badania florystyczne wykonano w dwóch sezonach wegetacyjnych, w 2013 i 2014 roku, a obiektem były wybrane zespoły roślinne występujące na łąkach półnaturalnych w Dolinie Noteci Leniwej. Wybrane fitocenozy zlokalizowane są w miejscowości Białośliwie- województwo wielkopolskie, powiat pilski, gmina Białośliwie. Przy użyciu metody Braun-Blanqueta wykonano 37 zdjęć fitosocjologicznych dobrze wykształconych płatów roślinności, co pozwoliło na wyróżnienie pięciu zespołów i jednego zbiorowiska z klasy Molinio-Arrhenatheretea oraz dwóch zespołów z klasy Phragmitetea. Wyróżnione asocjacje roślinne cechowały się znaczną różnorodnością florystyczną- sklasyfikowano 94 taksony przynależne do 28 rodzin botanicznych, wśród których najliczniejszą w gatunki, a także najczęściej reprezentowaną była rodzina wiechlinowatych.
Słowa kluczowe: waloryzacja przyrodnicza, wartość użytkowa, warunki siedliskowe, półnaturalne łąki wilgotne, bioróżnorodność, dolina Noteci Leniwej

1. Introduction

Permanent grasslands are found in river valleys, they are characterised by considerable floristic diversity and species richness, which are dependent on the intensity of their use and habitat conditions, contributing to habitat mosaic [5, 7, 9]. River valleys are also areas of great cultural, nature, landscape and esthetic as well as utility value [4, 10]. Moreover, they serve as shelter for small animals and avifauna [6].

The Noteć Leniwa river valley is classified to the group of well-developed river valleys and its diverse geomorphological structure contributes to variability of its habitat conditions. The plant communities described in this paper are found in habitats connected with river valleys and ice marginal valleys, numerous land depressions, with flowing watercourses and stagnant waters found in the area [9]. In turn, floristic diversity and richness are connected with the dominant vast permanent grasslands in the agricultural landscape, such as meadows and pastures, which thanks to adequate use retain their character [6, 8, 11].

2. Material and methods

The study was based on the relevés of well-established phytocenoses, prepared using the conventional Braun-Blanquet method [1], and classification of selected meadow plant communities to a phytosociological system [12]. Floristic diversity was calculated by analysing the species composition - the botanical structure of plants in the sward (%), total number of species, as well as the Shannon-Wiener diversity index (H') [5]. Moreover, the habitat evaluation factor was determined, estimated in terms of value classes [14]. Additionally, habitat conditions were determined including edaphic factors such as soil moisture content (F), soil reaction (R) and soil nitrogen content (N) [2]. The utility value of a given association was estimated based on the fodder value score FVS [3]. Nomenclature of plant species was adopted after Mirek et al. [13].

The aim of this study was habitat evaluation, determination of habitat conditions and utility value of selected plant associations in seminatural moist meadows in the Noteć Leniwa river valley.

3. Identified plant associations and plant communities

- Class: *Phragmitetea R. Tx. & Preising 1942*
- Order: *Phragmitetalia Koch 1926*
  - Alliance: *Magnocaricion Koch 1926*
  - **Caricetum gracilis (Graebn. & Hueck 1931) R. Tx. 1937**
  - **Phalaridetum arundinaceae (Koch 1926 n.n.) Libb. 1931**
- Class: *Molinio-Arrhenateretea R. Tx. 1937*
- Order: *Trifolio fragiferae-Agrostietalia stoloniferae R. Tx. 1970*
  - Alliance: *Agropyro-Rumicion crispi Nordh. 1940 em. R. Tx. 1950*
  - **Ranunculo- Alopecuretum geniculati R. TX. 1937**
- Order: Molinietalia caerulae *W.Koch 1926*
  - Alliance: *Filipendulion ulmariae Segal 1966*
  - **Lysimachio vulgaris- Filipenduletum BAL.-TUL. 1978**
  - **Lythro- Filipenduletum ulmariae HADAČ et all. 1997**
  - Alliance: *Calthion palustris R. Tx. 1936 em. Oberd. 1957*
  - **Scirpetum silvatici Ralski 1931**
  - **zb. Dechampsia caespitosa (= Deschampsietum caespitosae Horvatić 1930)**
  - Alliance: *Alopecurion pratensis PASS. 1964*
  - **Alopecuretum pratensis (REGEL 1925) STEFFEN 1931**

4. Floristic studies

Field studies were conducted in the years 2013-2014 in Białośliwie situated in the Noteć Leniwa river valley. A total of 37 relevés were prepared of well-established phytocenoses, on which basis 7 plant associations and 1 plant community were identified (tab. 1), comprising 94 taxa from 28 families. In each of the described associations the characteristic species had a high cover-abundance index (D) and degree of stability (S) - *Carex gracilis* (S=V$^{3-4}$, D=4821.43), *Phalaris arundinacea* (S=V$^{4-5}$, D=8035.71), *Ranunculus repens* (S=3$^{2-3}$, D=2416.67), *Lysimachia vulgaris* (S=2$^{3-4}$, D=5000), *Filipendula ulmaria* (S=2^4, D=6250), *Scirpus sylvaticus* (S=V$^{3-4}$, D=4750), *Deschampsia caespitosa* (S=V$^{3-4}$, D=4583.33) and *Alopecurus pratensis* (S=V$^{3-4}$, D=4750). The highest total number of species in a relevé was recorded for the plant association *Caricetum gracilis* - 36, while it was lowest for the plant associations *Lysimachio vulgaris-Filipenduletum* and *Lythro-Filipenduletum ulmariae* with 17 species each. The greatest shares of grasses (56%) and sedges (12%) was observed in the association *Ranunculo-Alopecuretum geniculati*, that of Fabaceae (14.71%) in *Alopecuretum pratensis*, while those of herbs and weeds (82.36%) in the tall herb association *Lythro-Filipenduletum ulmariae*. The analysed phytocenoses of the community are characterised by low floristic diversity, connected with the small number of species in the plant communities and the number of relevés. Among the identified associations the highest calculated Shannon-Wiener index H' = 1.49 was recorded for *Alopecuretum pratensis*.

When analysing the habitat evaluation factor the highest index value was found for *Lysimachio vulgaris-Filipenduletum* and *Lythro-Filipenduletum ulmariae*, amounting to 3.9 (value class VIII C), which indicates a very high value (tab. 2). The lowest index value was recorded for the plant community with *Deschampsia caespitosa* - 2.3 (class IV B- moderate natural value). Similar results for *Caricetum gracilis* and *Phalaridetum arundinacea* were reported by Gajewski et al. [5], while for the plant community with *Deschampsia caespitosa* by Grzelak et al. [8].

4.1. Habitat analyses

Habitat conditions of the identified plant associations were determined based on edaphic factors (tab. 3). In terms of soil moisture content the intensity of this factor may be given in two groups: fresh and partly moist, to which 2 plant associations and 1 plant community with *Dechampsia caespitosa* were classified (the lowest value F=6.43), and very moist, to which 5 plant associations were classified, among which *Lysimachio vulgaris- Filipenduletum* was characterised by the highest value F=8.68.

Table 1. Floristic diversity of identified plant communities
Tab. 1. Różnorodność florystyczna wybranych zbiorowisk roślinnych

Identified plant association/ plant community	Species		% share of utility groups of plants in sward				H'
	total	families	grasses	sedges	legumes	herbs and weeds	
Caricetum gracilis	36	17	25.00	5.56	11.11	58.37	1.45
Phalaridetum arundinacea	25	11	24.00	8.00	-	68.00	1.29
Ranunculo- Alopecuretum geniculati	25	8	56.00	12.00	8.00	24.00	1.35
Lysimachio vulgaris- Filipenduletum	17	12	11.76	11.76	-	76.48	1.18
Lythro- Filipenduletum ulmariae	17	11	-	11.76	5.88	82.36	1.22
Scirpetum silvatici	30	20	13.33	6.67	6.67	73.33	1.44
Community with *Dechampsia caespitosa*	25	11	32.00	8.00	4.00	56.00	1.33
Alopecuretum pratensis	34	14	20.59	11.76	14.71	52.94	1.49

Source: own work / Źródło: opracowanie własne

Table 2. Natural value factors for selected plant associations according to Oświt [14]
Tab. 2. Czynniki wartości przyrodniczej dla wybranych zespołów roślinnych wg Oświta [14]

Identified plant association/ plant community	Mean value factor	Value class	Natural value
Caricetum gracilis	2.9	V B	medium moderate
Phalaridetum arundinacea	3.3	VI B	high moderate
Ranunculo-Alopecuretum geniculati	2.4	IV B	moderate
Lysimachio vulgaris-Filipenduletum	3.9	VIII C	very high
Lythro-Filipenduletum ulmariae	3.9	VIII C	very high
Scirpetum silvatici	3.1	VI B	moderately high
zb. z *Dechampsia caespitosa*	2.3	IV B	moderate
Alopecuretum pratensis	3.2	VI B	moderately high

Table 3. Habitat conditions in selected plant communities
Tab. 3. Warunki siedliskowe w wybranych zbiorowiskach roślinnych

Identified plant communities	Phytoindicator indexes according to Ellenberg [2]					
	F		**R**		**N**	
	value	intensity	value	intensity	value	intensity
Caricetum gracilis	8.34	very moist	5.54	medium acid	4.66	moderate
Phalaridetum arundinacea	8.03	very moist	6.86	medium acid	6.82	high
Ranunculo-Alopecuretum geniculati	6.48	fresh and partly moist	3.28	acid	6.42	high
Lysimachio vulgaris-Filipenduletum	8.68	very moist	6.98	medium acid	5.46	moderate
Lythro-Filipenduletum ulmariae	8.19	very moist	7.16	medium acid	4.91	moderate
Scirpetum silvatici	8.05	very moist	4.34	acid	4.89	moderate
Community with *Dechampsia caespitosa*	6.43	fresh and partly moist	5.27	medium acid	5.04	moderate
Alopecuretum pratensis	6.76	fresh and partly moist	3.65	acid	5.61	moderate

Source: own work / Źródło: opracowanie własne

When comparing soil acidity the tested associations may be divided into 3 groups: acid (ranging from 3.28 to 4.34), where the lowest value was found for the plant association *Ranunculo-Alopecuretum geniculati* (R=3.28), medium acid ranging from R=5.27 (community *Dechampsia caespitosa*) to R=6.98 (*Lysimachio vulgaris-Filipenduletum*) and weakly acid *Lythro-Filipenduletum ulmariae* (R=7.16). When analysing soil reserves of nitrogen lower values ranging from N=4.66 (*Caricetum gracilis*) to N=5.61 (*Alopecuretum pratensis*) were ascribed to a moderate intensity of that factor, while higher values were found for *Ranunculo-Alopecuretum geniculati* N=6.42 and *Phalaridetum arundinacea* N=6.82, classified to the group of high intensity. Comparable results for *Caricetum gracilis*, *Phalaridetum arundinacea*, *Alopecuretum pratensis* and the community with *Deschampsia caespitosa* were obtained by Grzelak et al. [6].

4.2. Utility value

The fodder value score for the sward in the identified plant associations ranges from poor - *Scirpetum sylvatici* (FVS=0.92) to good - *Phalaridetum arundinacea* FVS= 6.39.

Table 4. Utility value of identified plant communities
Tab. 4. Wartość użytkowa zidentyfikowanych zbiorowisk roślinnych

Identified plant communities	Number of utility species	Utility value	
		*FVS	Value
Caricetum gracilis	9	2.02	poor
Phalaridetum arundinacea	3	6.36	good
Ranunculo- Alopecuretum geniculati	8	5.65	mediocre
Lysimachio vulgaris-Filipenduletum	1	2.75	poor
Lythro-Filipenduletum ulmariae	1	3.13	poor
Scirpetum silvatici	2	0.92	poor
Community with *Dechampsia caespitosa*	6	1.96	poor
Alopecuretum pratensis	8	6.15	poor

FVS – fodder value score index [3]
Source: own work and [3]/ Źródło: opracowanie własne oraz [3]

5. Conclusions

1. The highest biodiversity index H'=1.49 was found for the plant association *Alopecuretum pratensis*, while it was lowest H'=1.18 for the plant association *Lysimachio vulgaris-Filipenduletum*.

2. The highest mean value index L$_{val}$=3.9 (VIII C) was calculated for the plant association *Lysimachio vulgaris-Filipenduletum* and *Lythro-Filipenduletum ulmariae*, while it was lowest L$_{val}$=2.3 (IV B) for the plant community with *Deschampsia caespitosa*.

3. Based on the indicator factors according to Ellenberg the identified plant associations vary in terms of their habitat conditions. The mosaic pattern was mainly dependent on the soil moisture content.

The highest utility value expressed in terms of the fodder value score FVS=6.36 was recorded for the plant associations *Phalaridetum arundinacea* and *Alopecuretum pratensis* FVS=6.15, whereas the lowest value was calculated for the association *Scirpetum silvatici* FVS= 0.92.

6. References

[1] Braun-Blanquet J.: Pflanzensoziologie. Wien: Springer Verl., 1954.
[2] Ellenberg H.: Zeigerwerte von Pflanzen in Mitteleuropa. Scripta Geobotanica, 1992, 18: 5-258.
[3] Filipek J.: Projekt klasyfikacji roślin łąkowych i pastwiskowych na podstawie liczb wartości użytkowej [A proposal for classification of meadow and pasture plants based on utility value numbers]. Post. Nauk Roln., 1973, 4: 59-68.
[4] Gajewski P., Grzelak M., Kaczmarek Z., Glina B., Mocek A., Rybczyński P., Tylman O.: Geobotanical conditions of grassland habitats in the Samica Leszczyńska valley. Journal of Research and Applications in Agricultural Engineering, 2016, 61 (3): 101-104.
[5] Gajewski P, Kaczmarek Z., Owczarzak W., Grzelak M., Murawski M.: Floral and habitat diversity of ecological grasslands in the Bystra Noteć Valley. Journal of Research and Applications in Agricultural Engineering, 2015, 60 (3): 47-51.
[6] Grzelak M., Murawski M., Knioła A.: Geobotanical and economic valuation of meadow and pasture communities and their use. Journal of Research and Applications in Agricultural Engineering, 2014, 59 (3): 76-79.
[7] Grzelak M., Gaweł E., Mackiewicz D., Murawski M., Knioła A.: Floristic and habitat analyses and natural value of the association *Potentillo–Festucetum arundinaceae* (R.Tx. 1933). Nordh. 1940. Journal of Research and Applications in Agricultural Engineering, 2016, 61 (3): 173-175.
[8] Grzelak M., Mackiewicz D., Murawski M., Janyszek S., Runowski S., Knioła A.: Phytocenoses with a considerable share of *Deschampsia caespitosa* (L.) P. Beauv. Journal of Research and Applications in Agricultural Engineering, 2015, 60 (3): 106-108.
[9] Kaczmarek Z., Grzelak M., Gajewski P.: Warunki siedliskowe oraz różnorodność florystyczna ekologicznych siedlisk przyrodniczych w Dolinie Noteci. Journal of Research and

Applications in Agricultural Engineering, 2010, 55 (3): 142-146.

[10] Kaczmarek Z., Gajewski P., Mocek A., Grzelak M., Knioła A., Glina B.: Geobotanical conditions of ecological grasslands on light river alluvial soils. Journal of Research and Applications in Agricultural Engineering, 2015, 60 (3): 131-135.

[11] Kryszak A., Grynia M.: Zbiorowiska trawiaste siedlisk nadmiernie uwilgotnionych w dolinach rzecznych. Łąkarstwo w Polsce, 2005, 8: 97-106.

[12] Matuszkiewicz W.: Przewodnik do oznaczania zbiorowisk roślinnych Polski. Warszawa: PWN, 2014.

[13] Mirek Z., Piekoś-Mirkowa H., Zając A., Zając M.: Vascular plants of Poland. A checklist. Krytyczna lista roślin naczyniowych Polski. Pol. Bot. Stud. Guideb. Ser. 15, 1-303. W. Szafer Institute of Botany, Polish Acad. of Scien., Kraków, 2002.

[14] Oświt J.: Metoda przyrodniczej waloryzacji mokradeł i wyniki jej zastosowania w wybranych obiektach. Falenty: IMUZ, 2000, 23: 3-32.