

NATURAL VALUES OF STEPPE TURFS AND THEIR ECOTOURIST ATTRACTIVENESS

Summary

The aim of the research was to carry out a floristic assessment of steppe turfs in the context of their tourist attractiveness as well as the determination of the threats that it may cause for their existence. The research was conducted in Zielona Kępa ecological farmland in Kuyavian-Pomeranian voivodeship. Natural values of turfs which influence their tourist attractiveness were defined on the basis of 35 phytosociological relevés taken with Braun-Blanquet's method [1] in the representative areas of 25m². The assessment included: wealth of species (on the basis of a total and an average number of species in the phytosociological relevé), the determination of floral diversification with Shannon-Wiener's method, the geographical and historical spectrum, the existence of endangered species, the appearance of medicinal plants and ones which are useful for bees. Threats which may influence the unique areas as a result of tourism, were determined on the basis of classification coefficients by Mahon and Miller. Xerothermic turfs of Zielona Kępa represent significant natural values due to the existence of numerous protected, endangered and rare floral species and so called nature habitat which is endangered by environmental variabilities and lack of tillage (occasional mowing and grazing). Ecotourism or natural tourism in this area, despite its strong natural attractiveness and terrain's geomorphology, may result as a threat for the flora due to its low natural absorptiveness.

Key words: Zielona Kępa, xerothermic turfs, natural values, habitat, tourism attractiveness

WALORY PRZYRODNICZE MURAW STEPOWYCH A ICH ATRAKCYJNOŚĆ EKOTURYSTYCZNA

Streszczenie

Celem prowadzonych badań była ocena florystyczna muraw stepowych w kontekście atrakcyjności turystycznej oraz określenie zagrożenia jakie może ona stwarzać dla ich występowania. Badania prowadzono na użytku ekologicznym Zielona Kępa w woj. kujawsko-pomorskim. Walory przyrodnicze muraw wpływające na ich atrakcyjność turystyczną określono na podstawie wieloaspektowej analizy 35 zdjęć fitosocjologicznych wykonanych metodą Braun-Blanqueta [1] na reprezentatywnych powierzchniach wielkości 25 m². Ocena dotyczyła: bogactwa gatunkowego na podstawie ogólnej i średniej liczby gatunków w zdjęciu fitosocjologicznym, określenia różnorodności florystycznej wskaźnikiem Shannona-Wienera, spektrum geograficzno-historycznego, występowania gatunków zagrożonych, występowania roślin leczniczych i stanowiących pożytek dla pszczół. Zagrożenia jakim mogą podlegać unikatowe powierzchnie na skutek uprawiania turystyki oceniono przy pomocy wskaźników bonitacyjnych wg Mahona i Millera. Murawy kserotermiczne Zielonej Kępy przedstawiają wysokie walory przyrodnicze ze względu na występowanie wielu chronionych, zagrożonych i rzadkich gatunków roślin oraz tzw. „siedliska naturowego”, którym zagrażają zmiany warunków siedliskowych oraz brak użytkowania (sporadycznego koszenia, wypasu). Uprawianie ekoturystyki lub turystyki przyrodniczej na tym terenie, pomimo jego wysokiej atrakcyjności przyrodniczej oraz geomorfologii terenu może także stanowić zagrożenie dla występującej tam roślinności ze względu na ich niską chłonność naturalną.

Słowa kluczowe: Zielona Kępa, murawy stepowe, walory przyrodnicze, habitat, atrakcyjność turystyczna

1. Introduction and the aim of study

In Poland, semi-natural thermophile floral communities of extrazonal character, which are partly a relic of a cold steppe, are located on small isolated islands, often with unique flora [2]. However, taking into consideration their origin which is usually connected with the extensive graze, they are often called *xerothermic turfs* [3]. As a result of anthropopression, their phytocenoses undergo transformations and the existing populations of numerous species resistant to high temperature, droughts – and often also cold – shrink.

In Poland, xerothermic turfs are also located on steep slopes of southern or southern-western exposition, along main watercourses. Such conditions are offered, among all, in Pomerania and Kuyavia on steep, eroded slopes of river

valleys of e.g. Vistula. According to Rutkowski [3], their unique natural values are confirmed by the existence of 163 taxons of xerothermic turfs' for 34 among which are protected species and 35 – are listed on a Polish red list [4]. Thus, they often are a tourist attraction, especially when natural tourism (*Natura tourism*) or (*Eco-tourism*) are concerned.

The aim of the research was to carry out a floral assessment of steppe turfs in the context of tourism attractiveness and the determination of threats which it may cause for their existence.

2. Material and methods

The research was conducted in *Zielona Kępa* ecological farmland which is located on an island of the Vistula River

in Kuyavian-Pomeranian voivodeship. The farmland was established in 2006 on the basis of a regulation by Kuyavian-Pomeranian voivode.

Natural values of turfs which influence their tourist attractiveness were determined on the basis of a multidimensional analysis of 35 phytosociological relevés made with the Braun-Blanquet's method [1] in the representative areas of 25 m². The assessment included:

- The determination of species richness on the basis of a total and an average number of species in a relevé;
- Phytosociological structure of flora in the defined community;
- Floristic diversity according to Shannon-Wiener's coefficient and relating the values to a 10-degree scale by Jurko [5];
- Geographical and historical spectrum – classification according to Jackowiak [6];
- The existence of endangered species by the Polish Red Book of Flora [7] and the Red List of Flora and Fungi of Poland [4];

The existence of medicinal plants [8] which are useful for bees [9]. Habitat conditions of meadow communities were determined using the phytoindication method [10], assessing for each relevé: temperature (T), light conditions (L) and nitrogen content (N).

Threats which may be encountered by unique areas as a result of tourism were defined with classification coeffi-

cients by Mahon and Miller [11]. The area of *Zielona Kępa* was divided into squares of 250 m side each. Every criterion, among all those connected with the terrain cover, the existence of endangered species and communities, synanthropization of an ecosystem and natural land carrying capacity by Kostrowcki [12], allowed for the valorisation of naturally valuable areas.

3. Results

In the small area of *Zielona Kępa* and in other localizations in the Vistula River alike, xerothermic turfs exist owing to specific environmental conditions, i.e. strong insolation on the slopes and the presence of calcium carbonate in the soil [13]. The formed phytocenoses of thermophile turfs of *Zielona Kępa* represent 6 communities from the following classes: *Festuco-Brometea*, and also *Nardo-Callunetea*, *Molinio-Arrhenatheretea*, and *Epilobietea angustifolii*, which shows an evidence of a significant transformation of floral composition in the direction of grassland communities and even ones connected with near-forest terrains.

In the green growth of the defined communities, a total of 71 species of tracheophytes were found. Differences in the number of species between syntaxons were observed, though. Species composition of the phytocenoses from *Festuca rubra* and *Stipa joannis* were the richest in floral species (Table 1).

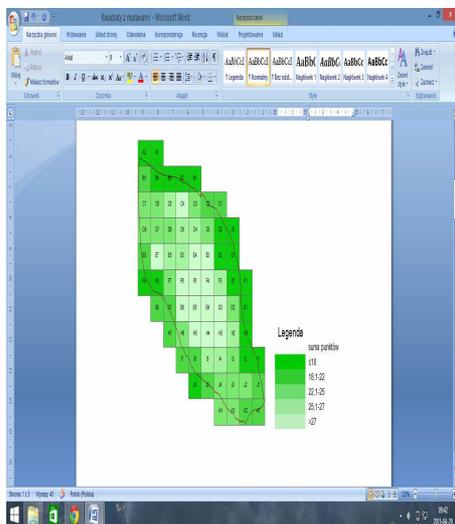
Table 1. Natural values of the defined communities

	Community with						Area of research
	<i>Festuca ovina</i>	<i>Galium boreale</i>	<i>Festuca pratensis</i>	<i>Festuca rubra</i>	<i>Calamagrostis epigejos</i>	<i>Stipa joannis</i>	
T	5.73	5.82	5.83	5.83	5.73	5.83	X
L	7.47	6.84	7.22	7.36	7.41	7.47	X
N	3.06	4.57	4.78	4.15	4.32	3.84	X
Number of species	17	13	10	52	40	35	71
The average number of species/phytosociological relevé	17	10	10	10.5	10.7	9.7	10.6
H'	1.546	1.244	0.961	1.378	1.112	1.188	x
Phytosociological structure (%)							
<i>Koelerio glauca-Corynephoretea</i>	17.65	-	-	7.69	7.5	2.86	8.45
<i>Festuco-Brometea</i>	17.65	15.38	10.00	21.15	12.5	17.14	15.49
<i>Epilobietea angustifolii</i>	11.76	7.69	-	5.77	5.0	2.86	4.23
<i>Rhamno-Prunetea</i>	11.76	15.38	10.00	3.85	2.5	2.86	2.82
<i>Stellarietea Mediae</i>	11.76	7.69	-	9.62	17.5	14.29	12.68
<i>Nardo-Callunetea</i>	5.88	-	-	-	5.0	-	2.82
<i>Artemisietea vulgaris</i>	5.88	7.69	10.00	3.85	10.0	5.71	7.04
<i>Agropyretea intermedio-repentis</i>	5.88	-	-	1.92	2.5	2.86	2.82
<i>Molinio-Arrhenatheretea</i>	5.88	30.77	40.00	26.92	17.5	31.43	23.94
<i>Trifolio-Geranitetea</i>	-	7.69	20.00	7.69	5.0	5.71	7.04
Associated species	5.88	7.69	10.00	11.54	15.0	14.29	12.68
Endangered species							
Protected species	2	0	0	4	1	2	6
Geographical-historical structure (%)							
spontaneophytes	5.88	-	-	9.62	10.0	8.57	12.68
apophytes	88.24	92.31	100.00	78.85	75.0	74.29	73.24
archeophytes	-	7.69	-	7.69	12.5	11.43	9.86
kenophytes	5.88	-	-	3.84	2.5	5.72	4.23
Number of species							
Melliferous species	4	3	3	3	2	2	4
Medicinal species	3	5	3	17	14	14	18

Source: own work

The analysed flora of the assessed area belongs to 10 phytosociological classes. Their floral composition is dominated by open space species, including grassland plants of *Molinio-Arrhenatheretea* class (almost 24%). Furthermore, numerous plants from thermophile habitats such as *Festuco-Brometea* (almost 15.5%), *Koelerio glauca-Corynephoretea canescentis* (8.45%) and *Trifolio-Geranietea* (7.04%) appear. There is also a large representation of segetal and ruderal species from *Stellarietea mediae* (12.68 %) and *Artemisietea* (7.04%).

The presented structure of communities and the phytosociological analysis of flora indicate that their floral composition depends on current thermal, light and trophic conditions. Phytocenoses of a higher share of thermophile habitat flora i.e. of *Festuco-Brometea* class have developed, especially on highly sunlit surfaces and in soils which were poorer in nitrogen compounds (Table 1). These are positions which represent the highest natural values and have the most species which undergo species protection in their floral composition. Especially the appearance of xerothermic communities with the share of *Stipa joannis*, which are protected in *Nature 2000* network as a priority habitat (code *6210.2), decide about natural values of *Zielona Kępa* (Fig. 1). Furthermore, among the species of the area, 6 endangered and protected taxa were observed: *Allium angulosum*, *Cirsium acuale*, *Helichrysum arenarium*, *Nonea pulla*, *Ononis arvensis*, *Stipa joannis*, 2 of which are placed on the Red List of Protected Plants in Poland, 1 in the Polish Red Book and 4 are endangered in the Pomeranian-Kuyavian region. Therefore, in the areas in the net of the following squares: E3, E4, F4, F5, F6, G3, G4, G5, G6, H3, H4, H5, xerothermic protected species were found, to which were given the highest natural assessments.



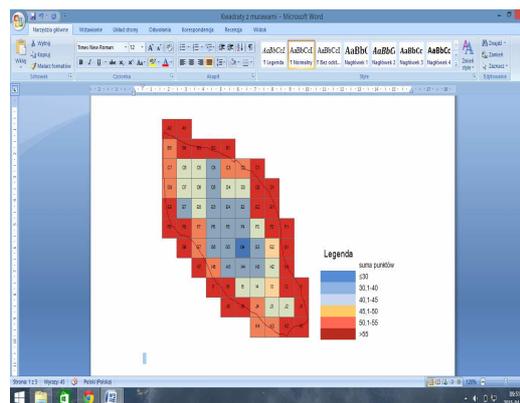
Source: own work

Fig. 1. Natural values of Zielona Kępa

Apart from the uniqueness of the communities of *Festuco-Brometea* class, which is visible in the phytosociological structure and the appearance of floral peculiarities, the values of the H' coefficient of floral diversity by Shannon-Wiener were low. According to a 10-degree scale by Jurko [5], these values show little floral diversity. Among the discussed communities, 5 were classified to the 3rd – half low-class (the coefficient of 1-1.7) and one community was classified to the 2nd – very low - class (the coefficient of 0.5-1). The highest value of the coefficient - H' =1.55 was

reached in the community from *Festuca ovina*. What is visible, though, this is the low value of the coefficient for the community from *Stipa joannis* - H' =1.19. Whereas low diversity of the community from *Festuca pratensis* may be a result of floral simplification of the green growth which follows the succession changes towards *Molinio-Arrhenatheretea* class.

The attractiveness for ecotourism is also raised by the geomorphology of the area i.e. small hills and dicks of irregular slopes whose values are especially visible in the large number of blooming flowers which also reflects in other phenological aspects. Among the flowers, there are honey plants such as *Centaurea scabiosa*, *Crataegus monogyna*, *Erygium planum* and *Pyrus communis* as well as 18 medicinal plants and 4 poisonous ones. It was also proved, that the area is populated with plants of documented medical properties used in phytotherapy: *Euphorbia cyparissias*, *Euphorbia helioscopia*, *Convolvulus arvensis* and *Linaria vulgaris*, *Achillea millefolium*, *Agropyron repens*, *Allium oleraceum*, *Asparagus officinalis*, *Daucus carota*, *Fragaria vesca*, *Rumex acetosa*, *Urtica dioica*, *Allium oleraceum*, *Galium verum* and *Crataegus monogyna*. Despite large natural values of xerothermic flora, the areas covered with it received a smaller number of points which were a sum of the values quantifying esthetical, recreational and natural values, due to the low calculated value of the land carrying capacity coefficient (Fig. 2)



Source: own work

Fig. 2. Resultant map of natural, esthetical and recreational values of Zielona Kępa

4. Discussion

Xerothermic communities are usually formed in small, isolated areas, which was proved by the phytocenoses of *Zielona Kępa*. They are located in the area which is submitted to natural succession and is currently administrated by Dobrzejewice Forestry Management. Having taken into consideration the fact that these terrains, alike many others in Poland, are of anthropoclimax character formed as a result of a long-term human activity, their existence and maintenance depends on the tillage which impedes their overgrowth and shading [14, 15]. Therefore, leaving the turf for the natural succession is a threat for their further existence. However, the location of turfs on an island, significantly impedes the implementation of active protection by grazing or mowing. Whereas transformations in the floral composition of xerothermic turfs and the appearance of

areas with, among all, *Calamagrostis epigejos* species and brushwood from *Rhamno-Prunetea* class, emphasizes the need for the implementation of currently active protection through grazing. The lack of usage may lead to the formation of forestry communities, xerothermic oak forests – so called oak forest of steppe-forestry type from *Quercetalia pubescenti-petraeae*, in the future. Currently, the results of the lack of grazing are stopped by numerous flocks of wild animals which use this flora as food.

Moreover, unfavourable changes in the floral composition of *Zielona Kępa* turfs may be additionally caused by habitat conditions. It was indicated by the research results which confirm that the best preserved turfs cover areas which are the most sunlit and simultaneously represent the highest natural values and are attractive for ecotourism. Goossen i Landers [16] emphasize that, despite the fact that the criterion of terrain's attractiveness for tourism and recreation depends on their form and kind, they still claim that one of the most important elements which influences its attractiveness are natural values. According to their research e.g. sandy, highly natural areas are considered as very attractive for cyclists and pedestrians. Similarly, Flanagan and Anderson [17] paid attention to the fact that the areas which are preferred for - among all – ecotourism, are the ones most valuable naturally e.g. xerothermic turfs. What should be emphasized, this is that Krzymowska-Kostrowicka [18] also granted sandy turfs with high assessment in terms of their recreational attractiveness of floral communities.

Recreational attractiveness of xerothermic turfs formed in *Zielona Kępa* also depends on the geomorphology of the area which is wavy, with small hills. Bródka [18] claims that, among other components and natural features, apart from flora, relief has the strongest impact on its recreational value. It is the changeability of relief elements which shapes the scenic panorama and conditions the harmony of landscape-forming elements, which also influences its recreational attractiveness.

Nevertheless, one needs to take into consideration that recreational usage of the area may expose flora to degradation mainly through direct mechanical destruction e.g. trampling. Both the coefficients of the natural land carrying capacity created by the Ministry of Municipal Economy in 1971 and ones assessing the sensitiveness of the species to trampling [12] prove that especially dry habitats and their species are exposed to destruction. *Zielona Kępa* is an island separated from mainland. Such a localization limits free access to its resources, yet the aesthetics of the landscape is connected with the presence of a large number of plant species, including medicinal ones, may attract people and cause the destruction of xerothermic turfs. Taking into consideration low natural absorptiveness of xerothermic turfs, the destruction of these areas may even deteriorate through the deficiency of the development of xerothermic turfs species which are sensitive to trampling, especially those of numerous natural values.

5. Conclusions

1. Xerothermic turfs of *Zielona Kępa* have high natural values due to the existence of numerous protected, endangered and rare floral species (e.g. *Allium angulosum*, *Cirsium acuale*, *Nonea pulla*, *Ononis arvensis*, *Stipa joannis*) and so called *nature habitat* which is endangered by envi-

ronmental changes and lack of utilization (e.g. occasional mowing or grazing).

2. Ecotourism or natural tourism in the area, despite its high natural attractiveness and geomorphology may also be a threat to the existing flora, due to its low natural absorptiveness.

6. References

- [1] Braun-Blanquet J.I.: Pflanzensociologie Third Edition. Springer, Berlin-Vien-Nev York, 1964, 865.
- [2] Ceynowa M.: Zbiorowiska roślinności kserotermicznej nad dolną Wisłą. [red. J. Zabłocki] Stud. Soc. Sci. Toruń, 1968, 8(4), 1-55.
- [3] Rutkowski L.: Murawy kserotermiczne regionu kujawsko-pomorskiego jako miejsca występowania rzadkich i cennej flory. W: Ciepłolubne murawy w Polsce – stan zachowania i perspektywy ochrony. [red. H. Ratyńska, B. Waldon]. Wyd. Uniwersytetu Kazimierza Wielkiego, Bydgoszcz, 2010, 44-54.
- [4] Zarzycki K., Szelaż Z.: Red list of the vascular plants of Poland: 11-20, (w:) Mirek Z., Zarzycki K., Wojewoda W., Szelaż Z. [red.] Red list of plants and fungi in Poland. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków, 2006.
- [5] Jurko A.: Plant communities and some questions of their taxonomical diversity. *Ekologia*, 1986, 5(1), 3-31.
- [6] Jackowiak B.: Antropogeniczne przemiany flory roślin naczyniowych Poznania. Wyd. Nauk. UAM, 1990, 42, 1-242.
- [7] Kaźmierczakowa R., Zarzycki K., Mirek Z. [red.]: Polska Czerwona Księga Roślin. PAN, Instytut Botaniki im. W. Szafera – Instytut Ochrony Przyrody, Kraków, 2014, ss.895.
- [8] Szafer W., Kulczyński S., Pawłowski B.: Rośliny polskie. Warszawa: PWN, 1986.
- [9] Atlas roślin naczyniowych Polski [on line 15.05.2015] <http://www.atlas-roslin.pl/rosliny-miododajne.html>.
- [10] Ellenberg H., Leuschner C. : Vegetation Mitteleuropas mit den Alpen in ökologischer, dynamischer und historischer Sicht. 6. Auflage, Eugen Ulmer, Stuttgart, Germany, 2010, 109.
- [11] Mahon J.R., Miller R.W.: Identifying high-value greenspace prior to land development. *Journal of Arboriculture*, 2003, 29(1), 25-33.
- [12] Kostrowicki A.S.: Metoda określania odporności roślin na uszkodzenia mechaniczne na skutek wydeptywania [w:] Kostrowicki [red.] Wybrane zagadnienia teorii i metod oddziaływania człowieka na środowisko. Wyd. PAN Wrocław-Kraków-Gdańsk, 1981, 39-70.
- [13] Waldon B., Rapacka-Gackowska A.: Stan zachowania i problem ochrony muraw kserotermicznych w dolinach Wisły i Noteci. [w:] H. Ratyńska, 2010.
- [14] Waldon B.: Zanikanie rzadkich i chronionych gatunków muraw kserotermicznych krawędzi doliny Wisły (okolice Gruczyna). *Przegląd Przyr.*, 1999, 3-4(10), 129-133.
- [15] Prajs B.: Rezerwaty kserotermiczne w dolinie Płoni – problemy ochrony siedlisk kserotermicznych na terenach rolniczych. [w:] Ciepłolubne murawy w Polsce – stan zachowania i perspektywy ochrony. [red. H. Ratyńska, B. Waldon] Wyd. Uniwersytetu Kazimierza Wielkiego, Bydgoszcz, 2010, 260-273.
- [16] Goossen M., Landers F.: Assessing quality of rural areas in the Netherlands: finding the most important indicators for recreation. *Landscape Urban Plan.*, 2000, 46, 241-251.
- [17] Flanagan T.S., Anderson S.: Mapping perceived wilderness to support and survival of management in the San Juan National Forest, Colorado. *Forest Ecol. Manag.*, 2008, 256, 1039-1048.
- [18] Krzymowska-Kostrowicka A.: Podstawy oceny przydatności i atrakcyjności szaty roślinnej dla rekreacji. [w:] Zimny H. [red.]: Problemy ochrony i kształtowania środowiska przyrodniczego na obszarach zurbanizowanych. CPBP 04.10, z. 22. Warszawa: Wyd. SGGW, 1990, 122-129.
- [19] Bródka S. [red.]: Praktyczne aspekty ocen środowiska przyrodniczego. Bogucki Wydawnictwo Naukowe. Poznań, 2010, 330.