



## VASCULAR FLORA OF THE NATURA 2000 AREA “ŁĄKI NAD WOJKÓWKĄ” PLH 180051 (DYNOWSKIE FOOTHILLS)

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(Received: March 27, 2015. Accepted: May 8, 2015)

**ABSTRACT.** The article presents the results of floristic investigations conducted in 2012–2014 in the Natura 2000 area “Łąki nad Wojkówką” (PLH 180051) situated in the Dynowskie Foothills. The area was established with the aim of conservation of thermophilic meadow complexes with fragments of xerothermic grasslands, which are extremely rare in the Carpathians. The vascular flora comprises 252 species from 49 families and 166 genera. Native spontaneophytes (45.7%) and apophytes (44.8%) dominated over anthropophytes (9.5%), and perennial species (85.3%) dominated over short-lived (14.7%) species. Thermophilic species of dry grasslands and scrubs were represented by the classes *Festuco-Brometea*, *Trifolio-Geranieetea*, and *Rhamno-Prunetea*. Fresh meadow plants from the class *Molinio-Arrhenatheretea* were most frequently noted in the flora composition, while ruderal species from the class *Artemisieteae vulgaris* had a substantial share. The occurrence of protected species e.g. *Centaurium erythraea*, *Dianthus armeria*, and *Gentiana cruciata* should also be noted.

**KEY WORDS:** vascular flora, “Łąki nad Wojkówką” Natura 2000 PLH 180051, xerothermic grassland, Western Carpathians, Podkarpackie Province

### INTRODUCTION

The Natura 2000 area “Łąki nad Wojkówką” (PLH 180051) protects fragments of the thermophilic xerothermic plant flora, which is rare in the Carpathian Foothills.

In the Carpathians, xerothermic grasslands represent extremely rare communities distributed as insular localities primarily in the Pieniny Mts. (KAŹMIERCZAKOWA 2004) and in the Przemyskie Foothills (KUCHARZYK 2010, TRĄBA et al. 2012). Fresh thermophilic meadows, which have been described in the Strzyżowskie Foothills (TOWPASZ 1990, WÓJCIK & PIĄTEK 2015), Przemyskie Foothills (BARABASZ-KRASNY 2011), and Dynowskie Foothills (ZIAJA & WÓJCIK 2014), occur more frequently.

Xerothermic grasslands are one of the most valuable but simultaneously most vulnerable elements of the natural habitats in Poland and Europe; hence, they have been listed in Annex I of the European Union Habitats Directive (COUNCIL DIRECTIVE... 1992) as a special priority habitat. This was prompted by the limited range of their occurrence, considerable frag-

mentation, and abandonment of agricultural management thereof, which is an important factor in the development of these habitats (PERZANOWSKA & KUJAWA-PAWLACZYK 2004).

The aim of the study was to make an inventory and analyse the vascular flora of the Natura 2000 area “Łąki nad Wojkówką” established to conserve the xerothermic flora.

### STUDY AREA

The Natura 2000 area “Łąki nad Wojkówką” (PLH 180051) comprises three grassland-meadow complexes (Fig. 1) with a total area of 9.6 ha situated on the hills of the Wisłok River valley (MRÓZ & ROGAŁA 2011). In the administrative division, the area is located in the Podkarpackie Province, Krosno Poviát, and Wojaszówka Commune. The entire area is part of the Czarnorzecko-Strzyżowski Landscape Park. According to the physical-geographical division proposed by KONDRACKI (2011), the analysed area is situated in two mezoregions: Jasielsko-Krośnieńska Basin and Dynowskie Foothills, which are part of

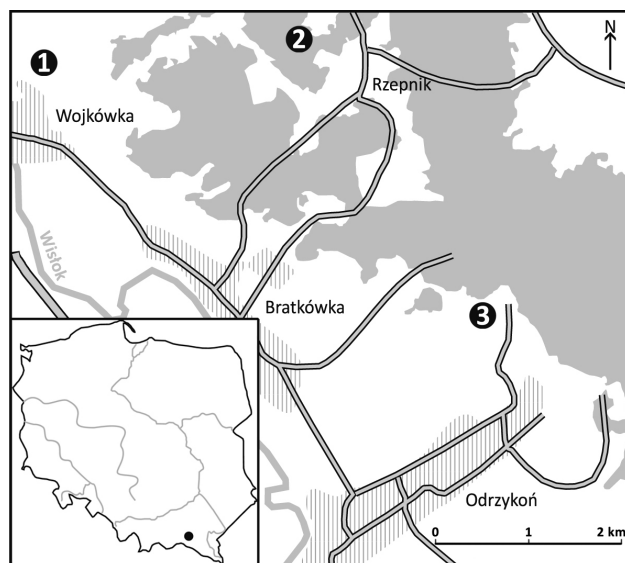


Fig. 1. Location of study area: 1 – Wojkówka, 2 – Rzepnik, 3 – Odrzykoń

the Środkowobeskidzkie Foothills macroregion, Outer Western Carpathians subprovince, and Western Carpathians Province with the Subcarpathia. In accordance with the geobotanical division of Poland (PAWŁOWSKI 1977), the area is located in the Fliszowe Foothills subregion, Western Carpathians subdivision, Carpathian division, Alpine subprovince.

The locality in Wojkówka is situated on the S-SW slopes of Ptasznik Hill (369 m a.s.l.); it covers a steep scarp over a road and the top part of a quarry. The thermophilic grasslands here are adjacent to arable land. The locality is only partially grazed, whereas the scarp over the road and the top part of the quarry are largely overgrown by trees and shrubs. In Odrzykoń, the vegetation forms a mosaic of grasslands and thermophilic scrubs growing on the S slope of Piekło Hill (386 m a.s.l.). The nearby abandoned quarry is also a part of the area. Currently, a vast part of the area is overgrown by scrubs from the class *Rhamno-Prunetea*. Meadows and grasslands occupy only small enclaves mainly located at the scrub edges and within the quarry. The third area situated in Rzepnik comprises an isolated clearing surrounded by forests on the S slope of Kiczary Hill (438 m a.s.l.). For several years, the area has not been managed, which has resulted in unfavourable changes in the plant communities. Phytocoenoses from the class *Festuco-Brometea*, occupying approx. 20% of the total area, are located in the central part of the analysed site on a fragment of a slope with the highest inclination of ca. 45°. The other part is covered by meadows from the class *Molinio-Arrhenatheretea*, which have undergone transformation as well (MRÓZ & ROGAŁA 2011, ZIAJA & WÓJCIK 2014). A greater part of the grassland area has been dominated by high perennials, e.g. *Solidago gigantea*, *Calamagrostis epigejos* in insolated and dry areas and by *Mentha longifolia*, *Urtica dioica*, *Juncus inflexus* in

wetter fragments as well as ruderal species, e.g. *Bromus inermis* and *Cirsium arvense*. In general, stands occupied by one or several of the aforementioned species are predominant, but there are no stands typical for fresh meadows and xerothermic grasslands.

## MATERIALS AND METHODS

The field investigations were carried out during the vegetation season in 2012–2014 over the entire Natura 2000 area “Łąki nad Wojkówką”, and more specifically in three localities: Wojkówka, Odrzykoń, and Rzepnik. The nomenclature for the plant species followed that proposed by MIREK et al. (2002) and the family names were used after RUTKOWSKI (2004). In the analysis of the flora based on the categories of life forms described by Raunkiaer (ZARZYCKI et al. 2002), affiliation to geographical-historical groups was determined and native species were divided into non-synanthropic spontaneophytes and apophytes (synanthropic spontaneophytes) (KORNAŚ 1968, ZAJĄC 1979, ZAJĄC & ZAJĄC 1992, 2011, TOKARSKA-GUZIŁ 2005). Additionally, phytosociological affiliation (MATUSZKIEWICZ 2005) was provided and the status of the protected plants was presented based on the Regulation (ROZPORZĄDZENIE... 2014).

## RESULTS

In total, 252 species of vascular plants from 166 genera and 49 families were noted in the analysed area (Table 1). Families represented by the most numerous species included *Asteraceae* (29 species – 11.5%), *Poaceae* (28 species – 11.1%), *Fabaceae* (24 species – 9.5%), *Rosaceae* (20 species – 8%), *Lamiaceae* (17 species – 6.7%), and *Apiaceae* (11 species – 4.4%). Altogether there were 129 species, which accounted for 51.2% of the flora. Other 13 families were represented by one species and nine families by two species.

The flora of the “Łąki nad Wojkówką” area comprised 63.5% of hemicryptophytes (160 species) and a substantial share of therophytes 14.7% (37 species). The proportion of representatives of other life forms was clearly lower, i.e. 8.7% of geophytes (22 species), 5.6% of megaphanerophytes (14 species), 5.1% of nanophanerophytes (13 species), and 2.4% of chamephytes (6 species) (Table 2).

As many as 27 (10.7%) representatives of den-droflora were noted in the analysed area, which is caused by progressive succession and the close neighbourhood of forests. These species usually occurred singly or formed small clusters. *Quercus robur*, *Populus tremula*, *Fraxinus excelsior*, *Acer campestre*, *Prunus spinosa*, *Crataegus monogyna*, *Rosa canina*, and *Ligustrum vulgare* were the most abundant species.

A vast majority of the analysed flora were native species (228 species – 90.5%), including 148 apo-

Table 1. List of vascular plant species found in the Natura 2000 "Łąki nad Wojkówką"

No.	Name of species	Family	Locality			LF	GHg	PSg
			W	O	R			
1	<i>Abies alba</i> Mill.	Pinaceae			+	M	Sp	Vac-Pice
2	<i>Acer campestre</i> L.	Aceraceae	+	+	+	M	Sp	Que-Fag
3	<i>Achillea millefolium</i> L. s. str.	Asteraceae	+	+	+	H	Ap	Mol-Arr
4	<i>Aegopodium podagraria</i> L.	Apiaceae	+	+	+	G	Ap	Que-Fag
5	<i>Agrimonia eupatoria</i> L.	Rosaceae	+	+	+	H	Ap	Trif-Ger
6	<i>Agrostis capillaris</i> L.	Poaceae		+	+	H	Ap	Nard-Cal
7	<i>Ajuga genevensis</i> L.	Lamiaceae	+			H	Sp	Fest-Brom
8	<i>Ajuga reptans</i> L.	Lamiaceae			+	H	Sp	-
9	<i>Alchemilla monticola</i> Opiz	Rosaceae	+	+		H	Sp	Mol-Arr
10	<i>Allium oleraceum</i> L.	Alliaceae	+	+	+	G	Sp	Fest-Brom
11	<i>Allium vineale</i> L.	Alliaceae	+	+	+	G	Ap	-
12	<i>Alnus glutinosa</i> (L.) Gaertn.	Betulaceae			+	M	Ap	Que-Fag
13	<i>Alnus incana</i> (L.) Moench	Betulaceae			+	M	Ap	Que-Fag
14	<i>Anagallis arvensis</i> L.	Primulaceae	+			T	Arch	Stel med
15	<i>Angelica sylvestris</i> L.	Apiaceae	+	+	+	H	Ap	Mol-Arr
16	<i>Anthoxanthum odoratum</i> L.	Poaceae	+	+	+	H	Ap	-
17	<i>Anthriscus sylvestris</i> (L.) Hoffm.	Apiaceae	+			H	Ap	Artemi
18	<i>Arabis glabra</i> (L.) Bernh.	Brassicaceae	+	+		H	Sp	-
19	<i>Arabis hirsuta</i> (L.) Scop.	Brassicaceae		+		H	Sp	Fest-Brom
20	<i>Arenaria serpyllifolia</i> L.	Caryophyllaceae	+			T	Ap	-
21	<i>Arrhenatherum elatius</i> (L.) Beauv. ex J. Presl et C. Presl	Poaceae	+	+	+	H	Ap	Mol-Arr
22	<i>Artemisia vulgaris</i> L.	Asteraceae	+	+	+	H	Ap	Artemi
23	<i>Asarum europaeum</i> L.	Aristolochiaceae	+	+	+	H	Sp	Que-Fag
24	<i>Astragalus glycyphyllos</i> L.	Fabaceae		+		H	Ap	Trif-Ger
25	<i>Ballota nigra</i> L.	Lamiaceae	+			H	Arch	Artemi
26	<i>Barbarea vulgaris</i> R. Br.	Brassicaceae	+			H	Ap	-
27	<i>Betonica officinalis</i> L.	Brassicaceae		+	+	H	Sp	Mol-Arr
28	<i>Betula pendula</i> Roth	Betulaceae	+	+	+	M	Ap	Rham-Pru
29	<i>Bidens frondosa</i> L.	Asteraceae			+	T	Kn	Bident
30	<i>Briza media</i> L.	Poaceae	+	+	+	H	Sp	-
31	<i>Bromus inermis</i> Leyss.	Poaceae	+		+	H	Ap	Fest-Brom
32	<i>Calamagrostis epigejos</i> (L.) Roth	Poaceae	+	+	+	G	Ap	Epilob
33	<i>Campanula patula</i> L.	Campanulaceae			+	H	Ap	Mol-Arr
34	<i>Campanula rapunculoides</i> L.	Campanulaceae		+	+	H	Ap	Trif-Ger
35	<i>Campanula trachelium</i> L.	Campanulaceae	+	+		H	Sp	Que-Fag
36	<i>Carduus acanthoides</i> L.	Asteraceae	+	+	+	H	Arch	Artemi
37	<i>Carex caryophyllea</i> Latourr.	Cyperaceae	+	+		G, H	Sp	Fest-Brom
38	<i>Carex hirta</i> L.	Cyperaceae	+	+	+	G	Ap	Mol-Arr
39	<i>Carex pairae</i> F.W. Schultz	Cyperaceae		+		H	Ap	-
40	<i>Carex pilulifera</i> L.	Cyperaceae	+			H	Sp	Nard-Cal
41	<i>Carex spicata</i> Huds.	Cyperaceae	+	+		H	Ap	-
42	<i>Carex sylvatica</i> Huds.	Cyperaceae			+	H	Sp	Que-Fag
43	<i>Carex tomentosa</i> L.	Cyperaceae			+	G, H	Sp	Mol-Arr
44	<i>Carlina vulgaris</i> L.	Asteraceae	+	+	+	H	Ap	Fest-Brom
45	<i>Centaurea jacea</i> L.	Asteraceae	+	+	+	H	Ap	Mol-Arr
46	<i>Centaurea scabiosa</i> L.	Asteraceae	+	+	+	H	Sp	Fest-Brom
47	<i>Centaurium erythraea</i> Rafn [P]	Gentianaceae	+		+	T	Sp	Epilob
48	<i>Cerasus avium</i> (L.) Moench	Rosaceae	+	+	+	M	Ap	Que-Fag
49	<i>Cerinthe minor</i> L.	Boraginaceae	+			H	Ap	-
50	<i>Chaerophyllum aromaticum</i> L.	Apiaceae	+	+	+	H	Ap	Artemi
51	<i>Chaerophyllum bulbosum</i> L.	Apiaceae	+	+		T, G	Ap	Artemi
52	<i>Chamaenerion angustifolium</i> (L.) Scop.	Onagraceae	+			H	Ap	Epilob
53	<i>Cichorium intybus</i> L.	Asteraceae	+	+	+	H	Arch	Artemi
54	<i>Circaea lutetiana</i> L.	Onagraceae			+	G	Sp	Que-Fag

No.	Name of species	Family	Locality			LF	GHg	PSg
			W	O	R			
55	<i>Cirsium arvense</i> (L.) Scop.	Asteraceae	+	+	+	G	Ap	Artemi
56	<i>Cirsium oleraceum</i> (L.) Scop.	Asteraceae			+	H	Ap	Mol-Arr
57	<i>Cirsium rivulare</i> (JACQ.) All.	Asteraceae			+	H	Sp	Mol-Arr
58	<i>Clinopodium vulgare</i> L.	Lamiaceae	+	+	+	H	Sp	Trif-Ger
59	<i>Consolida regalis</i> Gray	Ranunculaceae	+	+		T	Arch	Stel med
60	<i>Convolvulus arvensis</i> L.	Convolvulaceae	+	+	+	H	Ap	Agr-rep
61	<i>Cornus sanguinea</i> L.	Cornaceae	+	+	+	N	Ap	Rham-Pru
62	<i>Coronilla varia</i> L.	Fabaceae	+	+	+	H	Ap	Trif-Ger
63	<i>Crataegus monogyna</i> Jacq.	Rosaceae	+	+	+	N	Ap	Rham-Pru
64	<i>Crepis biennis</i> L.	Asteraceae	+	+	+	H	Ap	Mol-Arr
65	<i>Cruciata glabra</i> (L.) Ehrend.	Rubiaceae	+	+	+	H	Sp	Que-Fag
66	<i>Cuscuta epithimum</i> (L.) L. s. str.	Cuscutaceae	+	+	+	T	Sp	Nard-Cal
67	<i>Cuscuta europaea</i> L.	Cuscutaceae	+			T	Sp	Artemi
68	<i>Cynosurus cristatus</i> L.	Poaceae	+			H	Sp	Mol-Arr
69	<i>Dactylis glomerata</i> L.	Poaceae	+	+	+	H	Ap	Mol-Arr
70	<i>Danthonia decumbens</i> DC.	Poaceae		+		H	Sp	Nard-Cal
71	<i>Daucus carota</i> L.	Apiaceae	+	+	+	H	Ap	Mol-Arr
72	<i>Deschampsia caespitosa</i> (L.) P. Beauv.	Poaceae		+	+	H	Sp	Mol-Arr
73	<i>Dianthus armeria</i> L. [S]	Caryophyllaceae			+	H	Sp	-
74	<i>Dianthus deltoides</i> L.	Caryophyllaceae		+		H	Sp	Koel-Cory
75	<i>Dipsacus sylvestris</i> Huds.	Dipsacaceae	+			H	Ap	Artemi
76	<i>Dryopteris carthusiana</i> (Vill.) H. P. Fuchs	Dryopteridaceae	+		+	H	Sp	-
77	<i>Dryopteris filix-mas</i> (L.) Schott	Dryopteridaceae			+	H	Sp	Que-Fag
78	<i>Echium vulgare</i> L.	Boraginaceae	+	+		H	Ap	Artemi
79	<i>Elymus repens</i> (L.) Gould	Poaceae	+	+	+	G	Ap	Agr-rep
80	<i>Equisetum arvense</i> L.	Equisetaceae	+	+	+	G	Ap	Agr-rep
81	<i>Equisetum sylvaticum</i> L.	Equisetaceae			+	G	Sp	-
82	<i>Equisetum telmateia</i> Ehrh.	Equisetaceae		+	+	G	Sp	Que-Fag
83	<i>Erigeron acer</i> L.	Asteraceae	+		+	H, T	Ap	-
84	<i>Erigeron annuus</i> (L.) Pers.	Asteraceae	+	+	+	H, T	Kn	-
85	<i>Erophila verna</i> (L.) Chevall.	Brassicaceae	+			T	Ap	-
86	<i>Euonymus europaea</i> L.	Celastraceae	+			N	Ap	Rham-Pru
87	<i>Eupatorium cannabinum</i> L.	Asteraceae	+	+	+	H	Ap	Artemi
88	<i>Euphorbia cyparissias</i> L.	Euphorbiaceae	+	+	+	H	Ap	Fest-Brom
89	<i>Euphorbia esula</i> L.	Euphorbiaceae	+		+	H	Ap	-
90	<i>Euphorbia platyphyllos</i> L.	Euphorbiaceae	+		+	H	Ap	-
91	<i>Euphrasia rostkoviana</i> Hayne	Scrophulariaceae	+	+	+	T	Sp	Mol-Arr
92	<i>Fagus sylvatica</i> L.	Fagaceae		+	+	M	Sp	Que-Fag
93	<i>Fallopia convolvulus</i> (L.) Á. Löve	Polygonaceae	+		+	T	Arch	Stel med
94	<i>Festuca arundinacea</i> Schreb.	Poaceae			+	H	Ap	Mol-Arr
95	<i>Festuca gigantea</i> (L.) Vill.	Poaceae			+	H	Ap	Que-Fag
96	<i>Festuca pratensis</i> Huds.	Poaceae	+	+	+	H	Ap	Mol-Arr
97	<i>Festuca rubra</i> L. s. s.	Poaceae	+	+	+	H	Ap	Mol-Arr
98	<i>Filipendula ulmaria</i> (L.) Maxim.	Rosaceae			+	H	Sp	Mol-Arr
99	<i>Fragaria vesca</i> L.	Rosaceae	+	+	+	H	Sp	Epilob
100	<i>Fragaria viridis</i> Duchesne	Rosaceae	+	+	+	H	Sp	Trif-Ger
101	<i>Fraxinus excelsior</i> L.	Oleaceae	+	+		M	Ap	Que-Fag
102	<i>Fumaria officinalis</i> L.	Fumariaceae		+		T	Arch	Stel med
103	<i>Galeopsis pubescens</i> Besser	Lamiaceae			+	T	Ap	Artemi
104	<i>Galeopsis tetrahit</i> L.	Lamiaceae			+	T	Ap	Stel med
105	<i>Galium aparine</i> L.	Rubiaceae			+	T	Ap	Artemi
106	<i>Galium mollugo</i> L. s. str.	Rubiaceae	+	+	+	H	Ap	Mol-Arr
107	<i>Galium verum</i> L.	Rubiaceae	+	+	+	H	Ap	Trif-Ger
108	<i>Gentiana cruciata</i> L. [S]	Gentianaceae	+			H	Sp	Fest-Brom
109	<i>Geranium dissectum</i> L.	Geraniaceae			+	T	Arch	Stel med

No.	Name of species	Family	Locality			LF	GHg	PSg
			W	O	R			
110	<i>Geranium palustre</i> L.	Geraniaceae	+			H	Sp	Mol-Arr
111	<i>Geranium pratense</i> L.	Geraniaceae	+			H	Ap	Mol-Arr
112	<i>Glechoma hederacea</i> L.	Lamiaceae		+		G	Ap	Artemi
113	<i>Heracleum sphondylium</i> L. s. str.	Apiaceae	+	+	+	H	Ap	Mol-Arr
114	<i>Hieracium bauhinii</i> Schult.	Asteraceae	+	+		H	Sp	Fest-Brom
115	<i>Hieracium pilosella</i> L.	Asteraceae		+		H	Ap	Nard-Cal
116	<i>Holcus lanatus</i> L.	Poaceae			+	H	Ap	Mol-Arr
117	<i>Holcus mollis</i> L.	Poaceae		+	+	G, H	Ap	Que rob
118	<i>Humulus lupulus</i> L.	Cannabaceae	+			H	Ap	-
119	<i>Hypericum maculatum</i> Crantz	Hypericaceae			+	H	Sp	Nard-Cal
120	<i>Hypericum perforatum</i> L.	Hypericaceae	+	+	+	H	Ap	-
121	<i>Inula salicina</i> L.	Asteraceae		+		H	Sp	Mol-Arr
122	<i>Juncus conglomeratus</i> L.	Juncaceae	+		+	H	Ap	Nard-Cal
123	<i>Juncus effusus</i> L.	Juncaceae	+			H	Ap	Mol-Arr
124	<i>Juncus inflexus</i> L.	Juncaceae	+		+	H	Ap	Mol-Arr
125	<i>Knautia arvensis</i> (L.) J.M. Coult.	Dipsacaceae	+	+	+	H	Ap	Mol-Arr
126	<i>Lactuca serriola</i> L.	Asteraceae	+			H	Arch	Stel med
127	<i>Larix decidua</i> Mill.	Pinaceae	+			M	Ap	-
128	<i>Lathyrus pratensis</i> L.	Fabaceae	+	+	+	H	Ap	Mol-Arr
129	<i>Lathyrus tuberosus</i> L.	Fabaceae	+	+	+	H	Arch	Stel med
130	<i>Leontodon hispidus</i> L.	Asteraceae	+	+	+	H	Sp	Mol-Arr
131	<i>Lepidium campestre</i> (L.) R. Br.	Brassicaceae	+	+		T	Arch	-
132	<i>Leucanthemum vulgare</i> Lam. s. str.	Asteraceae	+	+	+	H	Ap	Mol-Arr
133	<i>Ligustrum vulgare</i> L.	Oleaceae	+			H	Ap	Rham-Pru
134	<i>Linaria vulgaris</i> Mill.	Scrophulariaceae	+		+	G	Ap	Artemi
135	<i>Linum catharticum</i> L.	Linaceae	+	+	+	T	Sp	-
136	<i>Lolium multiflorum</i> Lam.	Poaceae			+	H, T	Kn	-
137	<i>Lolium perenne</i> L.	Poaceae		+	+	H	Ap	Mol-Arr
138	<i>Lotus corniculatus</i> L.	Fabaceae	+	+	+	H	Ap	Mol-Arr
139	<i>Luzula campestris</i> (L.) DC.	Juncaceae		+		H	Sp	Nard-Cal
140	<i>Lychnis flos-cuculi</i> L.	Caryophyllaceae			+	H	Sp	Mol-Arr
141	<i>Lycopus europaeus</i> L.	Lamiaceae			+	H	Sp	Aln glu
142	<i>Lysimachia nummularia</i> L.	Primulaceae			+	C	Sp	Mol-Arr
143	<i>Lysimachia vulgaris</i> L.	Primulaceae		+	+	H	Sp	Mol-Arr
144	<i>Lythrum salicaria</i> L.	Lythraceae			+	H	Sp	Mol-Arr
145	<i>Medicago falcata</i> L.	Fabaceae	+	+	+	H	Ap	Trif-Ger
146	<i>Medicago lupulina</i> L.	Fabaceae	+	+		T	Ap	-
147	<i>Medicago sativa</i> L. s. str.	Fabaceae	+			H	Kn	-
148	<i>Medicago</i> × <i>varia</i> Martyn	Fabaceae	+	+		H	Kn	-
149	<i>Melampyrum arvense</i> L.	Scrophulariaceae	+	+		T	Sp	Fest-Brom
150	<i>Melampyrum nemorosum</i> L.	Scrophulariaceae	+	+		T	Sp	Trif-Ger
151	<i>Melandrium album</i> (Mill.) Garcke	Caryophyllaceae	+			T	Ap	Artemi
152	<i>Melilotus alba</i> Medik.	Fabaceae	+	+		T	Ap	Artemi
153	<i>Melilotus officinalis</i> (L.) Pall.	Fabaceae	+	+	+	T	Ap	Artemi
154	<i>Mentha arvensis</i> L.	Lamiaceae	+	+	+	G	Ap	-
155	<i>Mentha longifolia</i> (L.) L.	Lamiaceae	+	+	+	H	Ap	Mol-Arr
156	<i>Myosotis palustris</i> (L.) L. emend. Rchb.	Boraginaceae			+	H	Sp	Mol-Arr
157	<i>Nardus stricta</i> L.	Poaceae		+		H	Sp	Nard-Cal
158	<i>Odontites serotina</i> (Lam.) Rchb. s. str.	Scrophulariaceae	+		+	T	Sp	-
159	<i>Ononis arvensis</i> L.	Fabaceae	+	+	+	H	Ap	-
160	<i>Origanum vulgare</i> L.	Lamiaceae	+	+	+	C, H	Sp	Trif-Ger
161	<i>Padus avium</i> Mill.	Rosaceae	+			M	Ap	Que-Fag
162	<i>Papaver rhoeas</i> L.	Papaveraceae	+	+		T	Arch	Stel med
163	<i>Pastinaca sativa</i> L.	Apiaceae	+	+		H	Ap	Artemi
164	<i>Phalaris arundinacea</i> L.	Poaceae			+	H	Ap	Phragm

No.	Name of species	Family	Locality			LF	GHg	PSg
			W	O	R			
165	<i>Phleum pratense</i> L.	Poaceae		+	+	H	Ap	Mol-Arr
166	<i>Picris hieracioides</i> L.	Asteraceae	+	+	+	H	Ap	Artemi
167	<i>Pimpinella major</i> (L.) Huds.	Apiaceae	+	+	+	H	Sp	Mol-Arr
168	<i>Pimpinella saxifraga</i> L. s. str.	Apiaceae	+	+	+	H	Ap	-
169	<i>Pinus sylvestris</i> L.	Pinaceae	+	+	+	M	Ap	Vac-Pice
170	<i>Plantago lanceolata</i> L.	Plantaginaceae	+	+	+	H	Ap	Mol-Arr
171	<i>Plantago major</i> L. s. str.	Plantaginaceae			+	H	Ap	Mol-Arr
172	<i>Plantago media</i> L.	Plantaginaceae	+	+	+	H	Ap	Fest-Brom
173	<i>Poa compressa</i> L.	Poaceae	+	+	+	H	Ap	Fest-Brom
174	<i>Poa nemoralis</i> L.	Poaceae	+			H	Ap	Que-Fag
175	<i>Poa pratensis</i> L.	Poaceae	+	+	+	H	Ap	Mol-Arr
176	<i>Poa trivialis</i> L.	Poaceae			+	H	Ap	Mol-Arr
177	<i>Polygala comosa</i> Schkuhr	Polygalaceae	+	+		H	Sp	-
178	<i>Polygonum aviculare</i> L.	Polygonaceae			+	T	Ap	Stel med
179	<i>Polygonum hydropiper</i> L.	Polygonaceae			+	T	Ap	Bident
180	<i>Populus tremula</i> L.	Salicaceae	+	+	+	M	Ap	Epilob
181	<i>Potentilla anserina</i> L.	Rosaceae			+	H	Ap	Mol-Arr
182	<i>Potentilla argentea</i> L.	Rosaceae	+			H	Ap	Koel-Cory
183	<i>Potentilla erecta</i> (L.) Raeusch.	Rosaceae	+	+		H	Sp	Nard-Cal
184	<i>Potentilla recta</i> L.	Rosaceae	+			H	Sp	-
185	<i>Potentilla reptans</i> L.	Rosaceae	+	+	+	H	Ap	Mol-Arr
186	<i>Primula veris</i> L.	Primulaceae		+		H	Sp	Que-Fag
187	<i>Prunella vulgaris</i> L.	Lamiaceae			+	H	Ap	Mol-Arr
188	<i>Prunus spinosa</i> L.	Rosaceae	+	+	+	N	Ap	Rham-Pru
189	<i>Pyrus pyrastrer</i> (L.) Burgsd.	Rosaceae	+	+	+	M	Ap	Rham-Pru
190	<i>Quercus robur</i> L.	Fagaceae	+	+	+	M	Sp	Que-Fag
191	<i>Ranunculus acris</i> L.	Ranunculaceae	+	+	+	H	Ap	Mol-Arr
192	<i>Ranunculus auricomus</i> L. s. l.	Ranunculaceae	+	+		H	Sp	Que-Fag
193	<i>Ranunculus polyanthemos</i> L.	Ranunculaceae	+	+	+	H	Sp	Que-Fag
194	<i>Ranunculus repens</i> L.	Ranunculaceae	+	+	+	H	Ap	Mol-Arr
195	<i>Rhinanthus serotinus</i> (Schönh.) Oborný	Scrophulariaceae		+		T	Arch	Mol-Arr
196	<i>Rosa canina</i> L.	Rosaceae	+	+	+	N	Ap	Rham-Pru
197	<i>Rubus caesius</i> L.	Rosaceae	+	+	+	N	Ap	-
198	<i>Rubus hirtus</i> Waldst. et Kit. agg.	Rosaceae			+	N	Ap	Vac-Pice
199	<i>Rubus idaeus</i> L.	Rosaceae			+	N	Ap	Epilob
200	<i>Rumex acetosa</i> L.	Polygonaceae			+	H	Ap	Mol-Arr
201	<i>Rumex obtusifolius</i> L.	Polygonaceae		+	+	H	Ap	Artemi
202	<i>Salix caprea</i> L.	Salicaceae	+	+	+	N	Ap	Epilob
203	<i>Salix cinerea</i> L.	Salicaceae			+	N	Ap	Aln glu
204	<i>Salix purpurea</i> L.	Salicaceae	+			N	Ap	Sal purp
205	<i>Salvia glutinosa</i> L.	Lamiaceae			+	H	Sp	Que-Fag
206	<i>Salvia verticillata</i> L.	Lamiaceae	+	+	+	H	Sp	Fest-Brom
207	<i>Sambucus ebulus</i> L.	Caprifoliaceae	+	+		H	Ap	Artemi
208	<i>Sambucus nigra</i> L.	Caprifoliaceae	+	+	+	N	Ap	Epilob
209	<i>Sanguisorba minor</i> Scop. s. str.	Rosaceae	+	+		H	Sp	-
210	<i>Saponaria officinalis</i> L.	Caryophyllaceae	+			H	Ap	Artemi
211	<i>Scirpus sylvaticus</i> L.	Cyperaceae			+	G	Sp	Mol-Arr
212	<i>Sedum acre</i> L.	Crassulaceae	+	+		C	Ap	Koel-Cory
213	<i>Sedum maximum</i> (L.) Hoffm.	Crassulaceae		+		G, H	Ap	-
214	<i>Sedum sexangulare</i> L.	Crassulaceae		+		C	Sp	Koel-Cory
215	<i>Senecio jacobaea</i> L.	Asteraceae	+	+	+	H	Ap	-
216	<i>Senecio ovatus</i> (P. Gaertn., B. Mey. et Scherb.) Willd.	Asteraceae			+	H	Ap	Epilob
217	<i>Setaria pumila</i> (Poir.) Roem. et Schult.	Poaceae		+		T	Arch	Stel med
218	<i>Silene vulgaris</i> (Moench) Garcke	Caryophyllaceae		+		H	Ap	Stel med
219	<i>Sinapis arvensis</i> L.	Brassicaceae	+			T	Arch	Stel med

No.	Name of species	Family	Locality			LF	GHg	PSg
			W	O	R			
220	<i>Solidago gigantea</i> Aiton	Asteraceae	+	+	+	G, H	Kn	Artemi
221	<i>Solidago virgaurea</i> L. s. str.	Asteraceae	+	+	+	H	Sp	Que rob
222	<i>Stachys palustris</i> L.	Lamiaceae	+		+	G	Ap	Mol-Arr
223	<i>Stellaria graminea</i> L.	Caryophyllaceae			+	H	Ap	-
224	<i>Symphytum officinale</i> L.	Boraginaceae	+	+	+	H	Ap	-
225	<i>Tanacetum vulgare</i> L.	Asteraceae	+	+	+	H	Ap	Artemi
226	<i>Thlaspi arvense</i> L.	Brassicaceae		+		T, H	Arch	Stel med
227	<i>Thymus pulegioides</i> L.	Lamiaceae	+	+	+	C	Sp	-
228	<i>Torilis japonica</i> (Houtt.) DC.	Apiaceae	+		+	H, T	Ap	Artemi
229	<i>Tragopogon pratensis</i> L.	Asteraceae		+	+	H	Ap	Mol-Arr
230	<i>Trifolium arvense</i> L.	Fabaceae			+	T	Ap	Koel-Cory
231	<i>Trifolium campestre</i> Schreb.	Fabaceae	+		+	T	Ap	Koel-Cory
232	<i>Trifolium dubium</i> Sibth.	Fabaceae		+		T	Ap	Mol-Arr
233	<i>Trifolium hybridum</i> L.	Fabaceae	+		+	H	Ap	Mol-Arr
234	<i>Trifolium medium</i> L.	Fabaceae	+	+	+	H	Ap	Trif-Ger
235	<i>Trifolium montanum</i> L.	Fabaceae		+		H	Sp	Mol-Arr
236	<i>Trifolium pratense</i> L.	Fabaceae	+		+	H	Ap	Mol-Arr
237	<i>Trifolium repens</i> L.	Fabaceae		+	+	H	Ap	Mol-Arr
238	<i>Trisetum flavescens</i> (L.) P. Beauv.	Poaceae	+			H	Sp	Mol-Arr
239	<i>Tussilago farfara</i> L.	Asteraceae	+		+	G	Ap	Artemi
240	<i>Urtica dioica</i> L.	Urticaceae	+	+	+	H	Ap	Artemi
241	<i>Valeriana officinalis</i> L.	Valerianaceae	+			H	Sp	Mol-Arr
242	<i>Verbascum nigrum</i> L.	Scrophulariaceae	+	+		H	Sp	Epilob
243	<i>Veronica chamaedrys</i> L.	Scrophulariaceae	+	+	+	C	Ap	-
244	<i>Veronica serpyllifolia</i> L.	Scrophulariaceae	+			H	Ap	Mol-Arr
245	<i>Viburnum opulus</i> L.	Caprifoliaceae		+	+	N	Sp	Rham-Pru
246	<i>Vicia cracca</i> L.	Fabaceae	+	+	+	H	Ap	Mol-Arr
247	<i>Vicia grandiflora</i> Scop.	Fabaceae		+		T	Kn	-
248	<i>Vicia hirsuta</i> (L.) Gray	Fabaceae		+		T	Arch	Stel med
249	<i>Vicia sepium</i> L.	Fabaceae	+	+		H	Sp	Trif-Ger
250	<i>Viola canina</i> L.	Violaceae		+		H	Sp	Nard-Cal
251	<i>Viola odorata</i> L.	Violaceae	+			H	Ap	Artemi
252	<i>Viola riviniana</i> Rchb.	Violaceae		+		H	Sp	Que-Fag

## Explanations

Locality: W – Wojkówka, O – Odrzykoń, R – Rzepnik.

Protection of species: [S] – strictly protected species, [P] – partially protected species.

PSg (phytosociological group): Agr-rep – *Agropyreteae intermedio-repentis*, Aln glu – *Alnetea glutinosae*, Artemi – *Artemisietea*, Bident – *Bidentetea tripartiti*, Epilob – *Epilobietea angustifolii*, Fest-Brom – *Festuco-Brometea*, Koel-Cory – *Koelerio glaucae-Corynephoretea canescentis*, Mol-Arr – *Molinio-Arrhenatheretea*, Nard-Cal – *Nardo-Callunetea*, Phragm – *Phragmitetea*, Que-Fag – *Querceto-Fagetea*, Que rob – *Quercetea robori-petraeae*, Rham-Pru – *Rhamno-Prunetea*, Sal purp – *Salicetea purpureae*, Stel med – *Stellarietea mediae*, Trif-Ger – *Trifolio-Geranietea sanguinei*, Vac-Pice – *Vaccinio-Piceetea*.

LF (life forms): M – megaphanerophyte, N – nanophanerophyte, C – herbaceous chamaephyte, H – hemicryptophyte, G – geophyte, T – therophyte.

GHg (geographic-historical groups): Ap – apophytes (spontaneophytes synanthropic), Arch – archaeophytes, Kn – kenophytes, Sp – spontaneophytes nonsynanthropic.

phytes (58.7% of the total flora) and 80 spontaneophytes (31.8%). Anthropophytes were dominated by archeophytes (17 species – 6.7% of the flora) represented by common weeds: *Consolida regalis*, *Lathyrus tuberosus*, *Papaver rhoeas*, *Vicia hirsuta*, and *Setaria pumila*. The other anthropophytes were represented by seven kenophytes (2.8%) (Table 3).

The analysis of the phytosociological groups indicates that the investigated area is represented by species characteristic for 17 classes (Table 4). The primary aim of the conservation of the area is sustenance of the thermophilic meadow complexes (*Mo-*

*linio-Arrhenatheretea*) with fragments of xerothermic grasslands (*Festuco-Brometea*) and margin communities (*Trifolio-Geranietea*). Species typical of xerothermic grasslands (*Festuco-Brometea*) accounted for 5.6% (14 species). The most frequent taxa included *Centaurea scabiosa*, *Allium oleraceum*, *Carlina vulgaris*, *Euphorbia cyparissias*, *Salvia verticillata*, *Plantago media*, and *Melampyrum arvense*. A slightly lower proportion was reported for species of thermophilic margin communities (*Trifolio-Geranietea*) 4.7% (12 species) such as *Medicago falcata*, *Agrimonia eupatoria*, *Clinopodium vulgare*, *Coronilla varia*, *Origanum vulgare*, and *Galium*

Table 2. Share of life forms in the flora of Natura 2000 "Łąki nad Wojkówką"

Life form	Number of species	%
Megaphanerophyte	14	5.6
Nanophanerophyte	13	5.1
Chamaephyte	6	2.4
Hemicryptophyte	160	63.5
Geophyte	22	8.7
Therophyte	37	14.7
Total	252	100

Table 3. Geographic-historical status groups in the flora of Natura 2000 "Łąki nad Wojkówką"

Geographic-historical status	Number of species	%
Apophytes	148	58.7
Spontaneophytes	80	31.8
Archaeophytes	17	6.7
Kenophytes	7	2.8
Total	252	100

*verum*. Xerothermic grassland communities together with thermophilic scrubs and shrub communities formed a dynamic mosaic, which is an ecologically indivisible unit. The highest share in the analysed flora was exhibited by fresh meadow species from the class *Molinio-Arrhenatheretea* (66 species – 26.2%). The meadow structure was dominated by high grasses with the predominant *Arrhenatherum elatius* species. Species of the order *Arrhenatheretalia elatioris*, such as *Galium mollugo*, *Knautia arvensis*, *Lotus corniculatus*, *Pimpinella major*, *Plantago lanceolata*, *Achillea millefolium*, *Daucus carota*, and *Leucanthemum vulgare*, were particularly abundant; their presence is an indication of the thermophilic nature of these meadows.

Notably, other communities were represented by species from the class *Rhamno-Prunetea* accompany-

Table 4. Share of phytosociological groups in the flora of Natura 2000 "Łąki nad Wojkówką"

Phytosociological units	Number of species	%
<i>Bidentetea tripartiti</i>	2	0.8
<i>Stellarietea mediae</i>	15	6
<i>Epilobieteae angustifolii</i>	10	4
<i>Artemisieteae vulgaris</i>	30	12
<i>Agropyreteae intermedio-repentis</i>	3	1.1
<i>Phragmiteteae</i>	1	0.4
<i>Koelerio glaucae-Corynephoreteae canescentis</i>	6	2.4
<i>Molinio-Arrhenathereteae</i>	66	26.2
<i>Festuco-Brometeae</i>	14	5.6
<i>Nardo-Calluneteae</i>	11	4.3
<i>Trifolio-Geranieteae sanguinei</i>	12	4.7
<i>Rhamno-Pruneteae</i>	9	3.6
<i>Saliceteae purpureae</i>	1	0.4
<i>Alnetae glutinosae</i>	2	0.8
<i>Vaccinio-Piceeteae</i>	3	1.2
<i>Querceteae robori-petraeae</i>	2	0.8
<i>Quercio-Fageteae</i>	23	9.1
<i>Inne</i>	42	16.6
Total	252	100

ing xerothermic grasslands and accounting for 3.6% (9 species). The most frequent of these were *Prunus spinosa*, *Crataegus monogyna*, *Cornus sanguinea*, and *Rosa canina*. Ruderal species from the class *Artemisieteae vulgaris*, which were primarily noted at the border of the area near roads, paths, fallows, and disturbed sites, had a significant share (30 species – 12%) in the flora. Such species as *Artemisia vulgaris*, *Chaerophyllum aromaticum*, *Cirsium arvense*, *Eupatorium cannabinum*, *Melilotus officinalis*, *Picris hieracioides*, *Tanacetum vulgare*, and *Urtica dioica* were found in all the three localities. Forest species from the class *Quercio-Fageteae* (23 species – 9.1%) associated with the forest ecosystems adjacent to the study area were also reported. Plant species with undefined phytosociological affiliation accounted for 16.6% of the analysed flora.

The floristic inventory of the "Łąki nad Wojkówką" revealed occurrence of only three legally protected species, i.e. *Dianthus armeria* and *Gentiana cruciata*, which are under strict protection, and the partially protected *Centaurium erythraea* (ROZPORZĄDZENIE... 2014). However, the *Gentianella ciliata* species reported by MRÓZ & ROGALA (2011) was not found.

## DISCUSSION

The great richness of plant species in the analysed area is associated with the diversity of habitats in terms of wetness, terrain features, and the intensity and type of anthropogenic factors. The geological structure also exerts a significant effect on the occurrence of thermophilic vegetation. The geological formations of the analysed area are rich in calcium carbonate, which contributes to development of habitats of xerothermic plants (WÓJCIK et al. 2014). The area is overgrown by grassland, meadow, forest, scrub, and wet meadow species as well as species typical of segetal and synanthropic habitats. The degree of isolation of the individual study objects, which are located at a distance of a few to several dozen kilometres, is also important. They constitute small enclaves of xerothermic plants surrounded by forests, scrubs, and arable fields.

The study area exhibits a high proportion of species from the class *Molinio-Arrhenathereteae*, while the share of species characteristic for the classes *Festuco-Brometeae* and *Trifolio-Geranieteae* is substantially lower. The results of the phytosociological analyses confirm the occurrence of transitional phytocoenoses, which resemble thermophilic meadows, xerothermic grasslands, and margin communities (Ziaja & Wójcik 2014). Similar communities were distinguished by Kucharzyk (2010) and Barabasz-Krasny (2011) from the Przemyskie Foothills and by Wójcik & Piątek (2015) from the Strzyżowskie Foothills.

In the Carpathian Foothills, thermophilic grasslands are rare communities occurring primarily on



slopes with southern exposure in the valleys of large rivers. They occupy small areas with unspecified syntaxonomic affiliation and with a large share of species from the classes *Trifolio-Geranietea* and *Molinio-Arrhenatheretea* (TOWPASZ 1990, OKLEJEWICZ 1996, TRĄBA et al. 2006).

The floristic values of the analysed area are evidenced by the natural character of the flora, which confirms the high share of native species (90.5%). The proportion of alien species, which accounted for 9.5% of the analysed flora, is negligible. The management of the area, in particular of the quarries, promoted encroachment of alien elements in our flora. Keno-phytes can mainly be found in disturbed sites, e.g. at roadsides or quarries; *Solidago gigantea* and *Erigeron annuus* were the only species growing in all the three localities and they were common in the study area. The presence of the agrocoenoses in the area neighbourhood promoted occurrence of archeophytes.

A major threat to xerothermic grasslands is the abandonment of traditional management, which leads to progression of secondary succession, changes in the community structure, increased wetness, and transformation of grasslands into meadow and scrub communities (BĄBA 2004, PERZANOWSKA & KUJAWA-PAWLACZYK 2004, BARAŃSKA & JERMACEK 2009). This process results in a decline in the number and, in some sites, total disappearance of xerothermic species. This may have been the cause of the disappearance of *Gentianella ciliata* (partially protected species). Abandonment of grassland management leads to initial transformation into thermophilic margin communities from the class *Trifolio-Geranietea*, and next into thermophilic scrubs (BARAŃSKA & JERMACEK 2009).

Similar processes are observed in meadows that transform towards scrub communities after abandonment of management. A rapid decrease in the species richness accompanied by development of expansive grass and dicot species is then observed (KRYSZAK 2004, KRYSZAK & KRYSZAK 2007, WOLAŃSKI & ROGUT 2012). In the analysed area, such processes are especially intensive in Rzepnik, where due to abandonment of management the meadows have been colonised by nitrophilous and expansive species of high perennials (*Urtica dioica*, *Cirsium arvense*, *Solidago gigantea*).

The meadow and xerothermic vegetation in Wojkówka, Odrzykoń, and Rzepnik fully deserves to be protected. Active protection measures should be implemented in order to conserve these thermophilic vegetation stands, which are unique in the Western Carpathians. Mowing and hay removal, as well as grazing practices, will impede the development of expansive perennials and woody vegetation. Therefore, the degree of identification and conservation of xerothermic grassland species is important for effective protection.

## CONCLUSIONS

The Natura 2000 area "Łąki nad Wojkówką" aims at conservation of the communities of xerothermic grasslands and thermophilic meadows, which are rare in the region of the Carpathian Foothills.

The vascular flora comprises 252 species from 49 families and 166 genera. *Asteraceae*, *Poaceae*, *Fabaceae*, *Rosaceae*, *Lamiaceae*, and *Apiaceae* are the richest families.

Native species, i.e. spontaneophytes and apophytes, dominate, which indicates a natural character of the area.

Protected species *Dianthus armeria*, *Gentiana cruciata*, *Centaureum erythraea* were noted; however, *Gentianella ciliata* was not found during the investigations.

Conservation of the study area necessitates systematic treatments such as mowing, grazing, and felling trees and shrubs that disturb the structure of the ecosystem and contribute to retreat of thermophilic species.

## ACKNOWLEDGMENTS

The authors thank Waław Bartoszek PhD for identification of *Alchemilla monticola* and species from the genus *Carex*.

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- For citation:** ZIAJA M., WÓJCIK T. (2015): Vascular flora of the Natura 2000 area “Łąki nad Wojkówką” PLH 180051 (Dynowskie Foothills). *Steciana* 19(2): 105–114. DOI 10.12657/steciana.019.012