

Vegetation of the ‘Mierzvice’ nature reserve and its protection

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Abstract. The ‘Mierzvice’ nature reserve (forest district 206b, c and d of the Sarnaki Forest Inspectorate), situated in the area of the Podlaski Przełom Bug Landscape Park, is one of the most valuable natural assets of the central Bug river valley. The 12.98 ha reserve was established in 2010 to aid protection of the stand of xerothermic vegetation and its surrounding deciduous forest. In total, eight plant associations were identified within the reserve: *Geranio-Peucedanetum cervariae*, *Geranio-Anemonetum sylvestris*, *Geranio-Trifolietum alpestris*, *Trifolio medii-Agrimonetum*, *Rubro fruticosi-Prunetum*, *Rhamno-Cornetum sanguinei*, *Potentillo albae-Quercetum* and *Tilio cordatae-Carpinetum betuli*. Furthermore, 23 protected and 31 endangered species were found in the reserve including the following examples: *Cephalanthera rubra*, *Thesium ebracteatum*, *Cypripedium calceolus*, *Gentiana cruciata*, *Anemone sylvestris*, *Cimicifuga europaea*, *Viola rupestris*, *Crepis praemorsa*, *Asperula tinctoria*, *Stachys recta*, *Laserpitium latifolium*. Over the last few years, a regression of the species diagnostic number for thermophilous oak forests and xerothermic grasslands has been observed as a result of succession and expansion of *Calamagrostis epigejos*. Active protection of xerothermic vegetation such as uprooting of trees and bushes, regular grazing or mowing has been suggested in order to prevent the expansion of *Calamagrostis epigejos*.

Keywords: ‘Mierzvice’ nature reserve, Sarnaki Forest Inspectorate, vegetation, active protection

1. Introduction and aim of research

The Bug is one of the few rivers in Europe which has preserved its natural, meandering nature almost along its entire length and whose valley landscape has only slightly been transformed by man. Spontaneous erosion and accumulation processes are the main factors influencing the habitats in the river valley. As a result, gorges have developed with high slopes (up to 30 metres in height); well-developed fluvial terraces, oxbow lakes, and sandbanks can also be seen.

Established in 2010, the ‘Mierzvice’ floristic reserve with an area of 12.98 hectares, (Order No. 15 of the Regional Director of Environmental Protection in Warsaw of June 17, 2010 (Dz. Urz. Woj. Mazowieckiego of 24 August 2010, No. 155, item 3827)) is one of the most valuable natural sites of the Middle Bug River Valley. The thermophilous vegetation in the territory of the reserve and the surrounding deciduous forest with numerous protected and endangered plant species are subjected to legal protection.

The forest clearing (compartment 206d) with thermophilous forest edge communities and the patch of thermophilous

oak forest (*Potentillo albae-Quercetum*), being a valuable habitat of xerothermic vegetation, are the most valuable fragments of the reserve (Wierzba et al. 2010). Earlier, this fragment of the reserve (5.68 hectares) was under protection with the status of ‘Mierzvice rock outcrop’ documentation site. It holds about 100 rocks partly buried in the ground, consisting of fine-grained granite with a circumference of up to 230 cm.

The aim of the research was to present the characteristics of the vegetation cover of the ‘Mierzvice’ nature reserve, taking into account the resources of protected and endangered species, and to specify the main active protection measures.

2. Study site

The ‘Mierzvice’ reserve is located in the commune Sarnaki (Mazowieckie Province), south-west of the road Mierzvice Stare – Klepaczew. The Bug river is approximately 0.7 km north of the reserve boundaries. The geographical coordinates of the reserve are: N 52°19'48", E 22°59'17" (ATPOL GD00). From the northeast it neighbours with the Zabuże forest-landscape reserve.

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The reserve consists of forest compartments 206b, c and d, located in the territory of the Mierzvice Forest Subdistrict (Sarnaki Forest District). Compartment 206b consists of a mixed forest stand with dominant pine, age class IV. Compartment 206c differs from compartment 206b by the presence of deciduous species in stand composition with dominant oak, lime and hornbeam, age class III. In the forest clearing (compartment 206d), a young spruce stand (age class I and II) was established.

The diversified topography of the reserve and its surroundings (ravines, steep slopes, significant differences in relative height) was formed as a result of glacier accumulation activity and erosive impact of glacial and precipitation waters (Mojski 1972). There are no permanent watercourses within the reserve.

The ‘Mierzvice’ reserve is located in the ‘Podlaski Przełom Bugu’ mezoregion and Południowopodlaska Lowland macroregion (Kondracki 2009). According to the geobotanical division by Matuszkiewicz (1993), the area of the research is part of the ‘Ujście Krzny-Granne’ Subdistrict of the Bug Valley, Siedlce District, Południowomazowiecko-Podlaska Region. According to the natural-forest regionalization by Trampler et al. (1990), the reserve is located in the Siedlce Upland Mesoregion in the Mazowsze-Podlasie Natural-Forest Region IV.

This area is located in the ‘Podlaski Przełom Bugu’ Landscape Park within the confines of the Natura 2000 sites: ‘Ostoja Nadbużańska’ Refuge (PLB 140001) and ‘Ostoja Nadbużańska’ Refuge (PLH 140011).

3. Methods

The field studies were conducted in three study periods: 2000–2001, 2009 and 2013 during which a list of plant species in the reserve was made, including their frequency (1–2 patches – very rarely, 3–5 – rarely, 5–10 – rather often, more than 10 – often). Their dynamic growth was determined on the basis of the differences in species frequency and their range of expansion in the further study periods. Moreover, in 2013, 27 phytosociological relevés were made in accordance with the Braun-Blanquet method (Pawłowski 1977) based on which the reserve’s plant communities are described.

The nomenclature of vascular plant species was adopted after Mirek et al. (2002), the basic form of life was described after Zarzycki et al. (2002) and the phytosociological classification of the distinguished plant communities was done after Matuszkiewicz (2006). The comparison of the protected and endangered species in the territory of the reserve, including its forest clearing with the delimited plant communities is shown in Fig. 1.

4. Results

Vascular plants are represented in the reserve by 187 species of 48 families and 137 genera. Forest and thicket plants dominate (87 species – 46.5% of the flora), with the prevalence of

deciduous forest species of the class *Querc-Fagetea* (79.1%). Plants characteristic of the order *Quercetalia pubescenti-petraeae* are in a relatively large number (12.8%). The forest edge species of the class *Trifolio-Geranietea* (26 species – 13.9% of flora) and meadow species of the class *Molinio-Arrhenantheretea* (25 species – 13.4%) also have a significant share in the reserves’ vegetation. Only one geographically alien species – the greater musk-mallow *Malva alcea* was identified in the reserve.

Seventeen vascular plant species in the territory of the reserve are under legal protection (Ordinance of the Minister of the Environment of 9 October 2014) (Table 1); five species are under strict protection; and 12 under partial protection. Three of them require active protection (*Cypripedium calceolus*, *Gentiana cruciata*, *Thesium ebracteatum*). Two species – lady’s slipper orchid *Cypripedium calceolus* (Nowicka-Falkowska, Wierzba 2009) and bastard toadflax *Thesium ebracteatum* – are plants that are important in the community.

In total, 31 species are endangered on a regional (Głowacki et al., 2003) or national scale (Zarzycki, Szelağ 2006). In the Południowopodlaska Lowland, two species – *Anemone sylvestris* and *Cephalanthera rubra* – are considered critically endangered (CR), six others – *Achillea collina*, *Cimicifuga europaea*, *Laserpitium latifolium*, *Stachys recta*, *Viola collina*, *Viola rupestris* – endangered species (EN). The leafless hawk’s beard *Crepis praemorsa* included in the regional list of endangered species has the status of an extinct species (EX), because its only known location was not confirmed within the present confines of the ‘Mierzvice’ reserve at the time of drawing up the list (2003). The later detection of leafless hawk’s beard in this area (three flowering shoots in 2009, two in 2013) indicates the need to change the status of this species into CR during the next update of the current regional list.

The aforementioned lady’s slipper orchid is also preserved in the ‘Mierzvice’ reserve. In the period 2001–2009, two individuals were recorded there, whereas in 2013, only one flowering shoot was found. Due to the high rank of the species and a scarce number of its locations in the Południowopodlaska Lowland, it is necessary to consider lady’s slipper orchid critically endangered (CR) and include it in the next edition of the regional list.

The population of *Thesium ebracteatum* is systematically declining. In 2001, more than 50 individuals of this species were identified, in 2009 a total of 37 and in 2013 only 16 individuals. After 2001, the star gentian *Gentiana cruciata* appeared in one location. Their population decreased from a dozen individuals in the first study period to five individuals in 2013 (including three flowering specimens). *Anemone sylvestris* population in 2001 was represented by a few dozen individuals. In 2009 and 2013, there were only a dozen individuals of this species. The number of locations with *Cephalanthera rubra* declined from more than 20 individuals in 2001, 12 individuals in 2009, and 5 individuals in 2013. The *Achillea collina* population decreased in the last study period from several dozen to a dozen individuals.

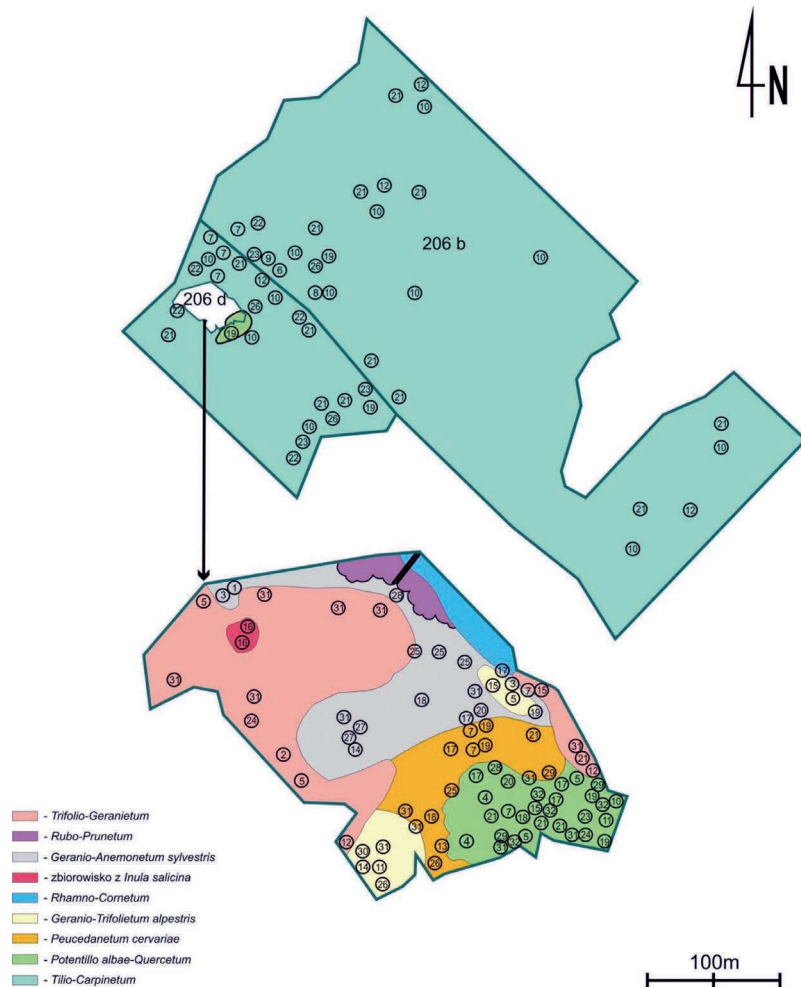


Figure 1. Comparison of the distribution of protected and endangered vascular plant species with the plant communities of the 'Mierzvice' nature reserve.

1 – *Achillea collina*, **2** – *Allium oleraceum*, **3** – *Anemone sylvestris*, **4** – *Anthericum ramosum*, **5** – *Aquilegia vulgaris*, **6** – *Cephalanthera rubra*, **7** – *Cimicifuga europaea*, **8** – *Crepis praemorsa*, **9** – *Cypripedium calceolus*, **10** – *Daphne mezereum*, **11** – *Digitalis grandiflora*, **12** – *Epipactis hellborine*, **13** – *Gentiana cruciata*, **14** – *Hieracium piloselloides*, **15** – *Hierochloë australis*, **16** – *Inula salicina*, **17** – *Laserpitium latifolium*, **18** – *Laserpitium prutenicum*, **19** – *Lilium martagon*, **20** – *Listera ovata*, **21** – *Melittis melissophyllum*, **22** – *Neottia nidus-avis*, **23** – *Platanthera bifolia*, **24** – *Pulmonaria angustifolia*, **25** – *Stachys recta*, **26** – *Thalictrum aquilegifolium*, **27** – *Thesium ebracteatum*, **28** – *Verbascum phoeniceum*, **29** – *Vicia cassubica*, **30** – *Vicia sylvatica*, **31** – *Viola collina*, **32** – *Viola hirta*.

In 2013, the occurrence of *Asperula tinctora* and *Viola rupestris* was not confirmed. The populations of other regionally endangered species (category EN), such as *Cimicifuga europaea*, *Laserpitium latifolium*, *Stachys recta*, *Viola collina* remain at the same level.

Plant communities

Eight plant communities were identified in the reserve (Matuszkiewicz 2006):

Class: *Trifolio-Geranieta sanguinei* Th. Müll. 1962

Order: *Origanetalia* Th. Müll. 1962

Alliance: *Geranion sanguinei* R.Tx. 1961 in Th. Müller 1962

1. Association: *Geranio-Peucedanetum cervariae* (Kuhn 1937) Th. Müll. 1961

2. Association: *Geranio-Anemonetum sylvestris* Th. Müll. 1961

3. Association: *Geranio-Trifolietum alpestris* Th. Müll. 1961

Alliance: *Trifolion medii* Th. Müll. 1961

4. Association: *Trifolio medii-Agrimonetum* Th. Müll. 1961

Class: *Rhamno-Prunetea* Rivas Goday et Garb. 1961

Order: *Prunetalia spinosae* R.Tx. 1952

Alliance: *Pruno-Rubion fruticosi* R.Tx. 1952 corr. Doing 1962

5. Association: *Rubo fruticosi-Prunetum spinosae* Web. 1974 n.inv. Wittig 1976

Alliance: *Berberidion* Br.-Bl. (1947) 1950

6. Association: *Rhamno-Cornetum sanguinei* (Kais. 1930) Pass (1957) 1962

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

Order: *Quercetalia pubescenti-petraeae* Klika 1933 corr. Moravec in Beg. et Theurill 1984

Alliance: *Potentillo albae-Quercion petraeae* Zöl. et Jakucs n.nov. Jakucs 1967

7. Association: *Potentillo albae-Quercetum* Libb 1933

Order: *Fagetalia sylvaticae* Pawł. in Pawł., Sokoł. et Wall. 1928

Alliance: *Carpinion betuli* Issl. 1931 em. Oberd. 1953

8. Association: *Tilio cordatae-Carpinetum betuli* Tracz. 1962.

Table 1. Protected and endangered plant species in the ‘Mierzvice’ nature reserve: ●● – strict protection, ● – partial protection (Ordinance of the Ministry of the Environment of 9.10.2014); * Nature 2000 list, ¹ – species requiring active protection, ² – ban on the transport of specimens, ³ – species not included in the exceptions mentioned in § 8. 1; NPP – Południowopodlaska Lowland (Głowacki et al. 2003); 1 – very rare, 2 – rare, 3 – rather frequent, 4 – frequent (see the chapter ‘Methods’).

Species	Legal protection	Category of threat		Frequency		
		in Poland (Zarzycki, Szelaǳ 2006)	NPP	2001	2009	2013
<i>Achillea collina</i>			EN	2	2	1
<i>Allium oleraceum</i>			LR	2	1	1
<i>Anemone sylvestris</i>	●		CR	2	1	1
<i>Anthericum ramosum</i>			VU	2	2	1
<i>Aquilegia vulgaris</i>	●		VU	1	1	1
<i>Asperula tinctoria</i>		V	VU	1	1	-
<i>Cephalanthera rubra</i>	●●	E	CR	1	1	1
<i>Cimicifuga europaea</i>	●		EN	3	3	3
<i>Crepis praemorsa</i>			EX	1	1	1
<i>Cypripedium calceolus</i>	●●* ^{1, 2, 3}	V	DD	1	1	1
<i>Daphne mezereum</i>	●		VU	4	4	4
<i>Digitalis grandiflora</i>	●		VU	2	1	1
<i>Epipactis helleborine</i>	●			2	2	2
<i>Gentiana cruciata</i>	●● ¹		VU	1	1	1
<i>Hieracium piloselloides</i>			DD	2	1	1
<i>Hierochloë australis</i>	●	V	VU	2	2	2
<i>Inula salicina</i>			VU	2	2	2
<i>Laserpitium latifolium</i>			EN	2	2	2
<i>Laserpitium prutenicum</i>			VU	3	3	2
<i>Lilium martagon</i>	●●		VU	3	3	2
<i>Listera ovata</i>	●		LR	1	1	1
<i>Melittis melissophyllum</i>	●			4	4	4
<i>Neottia nidus-avis</i>	●		VU	2	2	2
<i>Platanthera bifolia</i>	●		VU	2	2	2
<i>Pulmonaria angustifolia</i>			VU	2	1	1
<i>Stachys recta</i>			EN	2	2	2
<i>Thalictrum aquilegifolium</i>			VU	2	2	2
<i>Thesium ebracteatum</i>	●●* ^{1, 2, 3}	V	VU	1	1	1
<i>Verbascum phoeniceum</i>	●			1	1	1
<i>Vicia cassubica</i>			LR	2	1	1
<i>Vicia sylvatica</i>			LR	2	1	1
<i>Viola collina</i>			EN	3	3	3
<i>Viola hirta</i>			VU	2	2	2
<i>Viola rupestris</i>			EN	1	1	-

The phytosociological characteristics of forest edge and forest communities, presented in the form phytosociological relevés, are summarised in Tables 2 and 3.

Geranio-Peucedanetum cervariae

A three-layer plant community formed established on the border of compartments 206c and 206d. The canopy closure of the shrub layer does not exceed 10%. It includes blackthorn *Prunus spinosa*, dogwood *Cornus sanguinea*, European pear *Pyrus communis*, pedunculate oak *Quercus robur*. The dominant species in the highly dense herbaceous layer include broad-leaved spignel *Peucedanum cervaria* (coverage 3–4), accompanied by other species typical of the association: brown knapweed *Centaurea jacea*, multiflowered buttercup *Ranunculus polyanthemus*, Irish fleabane *Inula salicina*. The constancy degree of the species of the class *Trifolio-Geranietea* is high: flat pea *Lathyrus sylvestris*, wild basil *Clinopodium vulgare*, crown vetch *Coronilla varia*, oregano *Origanum vulgare*, zigzag clover *Trifolium medium*, hog's fennel *Peucedanum oreoselinum*, broad-leaved sermountain *Laserpitium latifolium*. The share of plants of the class *Festuco-Brometea* (greater knapweed *Centaurea scabiosa*, stiff hedgenettle *Stachys recta*), *Molinio-Arrhenatheretea* (cocksfoot *Dactylis glomerata*, lesser saxifrage *Pimpinella saxifraga*, hedge bedstraw *Galium mollugo*) and *Quercu-Fagetea* (hill violet *Viola collina*, *Cimicifuga europaea*) is also high. Attention should also be given to the presence of wood small reed *Calamagrostis epigejos*.

Geranio-Anemonetum sylvestris

This plant community develops in the central part and along the northern edge of compartment 206d. The canopy closure of the shrub layer does not exceed 10%. It includes *Cornus sanguinea*, *Prunus spinosa*, sometimes, *Quercus robur*. The snowdrop anemone *Anemone sylvestris* (coverage +2) is a permanent component of the herbaceous layer. The species of the class *Trifolio-Geranietea* (*Lathyrus sylvestris*, *Clinopodium vulgare*, *Origanum vulgare*, *Trifolium medium*, common agrimony *Agrimonia eupatoria*, *Coronilla varia*, astragalus liquorice milkvetch *Astragalus glycyphyllos*), *Festuco-Brometea* (*Centaurea scabiosa*, *Stachys recta*), *Molinio-Arrhenatheretea* (*Dactylis glomerata*, *Pimpinella saxifraga*, oxeye daisy *Leucanthemum vulgare*, *Laserpitium prutenicum*), and *Quercu-Fagetea* (*Viola collina*, *Cimicifuga europaea*, *Quercus robur* regeneration) are a permanent component of this community. The most abundant among the associated species are: *Calamagrostis epigejos*, wild strawberry *Fragaria vesca* and European goldenrod *Solidago virgaurea*.

Geranio-Trifolietum alpestris

This plant community occurs in the form of small patches in the western and northern parts of the clearing (separation

206d). The species characteristic and distinctive of the community *Geranio-Trifolietum alpestris* are, *inter alia*: clover *Trifolium alpestre*, lily of the valley *Convallaria majalis*, white cinquefoil *Potentilla alba*, Kashubian vetch *Vicia cassubica*. There is also a large number of species of the class *Trifolio-Geranietea* (*Lathyrus sylvestris*, *Clinopodium vulgare*, *Coronilla varia*, *Origanum vulgare*, *Trifolium medium*, *Peucedanum oreoselinum*, and *Astragalus glycyphyllos*), *Festuco-Brometea* (*Centaurea scabiosa* and *Stachys recta*), *Molinio-Arrhenatheretea* (*Dactylis glomerata*, *Pimpinella saxifraga*, *Galium mollugo*) and *Quercu-Fagetea* (*Viola collina*, mountain melick *Melica nutans*, wood bluegrass *Poa nemoralis*, cowslip *Primula veris*). *Calamagrostis epigejos* occurs in the community in large numbers.

Trifolio medii-Agrimonietum

This community dominates in the central and western parts of the forest clearing (compartment 206d). The shrub layer can reach up to 5% of the canopy closure, while the herbaceous layer has almost full canopy closure. The characteristic and distinctive species of the community include: *Trifolium medium*, common agrimony *Agrimonia eupatoria*, and blue alfalfa *Medicago falcata*, *Centaurea jacea*. The species with a high degree of constancy belong to the classes: *Trifolio-Geranietea* (*Coronilla varia*, *Lathyrus sylvestris*, *Peucedanum oreoselinum*, *Origanum vulgare*, smooth meadow-grass *Poa angustifolia*, *Clinopodium vulgare*), *Festuco-Brometea* (*Centaurea scabiosa* and tall hawkweed *Hieracium piloselloides*), *Molinio-Arrhenatheretea* (*Dactylis glomerata*, *Galium mollugo*, *Pimpinella saxifraga*, field scabious *Knautia arvensis*), *Quercu-Fagetea* (bugle *Ajuga reptans*, *Melica nutans*, and *Viola collina*) and, among the associated species, *Calamagrostis epigejos* and *Fragaria vesca*.

Rubo fruticosi-Prunetum and Rhamno-Cornetum sanguinei

Small patches of these communities can be encountered on the northern edge of the clearing (compartment 206d). *Rubo fruticosi-Prunetum* – is composed of shrub communities with *Prunus spinosa*, common hawthorn *Crataegus monogyna* and *Rubus* spp. *Rhamno-Cornetum sanguinei* develops in the form of dense thickets composed of: *Cornus sanguinea*, *Prunus spinosa*, common buckthorn *Rhamnus cathartica* and spindle *Euonymus verrucosa*. The herbaceous layer contains a few forest species (e.g. *Poa nemoralis*, *Melica nutans*, common bracken *Pteridium aquilinum*, *Brachypodium sylvaticum* *Brachypodium sylvaticum*) and forest edge species (e.g. *Trifolium medium* yellow bedstraw *Galium verum*, *Clinopodium vulgare*, *Galium mollugo*). In addition, a patch of the community with Irish fleabane *Inula salicina* as a dominant species was noted in compartment 206d, with a sporadic occurrence

Table 2. The phytosociological characteristic of nonforest communities in the ‘Mierzvice’ nature reserve. A – *Peucedanetum cervariae*, B – *Geranio-Anemonetum sylvestris*, C – *Geranio-Trifolietum alpestris*, D – *Trifolio medii-Agrimonetum*.

Association	A			B			C			D						
Relevé number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Date	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013	18.06.2013
Forest compartment	206d	206d	206d	206d	206d	206d	206d	206d	206d	206d	206d	206d	206d	206d	206d	206d
Area of relevé (m ²)	9	12	9	9	12	12	9	12	9	12	9	12	12	12	9	9
Exposition	NW	NW	NW	-	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
Cover of layer b (%)	5	10	5	-	10	5	-	-	-	-	-	-	-	-	5	-
Cover of layer c (%)	90	100	100	90	80	90	80	80	90	90	100	100	90	100	100	80
Ch., D. Ass. <i>Peucedanetum cervariae</i>																
<i>Peucedanum cervaria</i>	3	2	4	.	.	.	+	1	.	.	.	.	.	.	.	1
<i>Centaurea jacea</i>	.	1	1	.	+	.	.	.	+	.	.	.	.	.	.	.
<i>Ranunculus polyanthemos</i>	+	1	.	.	+	.	.	.	.	+	.	.	.	.	.	.
<i>Inula salicina</i>	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ch., D. Ass. <i>Geranio-Anemonetum sylvestris</i>																
<i>Anemone sylvestris</i>				1	+	+	.	.	.	.	.	.	.	.	.	.
Ch., D. Ass. <i>Geranio-Trifolietum alpestris</i>																
<i>Trifolium alpestre</i>	+	.	.	.	+	1	2	2	1	1	.	.	.	.	.	.
<i>Convallaria majalis</i>	.	.	.	.	+	+	1	2	1	.	.	.	.	.	.	.
<i>Potentilla alba</i>	.	.	.	.	.	.	1	1	+	.	.	.	.	.	.	.
<i>Vicia cassubica</i>	.	.	.	.	.	.	1	.	+	.	.	.	.	.	.	.
Ch, D. Ass. <i>Trifolio-Agrimonetum</i>																
<i>Trifolium medium</i>	+	1	2	2	1	1	1	.	+	1	4	3	1	4	3	2
<i>Agrimonia eupatoria</i>	.	.	.	+	1	+	.	.	+	+	1	1	+	1	.	1
<i>Medicago falcata</i>	.	.	.	.	.	.	.	.	.	.	.	+	1	+	.	1
Ch, <i>Trifolio-Geranietea</i>																
<i>Lathyrus sylvestris</i>	1	1	1	+	1	2	+	+	1	.	.	1	2	+	1	+
<i>Coronilla varia</i>	1	+	+	+	.	1	.	1	+	1	+	.	.	+	+	1
<i>Clinopodium vulgare</i>	1	1	.	+	+	1	1	.	+	+	1	+	+	.	.	.
<i>Origanum vulgare</i>	+	1	.	1	1	1	+	.	+	+	+	.	.	+	.	+
<i>Peucedanum oreoselinum</i>	.	+	+	+	.	.	.	+	+	1	1	+	1	+	.	.
<i>Astragalus glycyphyllos</i>	.	.	.	1	1	.	.	+	+	.	.	+	+	+	.	.
<i>Laserpitium latifolium</i>	1	1	.	.	.	1	.	+	.	.	.	.	.	+	.	.
Sporadically: <i>Astragalus cicer</i> 1 (4, 12, 15); <i>Galium verum</i> 1 (5, 11, 13); <i>Polygonatum odoratum</i> 1 (1, 5, 7); <i>Campanula rapunculoides</i> + (3, 8); <i>Medicago sativa</i> 1 (2, 9); <i>Vicia sylvatica</i> + (13)																
Ch. <i>Festuco-Brometea</i>																
<i>Centaurea scabiosa</i>	1	+	2	2	+	1	+	1	1	.	+	1	1	+	.	+
<i>Stachys recta</i>	1	1	+	+	1	+	+	.	1	.	.	.	.	.	.	.
<i>Hieracium piloselloides</i>	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	+
Sporadically: <i>Gentiana cruciata</i> + (1, 2); <i>Salvia pratensis</i> + (1); <i>Artemisia campestris</i> + (4); <i>Campanula glomerata</i> + (10); <i>Achillea collina</i> + (11)																
Ch. <i>Molinio-Arrhenatheretea</i>																
<i>Dactylis glomerata</i>	1	1	+	1	.	+	.	1	+	1	2	+	.	1	1	1
<i>Galium mollugo</i>	.	1	+	.	.	+	1	.	1	.	2	1	1	1	+	1

Association	A			B			C			D						
<i>Pimpinella saxifraga</i>	1	1	.	+	+	.	+	.	1	+	+	+	.	+	.	1
<i>Knautia arvensis</i>	.	+	.	.	.	.	.	.	.	1	1	+	.	+	.	.
<i>Lathyrus pratensis</i>	.	.	.	.	+	.	.	+	.	.	.	+	.	.	.	.
<i>Leucanthemum vulgare</i>	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.
Sporadically: <i>Achillea millefolium</i> 1 (13, 14, 16); <i>Laserpitium prutenicum</i> + (5, 6, 16); <i>Prunella vulgaris</i> 1 (14, 16); <i>Carex hirta</i> + (2, 10); <i>Serratula tinctoria</i> + (1, 6); <i>Taraxacum officinale</i> + (14); <i>Pimpinella major</i> + (11)																
Ch. Rhamno-Prunetea																
<i>Cornus sanguinea</i> (b)	1	.	.	.	1	1	.	.	.	1	+	.	.	+	.	+
<i>Prunus spinosa</i> (b)	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.	.
Ch. Quercu-Fagetea																
<i>Viola collina</i>	1	+	1	+	+	1	1	.	+	3	1	.	.	+	.	1
<i>Melica nutans</i>	.	1	.	.	.	+	.	1	1	1	.	2	.	+	.	+
<i>Ajuga reptans</i>	.	.	.	1	.	.	.	.	.	1	+	.	.	+	+	.
<i>Cimicifuga europaea</i>	1	1	.	.	+	+	.	.	.	.	+	.	.	.	.	.
<i>Quercus robur</i> (c)	.	.	.	+	.	+	+	+	+	.	.	.	.	.	.	.
<i>Aegopodium podagraria</i>	.	1	.	.	.	.	.	1	.	.	+	.	.	.	+	.
<i>Brachypodium sylvaticum</i>	.	+	.	.	+	.	1	.	.	.	.	.	.	.	.	+
<i>Poa nemoralis</i>	.	.	.	.	.	.	+	1	+	.	.	+	.	.	.	.
<i>Quercus robur</i> (b)	.	1	.	.	.	1	.	.	.	1	.	.	.	.	.	+
<i>Viola mirabilis</i>	.	.	1	.	.	.	.	1	.	.	.	+	.	.	+	.
Sporadically: <i>Aquilegia vulgaris</i> + (6, 9, 12); <i>Lilium martagon</i> + (5, 6); <i>Primula veris</i> + (5, 7, 9); <i>Corylus avellana</i> c + (3, 8); <i>Populus tremula</i> c + (12, 13); <i>Pulmonaria obscura</i> + (2, 8); <i>Stellaria holostea</i> 1 (12), + (14); <i>Carex digitata</i> + (10); <i>Pulmonaria angustifolia</i> + (10); <i>Hepatica nobilis</i> + (12); <i>Lathyrus vernus</i> + (15)																
Other species																
<i>Calamagrostis epigejos</i>	1	2	2	2	1	2	1	1	2	.	+	2	2	2	4	2
<i>Fragaria vesca</i>	+	2	.	1	.	1	+	.	+	1	1	.	.	2	.	1
<i>Solidago virgaurea</i>	.	1	+	1	.	+	+	.	+	+	.	+	.	.	.	+
<i>Cirsium arvense</i>	.	r	.	.	.	.	.	.	.	.	.	r	.	.	+	+
<i>Convolvulus arvensis</i>	.	+	.	.	.	.	.	.	.	.	+	.	+	+	.	.
<i>Hypericum perforatum</i>	.	.	.	.	.	.	.	.	.	+	+	.	.	+	.	+
<i>Plagiomnium affine</i>	1	.	.	.	.	.	.	.	.	1	2	.	.	1	.	.
<i>Pteridium aquilinum</i>	.	.	+	.	+	1	.	.	.	.	.	.	1	.	.	.
<i>Pyrus communis</i> (b)	.	+	.	.	.	.	.	.	.	.	.	1	1	+	.	.
<i>Pleurozium schreberi</i>	.	+	.	1	.	.	.	.	.	2	3	.	.	.	.	.
Sporadically: <i>Chaerophyllum temulum</i> + (12, 13); <i>Chamaecytisus ruthenicus</i> 1 (10), + (3, 16); <i>Convallaria majalis</i> 1 (1, 4, 8); <i>Genista tinctoria</i> + (9, 10, 11); <i>Rhynchospora triquetra</i> 1 (10), + (2, 3); <i>Rubus saxatilis</i> 1 (12, 11, 16); <i>Hierochloë australis</i> + (8, 9); <i>Linaria vulgaris</i> 1 (2, 6); <i>Thuidium philibertii</i> 1 (10), + (14); <i>Verbascum nigrum</i> + (6, 9); <i>Sedum maximum</i> + (2); <i>Hieracium pilosella</i> + (4); <i>Atrichum undulatum</i> 1 (11); <i>Frangula alnus</i> r (14); <i>Betula pendula</i> 1 (15); <i>Agrostis capillaris</i> + (16)																

of *Trifolium medium*, *Origanum vulgare*, *Galium mollugo*, *Clinopodium vulgare*, *Calamagrostis epigejos*, *Centaurea scabiosa*, *Pimpinella saxifraga*, and *Medicago sativa*.

Potentillo albae-Quercetum

The forest community established on the border of compartments 206c and 206d (Figs. 26, 27) was classified as a juvenile form of thermophilous oak forest (*Potentillo albae-Quercetum*).

The present non-typical stand (closure 10%) consists of single individuals of Scots pine *Pinus sylvestris* and Norway spruce *Picea abies*, artificially established by planting, while pedunculate oak *Quercus robur* – by natural regeneration. The multi-species herbaceous layer is dominated by species typical of oak forests (blackening flat pea *Lathyrus niger*, bastard balm *Melittis melissophyllum*, *Ranunculus polyanthemus*, narrow-leaved lungwort *Pulmonaria angustifolia*, white cinquefoil *Potentilla alba*) and species typical of the order *Fagetalia sylvaticae* and

Table 3. Phytosociological characteristics of forest communities in the ‘Mierzvice’ nature reserve. A – *Tilio-Carpinetum*, B – *Potentillo albae-Quercetum*

Association	A									B	
	17	18	19	20	21	22	23	24	25	26	27
Relevé number	17	18	19	20	21	22	23	24	25	26	27
Date	18.06.13	18.06.13	18.06.13	18.06.13	18.06.13	18.06.13	18.06.13	18.06.13	18.06.13	18.06.13	18.06.13
Forest compartment	206c	206c	206c	206c	206c	206c	206b	206b	206b	206c	206c
Area of relevé (m ²)	400	400	400	400	400	400	250	400	300	100	100
Exposition	NNW	NNW	NW	NNW	NNW	NNW	NNW	NNW	-	NNW	NNW
Cover of layer a (%)	70	70	70	60	60	70	70	70	60	10	10
Cover of layer b (%)	20	30	30	30	10	40	40	80	40	20	10
Cover of layer c (%)	80	70	80	80	80	70	40	80	100	90	100
Cover of layer d (%)	0	5	10	5	0	0	5	20	0	0	0
Trees and shrubs											
<i>Quercus robur</i> (a ₁)	1	.	2	2	1	2	3	3	2	.	.
<i>Quercus robur</i> (b)	.	.	.	.	.	.	.	.	.	1	1
<i>Quercus robur</i> (c)	.	.	.	.	+	+	.	.	.	2	2
<i>Corylus avellana</i> (b)	2	2	1	2	1	2	2	3	2	.	.
<i>Corylus avellana</i> (c)	.	+	.	+	+	1	+	.	+	1	2
<i>Betula pendula</i> (a ₁)	2	3	3	2	3	3	.	.	1	.	.
<i>Betula pendula</i> (b)	.	.	.	.	.	.	.	.	.	.	1
<i>Pinus sylvestris</i> (a ₁)	2	3	1	.	.	2	3	2	1	.	.
<i>Pinus sylvestris</i> (a ₂)	.	.	.	.	.	.	.	.	.	.	2
<i>Euonymus verrucosus</i> (b)	1	2	2	1	.	1	1	.	1	.	.
<i>Euonymus verrucosus</i> (c)	1	.	+	1	+	1	.	.	.	.	.
<i>Cornus sanguinea</i> (b)	.	.	.	.	1	1	2	2	.	1	.
<i>Sorbus aucuparia</i> (b)	.	.	1	.	1	1	1	1	.	.	.
<i>Tilia cordata</i> (a ₁)	.	1	1	1	1	1	.	.	.	.	.
<i>Tilia cordata</i> (a ₂)	.	.	2	3	.	1	.	.	.	.	.
<i>Carpinus betulus</i> (a ₂)	1	1	1	.	.	.	.	2	.	.	.
<i>Carpinus betulus</i> c	1	+	.	+	1	.	.	.	.	.	.
Sporadically: <i>Viburnum opulus</i> b 1 (23, 21), + (20); <i>Euonymus europaeus</i> c + (18); <i>Populus tremula</i> b 1 (19); <i>Frangula alnus</i> b 1 (17); <i>Crataegus monogyna</i> c + (21); <i>Picea abies</i> a ₂ 2 (26); <i>Juniperus communis</i> b 1 (26); <i>Frangula alnus</i> b 1 (26)											
Ch. i D <i>Carpinion betuli</i>, <i>Tilio-Carpinetum</i>											
<i>Stellaria holostea</i>	2	1	2	1	2	2	+	1	1	.	.
<i>Viola mirabilis</i>	1	2	1	1	1	+	2	2	.	+	.
<i>Galium schultesii</i>	1	1	1	+	1	1	+	1	.	.	.
Ch i D. <i>Quercetalia pubescenti-petraeae</i> i <i>Potentillo albae-Quercetum</i>											
<i>Melittis melissophyllum</i>	+	.	.	+	+	.	1	+	+	2	2
<i>Lathyrus niger</i>	+	.	.	.	1	.	+	.	+	1	2
<i>Campanula persicifolia</i>	.	.	.	.	+	.	.	.	.	1	1
<i>Potentilla alba</i>	.	.	.	.	.	.	.	.	.	1	1
<i>Primula veris</i>	.	.	.	.	.	.	.	.	.	+	1
<i>Ranunculus polyanthemus</i>	.	.	.	.	.	.	.	.	.	1	1
Ch. <i>Trifolio-Geranietea</i>, <i>Festuco-Brometea</i>											
<i>Clinopodium vulgare</i>	.	.	+	.	+	+	.	+	+	1	2
<i>Astragalus glycyphyllos</i>	.	.	.	.	.	.	+	.	1	1	+

Association	A									B	
<i>Vicia sylvatica</i>	.	.	.	1	.	.	.	.	.	+	1
<i>Capanula rapunculoides</i>	1	.	.	1	1
<i>Viola hirta</i>	1	1	2
<i>Cornilla varia</i>	+	1	1
<i>Polygonatum odoratum</i>	+	2	2
<i>Trifolium alpestre</i>	1	.	.	.	.	.	.	.	.	+	1
<i>Trifolium medium</i>	1	+
<i>Melampyrum nemorosum</i>	+	+	1
<i>Vincetoxicum hirundinaria</i>	1	+
<i>Ajuga genevensis</i>	+	1
<i>Centaurea scabiosa</i>	1	1
<i>Galium verum</i>	2	1
<i>Medicago falcata</i>	1	1	+
<i>Origanum vulgare</i>	2	1
<i>Peucedanum cervaria</i>	2	1
<i>Stachys recta</i>	+	+

Ch. Fagetalia sylvaticae

<i>Pulmonaria obscura</i>	1	2	1	+	1	1	.	+	.	1	+
<i>Cimicifuga europaea</i>	+	+	.	1	2	+	.	2	+	.	r
<i>Daphne mezereum</i>	.	.	1	+	1	1	+	+	+	.	.
<i>Lathyrus vernus</i>	1	+	1	1	.	1	.	1	+	.	.
<i>Actaea spicata</i>	+	1	+	1	2	.	+	1	.	.	.
<i>Galeobdolon luteum</i>	2	1	2	2	2	1	.	.	.	.	.
<i>Milium effusum</i>	.	1	1	+	.	1	.	1	+	.	.
<i>Neottia nidus-avis</i>	r	.	.	+	+	.	r	+	+	.	.
<i>Viola reichenbachiana</i>	.	1	1	1	1	+	.	+	.	.	.
<i>Galium odoratum</i>	.	.	+	+	.	.	+	1	+	.	.
<i>Plagiomnium affine (d)</i>	.	1	+	1	.	.	+	2	.	.	.
<i>Asarum europaeum</i>	.	.	.	1	1	+	.	1	.	.	.
<i>Festuca gigantea</i>	.	.	1	+	1	.	.	+	.	.	.
<i>Lilium martagon</i>	.	.	.	1	.	+	.	+	1	.	.
<i>Phyteuma spicata</i>	.	.	+	+	1	1	.	.	.	.	.

Sporadically: *Lysimachia nemorum* 1 (20, 22); *Paris quadrifolia* 1 (19, 22, 24); *Sanicula europaea* 1 (21, 23, 24); *Scrophularia nodosa* + (19, 21, 22); *Carex sylvatica* 1 (19, 21)

Ch., D. Querco-Fagetea

<i>Hepatica nobilis</i>	1	2	1	+	1	1	.	+	.	1	+
<i>Anemone nemorosa</i>	+	+	.	1	2	+	.	2	+	.	r
<i>Carex digitata</i>	.	.	1	+	1	1	+	+	+	.	.
<i>Brachypodium sylvaticum</i>	1	+	1	1	.	1	.	1	+	.	.
<i>Melica nutans</i>	+	1	+	1	2	.	+	1	.	.	.
<i>Poa nemoralis</i>	2	1	2	2	2	1	.	.	.	.	.
<i>Viola riviniana</i>	.	1	1	+	.	1	.	1	+	.	.
<i>Moehringia trinervia</i>	r	.	.	+	+	.	r	+	+	.	.

Sporadically: *Aegopodium podagraria* 1 (17, 18); *Epipactis helleborine* + (23, 24); *Cephalanthera rubra* 1 (23); *Cypripedium calceolus* r (24)

Ch. Molinio-Arrhenatheretea

Sporadically: *Veronica chamaedrys* 1 (21, 22), + (27); *Angelica sylvestris* 1 (21, 26); *Betonica officinalis* 1 (25,23); *Centaurea jacea* 1 (26); *Galium mollugo* + (26); *Pimpinella saxifraga* + (26); *Knautia arvensis* + (27); *Laserpitium prutenicum* 1 (27)

Others											
<i>Majanthemum bifolium</i>	.	.	1	+	1	2	+	+	1	.	1
<i>Ajuga reptans</i>	.	1	2	+	2	+	.	.	+	.	.
<i>Convallaria majalis</i>	.	.	.	.	+	+	.	1	2	2	2
<i>Geranium robertianum</i>	+	1	1	1	+	+	.	.	.	.	.

Sporadically: *Dryopteris spinulosa* 1 (20, 18), + (21, 22); *Fragaria vesca* 1 (27, 23), + (21, 26); *Mycelis muralis* 1 (17, 21, 24), + (20); *Pteridium aquilinum* 1 (17, 22), + (19, 27); *Cornus sanguinea* c 1 (25), + (20, 21); *Hieracium lachenalii* 1 (19, 21, 23); *Hieracium murorum* 1 (20, 21) + (22); *Hieracium umbellatum* 1 (27, 25, 26); *Platanthera bifolia* + (23, 24, 25); *Atrichum undulatum* d 1 (18, 20); *Oxalis acetosella* 1 (19, 22); *Vaccinium myrtillus* 1 (21, 22); *Rubus saxatilis* 1 (18, 26); *Viola collina* 1 (26, 27), *Peucedanum oreoselinum* 1 (27, 26); *Thalictrum aquilegifolium* + (18); *Brachytecium rutabulum* d 1 (19); *Digitalis grandiflora* + (21); *Pimpinella saxifraga* + (23); *Laserpitium latifolium* 1 (26), *Chamaecytisus ruthenicus* 1 (26); *Hieracium piloselloides* + (26); *Solidago virgaurea* 1 (26); *Calamagrostis epigejos* 1 (27); *Hierochloe australis* + (27)

Quercus-Fagetea (e.g. *Brachypodium sylvaticum*, *Melica nutans*, liverwort *Hepatica nobilis*, *Viola collina*, unspotted lungwort *Pulmonaria obscura*, *Cimicifuga europaea*). The share of species of the class *Trifolio-Geranietaea* in the herbaceous layer (*Peucedanum cervaria*, *Trifolium medium*, *Peucedanum oreoselinum*, *Polygonatum odoratum*, *Medicago falcata*, *Coronilla varia*, *Astragalus glycyphyllos*, *Clinopodium vulgare*) is also high. The share of xerothermic species of the class *Festuco-Brometea* (e.g. dyer's woodruff *Asperula tinctoria*, *Centaurea scabiosa*) and the meadow species of the class *Molinio-Arrhenatheretea* is insignificant.

Tilio cordatae-Carpinetum betuli

The community *Tilio cordatae-Carpinetum betuli* dominates in compartments 206b and c. For the most part, it represents a form typical of *Tilio-Carpinetum typicum*. Patches of *Tilio-Carpinetum calamagrostietosum* occur only in the north-eastern part of compartment 206b. The stand with a 60–70% canopy closure is dominated by *Pinus sylvestris* and silver birch *Betula pendula* admixed with pedunculate oak *Quercus robur* and small-leaved lime *Tilia cordata*. Patches of deciduous forests with dominant lime and oak are less frequent. In the understory of the stand, the share of common hornbeam *Carpinus betulus* is also significant. Despite significant stand 'pinetisation' (expressed by the considerable share of pine ousting the species typical of the association) the herbaceous layer still retains species characteristic of *Tilio-Carpinetum* and *Carpinion betuli*, such as greater stitchwort *Stellaria holostea grandiflora*, wonder violet *Viola mirabilis*, Schultes bedstraw *Galium schultesii* and *Carpinus betulus*. The order *Fagetalia sylveticae* is represented here by a large number of species typical of the order *Fagetalia sylveticae*, *inter alia*, February daphne *Daphne mezereum*, *Pulmonaria obscura*, *Ajuga reptans*, yellow archangel *Galeobdolon luteum*, American milletgrass *Milium effusum*, bird's-nest orchid *Neottia nidus-avis*, bugbane *Cimicifuga europaea*, Solomon's seal *Polygonatum multiflorum*) and of the class *Quercus-Fagetea* – by wood anemone *Anemone nemorosa*,

Hepatica nobilis, baneberry *Actaea spicata*, sedge *Carex digitata*, *Brachypodium sylvaticum*, *Melica nutans*, *Poa nemoralis*. A few patches with a significant share of thermophilous species (*Melittis melissophyllum*, *Clinopodium vulgare*, *Lathyrus niger*, *Convallaria majalis*, lesser butterfly orchid *Platanthera bifolia*, peach-leaved bellflower *Campanula persicifolia*, *Astragalus glycyphyllos*, betony *Betonica officinalis*) resemble the community *Melitti-Carpinetum* singled out by some authors.

Small patches (with a few m² each) of thermophilous thickets of the class *Rhamno-Prunetea* also occur on the northern edge of the clearing (compartment 206d) on the border of oak-hornbeam forest and forest edge communities. *Rubus fruticosus-Prunetum* is formed by the thickets with dominant blackthorn *Prunus spinosa*, common hawthorn *Crataegus monogyna* and *Rubus* spp. *Rhamno-Cornetum sanguinei* represents the peripheral, depleted form of the alliance *Berberidion*. It forms dense thickets, composed of common dogwood *Cornus sanguinea*, blackthorn, buckthorn *Rhamnus cathartica* common, and *Euonymus verrucosus*. The herbaceous layer consists of a few species spread from the adjacent forest (e.g. *Poa nemoralis*, *Melica nutans*, *Pteridium aquilinum*, *Brachypodium sylvaticum*) and forest edge communities dominating in the clearing (e.g. *Trifolium medium*, *Galium verum*, *Clinopodium vulgare*, *Galium mollugo*).

5. Discussion

The 'Mierzvice' reserve is one of the unique natural sites situated in the middle and lower Bug river valley. There are only two other reserves established to protect xerothermic vegetation in this area: Uszeście Mt. near Melnik (Rakowski et al. 2005) and 'Mołozewska Skarpa' Scarp (Rakowski et al. 2006). A variety of protected and endangered species, especially those characteristic of xerothermic grasslands (e.g. *Thesium ebracteatum*, *Crepis praemorsa*, *Stachys recta*, *Viola rupestris* and *V. collina*, *Achillea collina*, *Asperula tinctoria*, *Gentiana cruciata*, *Anemone sylvestris*) as well as forest species (e.g. *Cypripedium calceolus*, *Cephalanthera rubra*) accounts for the outstanding

natural values of the ‘Mierzvice’ reserve. The occurrence of two communities listed in Annex I to the Council Directive 92/43/EEC (*Potentillo albae-Quercetum* – 9110 and *Tilio-Carpinetum* – 9170) increases the value significance of the reserve.

Comparing the changes in the population size of the species over the last dozen or so years, a clear regression of species richness (decrease in the number of locations, population abundance) of grasslands and thermophilous deciduous forests (*Potentillo albae-Quercetum*) is noted (e.g. *Gentiana cruciata*, *Allium oleraceum*, *Viola rupestris*, *Hieracium piloselloides*, *Pulmonaria angustifolia*, *Digitalis grandiflora*, *Crepis praemorsa*, *Anemone sylvestris*). These changes are the result of natural succession (deterioration of the light conditions in the herbaceous layer and clearing) and expansion of wood small-reed *Calamagrostis epigejos* in the forest clearing competing with thermophilous species. In the case of forest species, such evident, negative changes in the number of locations and in the population size is not observed.

To maintain the full range of habitat and species diversity, it is necessary to differentiate the forms of forest use or active protection in various parts of the reserve. The area of the forest clearing covered by thermophilous forest edge communities needs active protective measures. They should apply not only to the species listed in the Ordinance of the Minister of the Environment of 9 October 2014 (*Cypripedium calceolus*, *Gentiana cruciata*, *Thesium ebracteatum*), but also to other xerothermic species.

In view of the exceptionally thermophilous phytocoenoses, actions commonly used to protect xerothermic grasslands should be taken. Spruce trees excessively shading herbaceous vegetation should be gradually removed from the clearing. To increase light availability and reduce soil moisture, the closure of the shrub canopy should also be regulated (Mróz, Bąba 2010). These treatments should be carried out in June-July to prevent the expansion of shrubs through root suckers (Perzanowska, Kujawa-Pawlaczyk 2004). To avoid the invasion of *Calamagrostis epigejos*, a one-time removal of shrubs from a maximum of 10% of the surface area is recommended. The mowing of the meadow usually should be performed every 2–3 years (August-September) including biomass removal and leaving non-mown strips or alternate mowing (Perzanowska, Kujawa-Pawlaczyk 2004). In the case of the described forest compartment, the first mowing should be done in the first few years at the beginning of May, before the flowering period of *Calamagrostis epigejos*. Grazing may be an alternative to mowing. In addition to browsing, trampling and dunging, some animals, such as sheep, are involved in the transport of diaspores (fleece, hooves, droppings). The raking of the remnants of dead plants reducing the germination rate and growth of thermophilous plants is also necessary.

To protect the habitat of *Tilio-Carpinetum*, most of the area under consideration (minor changes in the community structure) should be subject to passive protection measu-

res consisting of spontaneous stand conversion processes, usually enhancing the naturalness of the forest structure. In the patches of pine stands (eastern part of the reserve), pine trees should be gradually removed in favour of planting the species suitable for the habitat conditions or leaving them to natural regeneration (Danielewicz, Pawlaczyk 2004). In the case of thermophilous oak forests (*Potentillo albae-Quercetum*), it is desirable to maintain or obtain the proper structure of the community (moderate stand closure, poorly-developed underbrush and rich multi-species herbaceous layer). It is recommended to apply thinning in cases of excessive growth of the underbrush as a result of the expansion of hornbeam, hazel or other hardwood species. Too heavy thinning is not desirable, as it may result in an expansion of grasses or blackberry (Jakubowska-Gabara et al. 2004, Kiedrzyński et al. 2010).

The exclusion of compartments 206b and c from use is not necessary for the protection of rare elements of the flora; it only requires modification of the standard measures related to the protection and tending of stands. The sites with the most valuable specimens of the flora should be determined before the tending treatments or felling, and before selecting the logging trails and forest landings (Gorzela 2012). These treatments should be performed after the end of the growing season.

6. Conclusions

The research results allow drawing the following conclusions:

1. Due to the large number of endangered species on a regional and national scale, the ‘Mierzvice’ nature reserve is one of the most valuable natural sites in the middle Bug river valley. Two species: *Cypripedium calceolus* and *Thesium ebracteatum* are of Community importance. Two others have the status of critically endangered in the region (CR), and six others – of endangered species (EN).
2. The occurrence of two communities included in the list Natura 2000 – *Potentillo albae-Quercetum* (9110) and *Tilio-Carpinetum* (9170) augments the value significance of the reserve.
3. There is a clear regression in the number of plant species characteristic of thermophilous oak forests (*Potentillo albae-Quercetum*) and xerothermic grasslands in the reserve. This is the result of natural succession and expansion of wood small-reed.
4. Active protection of xerothermic vegetation (planned uprooting, mowing, grazing, biomass removal, control of expansive wood small-reed) is necessary.
5. Forest management conducted in accordance with the Nature Conservation Plan prepared for the reserve should take into account the location of the most valuable plant species and the length of the growing season. It should be noted that recent methods of forest management have created favourable conditions for plant growth and maintenance of natural habitats.

Conflict of interest

None declared.

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Author's contribution

J.K., K.P. – fieldwork, concept of research literature review, manuscript preparation; M.F., M.W. – fieldwork, concept of the work.