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THE VASCULAR PLANTS AND PLANT COMMUNITIES OF THE "ŹRÓDŁA RZEKI ŁYNY IM. PROF. R. KOBENDZY" NATURE RESERVE

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ABSTRACT. The "Źródła Rzeki Łyny im. prof. R. Kobendzy" nature reserve was established in 1959 and occupies the area of 120.54 ha. The paper describes flora and plant communities of this reserve. In total 409 vascular plant taxa from 70 families and 235 genera were inventoried, including 24 species which are under legal protection, as well as rare plants and those which are threatened in this region. Nine plant communities were identified within the boundaries of the reserve of which three were forest autogenic or autogenic-like communities (*Ribeso nigri-Alnetum*, *Stellario nemorum-Alnetum glutinosae*, *Tilio cordatae--Carpinetum betuli*), three were forest anthropogenic communities with *Pinus sylvestris*, *Betula pendula*, *Larix decidua* and *Larix ×eurolepis* and *Picea abies* on lime-oak-hornbeam forest sites, as well as three non-forest communities (*Salicetum pentandro-cinereae*, *Phragmitetum australis* and a meadow community from the *Molinio-Arrhenatheretea* class). The highest natural value was determined in very well developed phytocoenoses of *Stellario nemorum-Alnetum glutinosae* (the rarest in the reserve), in *Ribeso nigri-Alnetum* and *Tilio cordatae-Carpinetum betuli*, as well as meadow communities from the *Molinio-Arrhenatheretea* class. They provide sanctuary for many species of rare and threatened plants.

KEY WORDS: "Źródła rzeki Łyny im. prof. R. Kobendzy" nature reserve, vascular plants, plant communities, Łyna River

INTRODUCTION

The partial landscape-geomorphological "Źródła rzeki Łyny im. prof. R. Kobendzy" nature reserve was established on the 20th of October 1959 (Zarządzenie... 1959). The initial area of the reserve amounted to 121.04 ha (Plan urządzenia... 2008).

The objective of the establishment of the reserve was to maintain – for scientific, didactic and touristic purposes – processes of headward erosion taken as a whole. The young erosion of the Łyna River, by destroying the old, abandoned valley from the previous geological period, is a classic example of hydrographical and morphological transformations of the Mazury Lake District taking place in the contemporary geological period. It is an example of headward erosion, a very rare phenomenon on lowland (Panfil 1985, Wołejko 1991, 1999, Osadowski and Wołejko 1999, Wawer 2002).

The Łyna River is the largest river in the Warmia--Mazury voivodeship and it constitutes the left tributary of the Pregoła River. The river is 289 km long and its drainage basin occupies the area of 7126 km^2, of which 2/3 are situated on the territory of Poland (Panfil 1985, Kondracki 2011).

The area of the nature reserve is quite valuable with respect to its natural value and, at the same time, it distinguishes itself by its unique landscape significance. It is an extensive valley with numerous lateral ravines and gorges with steep slopes of 30-40 m in height. The area of the reserve constitutes part of the end moraine of the last glaciation with a distinctly marked outflow gate of melting waters. At the present time, the gate is visible as a wide ravine 300 to 500 m wide (Plan urządzenia... 2008).

The flora of the reserve had not been studied until the beginning of the 21st century (Pisarek et al. 2002, Szczecińska 2002). Until then, only investigations of valuable groups of water and land microfauna had been conducted (Biesiadka and Lewandowski 1986). Scarce mentions of the flora of the described object can be found in articles of Kobendzina (1949), Plan ochrony... (1988), Szczepański (2007) and in Plan urządzenia... (2008). Plant communities of the reserve have not been inventoried yet.

The objective of this study was to perform an inventory of vascular plants and plant communities of this nature reserve and then, on the basis of the obtained data, to evaluate its floristic value.

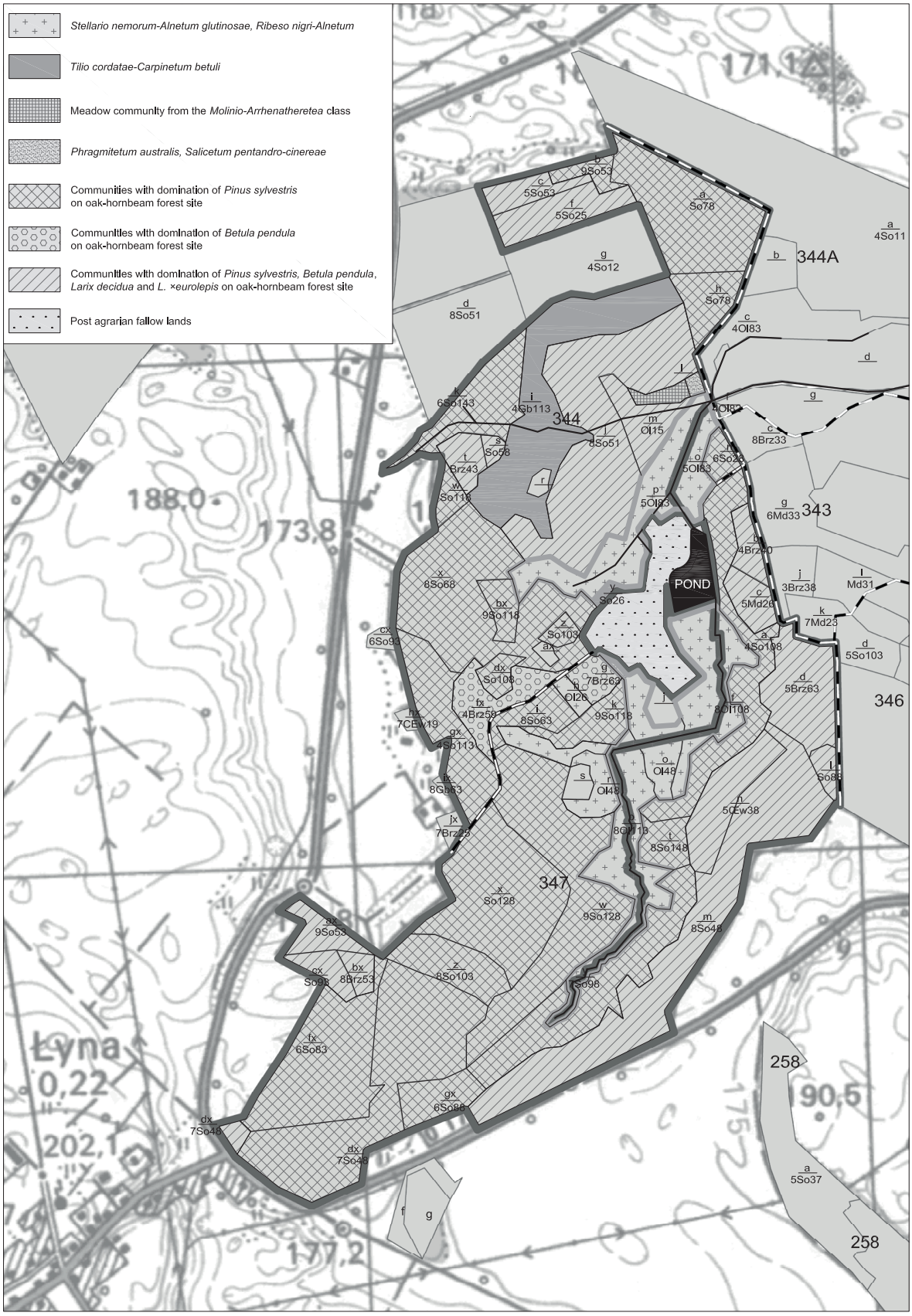

Fig. 1. Plant communities and the boarders of nature reserve

OBJECT OF RESEARCH

The examined reserve is situated near the Łyński Młyn settlement (53°26'57.695"N, 20°25'34.499"E) at the distance of 2 km from the village of Łyna and 5 km from Orłowo village, 12 km south of Nidzica. The nature reserve is situated in Nidzica District, Nidzica commune, and southern part of the Warmia-Mazury voivodeship. The reserve occupies an edge of the Napiwodzko-Ramudzka Primeval Forest.

According to Kondracki (2011) physico-geographical division, the reserve is situated within boundaries of the East-Baltic – Belarusian Lowland, sub-province of the East-Baltic Lake District, in the Mazury and Chełmińsko-Dobrzyńskie macro-regions and Olsztyn Lake District and Garb Lubawski Mesoregions. In accordance with the geobotanical division of Poland proposed by Matuszkiewicz (2008), the examined area is situated in the Northern Mazury – Belarusian Division, Region of Mazury and Western Mazury Sub-Region. In the natural-forest regionalisation of Trampler et al. (1990), the area belongs to the 2nd Mazury-Podlasie Region, Mazury Plain District and Ciechanów-Płońsk Highland Mesoregion.

The reserve constitutes a part of the Regional Directorate of State Forests in Olsztyn, Nidzica Forest District, and Orłowo Forest Range.

The studied object extends on the area of 120.54 ha, of which 114.17 ha are forests. The Nidzica Forest District is the owner of 116.83 ha, while the remaining 3.71 ha are enclaves of land belonging to Łyna village (Plan urządzenia... 2008). It seems worthwhile to consider inclusion to the existing reserve of valuable communities of extensive, wet meadows adjacent to the reserve which are situated in subsections 344A, c, d, f and g. Boundaries of the examined area are presented on the map (Fig. 1).

Basic data regarding the climate of the studied area derive from observations carried out at the meteorological station of the Institute of Meteorology and Water Management in Nidzica (data cover the period from 1949-1971). The climate of this region is characterised by a short period of vegetation (approximately 160-200 days) and mean annual temperature of 6.4°C, with July being the warmest month (mean temperature of 17.0°C) and January – the coldest one (1.7°C). The climate of this area is characterised by transitional features of sea to continental climate as shown, among others, by considerable differences in precipitation in the same months in different years. Mean total annual precipitation fluctuate from 610 to 630 mm. There are ca. 170--180 days with precipitation in a year and the snow cover remains on the ground surface, on average, for 105 days a year. The mean annual relative air humidity amounts to 82%. Winds blow, primarily, from south-western direction, although western winds are also very frequent; the rarest winds are those blowing from the northern direction. The mean wind speed is about 3.0 m/s. The highest wind speed are recorded in the autumn and winter – very strong and gusting winds, whereas the weakest winds are recorded in summer; calms occur most frequently in August.

Soils in the reserve are made up mainly from sands with pure admixture of gravels and clays. From the above-mentioned formations – on slopes of ravines and hill tops - brown, acid and leached soils developed, whereas the bottom of the valley is filled with proper gley soils (Operat... 1998, 2005).

MATERIALS AND METHODS

Investigations were conducted from March to October 2011. Plant species names were given after Mirek et al. (2002) and Seneta and Dolatowski (2011).

The occurrence frequency of rare and threatened species was determined according to Żukowski et al. (1995) as follows: very rare species (1-5), rare (6-10), dispersed (11-20), frequent (21-40), very frequent (41-80), and widespread (> 80 of sites). The classification of life forms was based on the Raunkiaer's system. The geographic-historical division was adopted after Żukowski et al. (1995), while the sociological-ecological division – according to Jackowiak (1993).

We listed the most valuable plant species occurring in the study area, i.e.: species under legal protection (Rozporządzenie... 2012), rare and threatened in Poland (Zarzycki and Szeląg 2006) and in the region of Warmia and Mazury. The latter ones were identified on the basis of several publications (Atlas... 2001, Pisarek et al. 2002, Zarzycki and Szeląg 2006) as well as our own observations.

Based on Braun-Blanquet method, 56 phytosociological relevés were taken in the examined reserve. The description and nomenclature of the inventoried plant communities were adopted after Matuszkiewicz (2001) and Matuszkiewicz (2007).

Full inventory data, as well as cartographic and photographic documentation of the flora and fauna of the examined object can be found in the manuscript by Wrońska-Pilarek and Kiciński (2011).

RESULTS

Flora

The total of 409 taxa of vascular plants from 70 families and 235 genera were inventoried in the reserve. Flora was dominated by monocotyledonous and dicotyledonous plants (390 species), while ferny (14 species) and gymnospermous (5 species) were far less numerous.

Individual families were represented by 1 to 39 species. Families richest in species included: *Asteraceae*, *Poaceae*, *Rosaceae* and *Fabaceae* as well as *Caryophyllaceae*, *Cyperaceae*, *Lamiaceae*, *Scrophulariaceae*, *Apiaceae*, *Ranunculaceae*, and *Polygonaceae*. The total of 241 species derived from these 11 families (58.9% of all species). Up to 48 families were represented by 1-5 species, of which 22 families were represented by only one species.

Majority of plants (363 species – 89%) of the examined area were plants of indigenous origin, i.e. spontaneophytes (160 species – 39%) and apophytes (203 species – 50%). From among 46 taxa (11%) of alien origin, majority (42 species) were archeophytes (5%) and kenophytes (5%), while the remaining four species (1%) were ephemerophytes.

The most numerous category of life forms determined in accordance with Raunkiaer's classification were hemicryptophytes (196 species – 48%). Cryptophytes (67 species – 16%), phanerophytes (63 species – 15%) and terophytes (60 species – 15%) occupied significantly smaller proportions, while chamephytes (23 species – 6%) were the least frequent.

The species occurring in the examined reserve were classified into 17 socio-ecological groups corresponding to plant communities. The share of species within the framework of individual groups ranged from 5 to 91 (1.2-22.3%). Majority of them was associated with eight socio-ecological groups whose proportions exceeded 5%. Those groups were represented by 23 to 90 species, whereas the remaining nine groups were represented by 5 to 20 species. Due to a forest character of the reserve, the most numerous species were those of fertile broad-leaved forests and shrub communities, as well as acid oak and mixed forests and mixed coniferous forests. Fertile and wet sites occurring along the Łyna River provided optimal conditions for the development of swampy species of alder and riparian forests and shrubs as well as rash and aqueous communities. Moreover, many fresh and moderately wet plants, as well as moist meadows and herbaceous communities were determined.

The reserve is inhabited by 11 plant species which are covered by legal protection (Rozporządzenie... 2012) and by 13 species which are considered as rare and threatened for the region (Table 1). From among the protected species, three are under strict protection and the remaining eight species are under partial protection. *Hippophaë rhamnoides*, which in natural conditions occurs only in the Pomerania and is covered by strict protection, was also found in the reserve. However, it was planted in the reserve and, therefore, was not mentioned on the list of protected plants. Majority of the described plants can be found only in one or several places at the most. These include: very rare species (17), rare (5) and only four of them are frequent (Table 1).

We found no protected species (*Dactylorhiza incarnata, D. maculata, D. majalis, Lilium martagon, Listera ovata*) or rare in the region (*Fragaria moschata, Hierochloë australis, Stellaria longifolia*) reported by Pisarek et al. (2002). We also did not find sites of other rare species, *Petasites spurius* reported by Kobędzina (1949) or species listed in Plan ochrony... (1988) – *Potentilla alba, Pulmonaria angustifolia* and *Ranunculus polyanthemos*.

Alphabetical list of the inventoried vascular plants

Aceraceae*:** *Acer platanoides, A. pseudoplatanus, A. pseudoplatanus* 'Purpurascens'; ***Adoxaceae: *Adoxa moschatelina*; ***Alismataceae*:** *Alisma plantago-aquatica*; ***Apiaceae*:** *Aegopodium podagraria, Aethusa cynapium, Angelica sylvestris, Anthriscus sylvestris, Berula erecta, Chaerophyllum aromaticum, Ch. temulentum, Daucus carota, Heracleum sibiricum, H. sphondylium, Peucedanum oreoselinum, P. palustre, Pimpinella saxifraga, Torilis japonica*; ***Aristolochiaceae*:** *Asarum europaeum*; ***Aspidiaceae*:** *Dryopteris carthusiana, D. dilatata, D. filix-mas, Gymnocarpium dryopteris*; ***Asteraceae*:** *Achillea millefolium, Anthemis arvensis, Arctium lappa, A. tomentosum, Artemisia absinthium, A. campestris, A. vulgaris, Bidens tripartita, Carduus crispus, Centaurea scabiosa, Chamomilla suaveolens, Cichorium intybus, Cirsium arvense, C. oleraceum, C. palustre, Conyza canadensis, Erigeron acer, E. annuus, Eupatorium cannabinum, Galinsoga parviflora, Gnaphalium sylvaticum, Helichrysum arenarium, Hieracium lachenalii, H. laevigatum, H. pilosella, Hypochoeris radiata, Lapsana communis, Leontodon autumnalis, L. hispidus, Mycelis muralis, Senecio jacobaea, S. vernalis, Solidago virgaurea, Sonchus arvensis, S. oleraceus, Tanacetum vulgare, Taraxacum officinale* coll., *Tussilago farfara*; ***Athyriaceae*:** *Athyrium filix-femina*; ***Balsaminaceae*:** *Impatiens noli-tangere, I. parviflora*; ***Betulaceae*:** *Alnus glutinosa, Betula ×aurata, B. pendula, B. pubescens*; ***Boraginaceae*:** *Anchusa officinalis, Echium vulgare, Myosotis arvensis, M. palustris, M. sylvatica, Pulmonaria obscura, Symphytum officinale*; ***Brassicaceae*:** *Alliaria petiolata, Armoracia rusticana, Berteroa incana, Capsella bursa-pastoris, Cardamine amara, Descurainia sophia, Rorippa amphibia, Sisymbrium altissimum, Thlaspi arvense*; ***Callitrichaceae*:** *Callitriche cophocarpa*; ***Campanulaceae*:** *Campanula patula, C. persicifolia, C. rapunculoides, C. trachelium, Jasione montana, Phyteuma spicatum*; ***Cannabaceae*:** *Humulus lupulus*; ***Caprifoliaceae*:** *Lonicera xylosteum, Sambucus nigra, S. racemosa, Viburnum opulus*; ***Caryophyllaceae*:** *Arenaria serpyllifolia, Cerastium arvense, C. holosteoides, C. semidecandrum, Dianthus carthusianorum, D. deltoides, Herniaria gabra, Lychnis flos-cuculi, Melandrium album, M. rubrum, Moehringia trinervia, Myosoton aquaticum, Saponaria officinalis, Scleranthus annuus, Silene nutans, S. vulgaris, Stellaria graminea, S. holostea, S. media, S. nemorum, S. uliginosa, Viscaria vulgaris*; ***Celastraceae*:** *Euonymus europaeus, E. verrucosus*; ***Chenopodiaceae*:** *Chenopodium album*; ***Clusiaceae*:** *Hypericum perforatum, H. tetrapterum*; ***Convolvulaceae*:** *Calystegia sepium, Convolvulus arvensis*; ***Cornaceae*:** *Cornus sanguinea*; ***Corylaceae*:** *Carpinus betulus, Corylus avellana*; ***Crassulaceae*:** *Sedum acre, S. maximum*; ***Cupressaceae*:** *Juniperus communis*; ***Cyperaceae*:** *Carex acuta, C. acutiformis, C. apropinquata, C. cespitosa, C. curta, C. diandra, C. digitata, C. ericetorum, C. hirta, C. nigra, C. pallescens, C. paniculata, C. pilulifera, C. pseudocyperus, C. remota, C. rostrata, Schoenoplectus lacustris, Scirpus silvaticus*; ***Dipsacaceae*:** *Knautia arvensis, Scabiosa columbaria*; ***Elaeagnaceae*:** *Hippophaë rhamnoides*; ***Equisetaceae*:** *Equisetum arvense, E. fluviatile, E. hyemale, E. palustre, E. pratense, E. sylvaticum*; ***Ericaceae*:** *Vaccinium myrthillus, V. vitis-idaea*; ***Euphorbiaceae*:** *Euphorbia cyparissias, E. helioscopia*; ***Fabaceae*:** *Anthylis vulneraria, Astragalus glycyphyllos, Coronilla varia, Genista trinctoria, Lathyrus pratensis, L. sylvestris, L. vernus, Lotus corniculatus, L. uliginosus, Medicago falcata, M. lupulina, Melilotus alba, M. officinalis, Robinia pseudoacacia, Trifolium alpestre, T. arvense, T. campestre, T. dubium, T. pratense, T. repens, Vicia angustifolia, V. cassubica, V. cracca, V. hirsuta, V. sepium, V. tetrasperma*; ***Fagaceae*:** *Fagus sylvatica, Quercus ×rosacea, Q. petraea, Q. robur, Q. rubra*; ***Geraniaceae*:** *Erodium cicutarium, Geranium pratense, G. pusillum, G. robertianum*; ***Grossulariaceae*:** *Ribes alpinum, R. nigrum, R. rubrum, R. spicatum, R. uva-crispa*; ***Hippocastanaceae*:** *Aesculus hippocastanum*; ***Hypolepidaceae*:**

Table 1. Protected, rare and endangered vascular plant species of the nature reserve

No	Species	Protected species	Species rare and endangered in the region according to Pisarek et al. (2002)
1	***Actaea spicata*** L.		X
2	*Asarum europaeum* L.	ch	
3	*Carex diandra* Schrank		X
4	*Convallaria majalis* L.	ch	
5	*Corydalis intermedia* (L.) Mérat		X
6	*Daphne mezereum* L.	Ch	
7	*Dryopteris dilatata* (Hoffm.) A. Gray		X
8	*Epilobium obscurum* Schreber		X
9	*Frangula alnus* Mill.	ch	
10	*Galium odoratum* (L.) Scop.	ch	
11	*Galium schultesii* Vest		*
12	*Galium sylvaticum* L.		X
13	*Helichrysum arenarium* (L.) Moench	ch	
14	*Hepatica nobilis* Miller	Ch	
15	*Melandrium rubrum* (Weig.) Garcke		*
16	*Polypodium vulgare* L.	Ch	
17	*Primula veris* L.	ch	
18	*Ribes nigrum* L.	ch	
19	*Scrophularia umbrosa* Dumort.		X
20	*Stellaria uliginosa* Murray		X
21	*Valeriana dioica* L.		*
22	*Viburnum opulus* L.	ch	
23	*Vicia cassubica* L.		X
24	*Viola mirabilis* L.		*

Ch – strictly protected plant species, ch – partly protected plant species, X – endangered plant species in the Warmia and Mazury regions, listed by Pisarek et al. (2002), * – vascular plant species classified as rare by the authors of the study.

Pteridium aquilinum; ***Iridaceae*****:** *Iris pseudacorus*; ***Juncaceae*****:** *Juncus articulatus, J. bufonius, J. conglomeratus, J. effusus, Luzula campestris, L. multiflora, L. pilosa*; ***Lamiaceae*****:** *Acinos arvensis, Ajuga reptans, Ballota nigra, Galeobdolon luteum, Galeopsis pubescens, G. speciosa, G. tetrahit, Glechoma hederacea, Lamium purpureum, Lycopus europaeus, Mentha ×verticillata, M. aquatica, M. arvensis, Prunella vulgaris, Scutellaria galericulata, Stachys palustris, S. sylvatica, Thymus serpyllum*; ***Lemnaceae*****:** *Lemna minor, L. trisulca, Spirodela polyrhiza*; ***Liliaceae*****:** *Anthericum ramosum, Convallaria majalis, Gagea lutea, Maianthemum bifolium, Paris quadrifolia, Polygonatum multiflorum*; ***Lythraceae*****:** *Lythrum salicaria*; ***Oleaceae*****:** *Fraxinus excelsior, Syringa vulgaris*; ***Onagraceae*****:** *Circaea alpina, C. lutetiana, Epilobium angustifolium, E. hirsutum, E. montanum, E. obscurum, E. palustre, E. parviflorum, E. roseum*; ***Oxalidaceae*****:** *Oxalis acetosella*; ***Papaveraceae*****:** *Chelidonium majus, Corydalis intermedia, Papaver dubium, P. rhoeas*; ***Pinaceae*****:** *Larix ×eurolepis, L. decidua, Picea abies, Pinus sylvestris*; ***Plantaginaceae*****:** *Plantago lanceolata, P. major, P. media*; ***Poaceae*****:** *Agrostis capillaris, A. stolonifera, Alopecurus aequalis, A. pratensis, Anthoxanthum odoratum, Arrhenatherum elatius, Avenula pubescens, Brachypodium sylvaticum, Briza media, Bromus inermis, Calamagrostis arundinacea, C. epigeios, Corynephorus canescens, Dactylis glomerata, D. polygama, Danthonia decumbens, Deschampsia caespitosa, D. flexuosa, Elymus repens, Festuca gigantea, F. ovina, F. pratensis, F. rubra, Glyceria plicata, Holcus lanatus, H. mollis, Lolium perenne, Melica nutans, Milium effusum, Phalaris arundinacea, Phleum pratense, Phragmites australis, Poa annua, P. nemoralis, P. palustris, P. pratensis, P. trivialis, Setaria viridis*; ***Polygonaceae*****:** *Fallopia convolvulus, F. dumetorum, Polygonum amphibium, P. aviculare, P. bistorta, P. hydropiper, Rumex acetosa, R. acetosella, R. obtusifolius, R. thyrsiflorus*; ***Polypodiaceae*****:** *Polypodium vulgare*; ***Primulaceae*****:** *Anagallis arvensis, Lysymachia vulgaris, Primula veris, Trientalis europaea*; ***Ranunculaceae*****:** *Actaea spicata, Anemone nemorosa, A. ranunculoides, Caltha palustris, Ficaria verna, Hepatica nobilis, Ranunculus acris, R. bulbosus, R. lanuginosus, R. repens, R. sceleratus*; ***Rhamnaceae*****:** *Frangula alnus, Rhamnus catharticus*; ***Rosaceae*****:** *Agrimonia eupatoria, A. procera, Alchemilla*

plicata, Aronia melanocarpa, Crataegus monogyna, C. rhipidophylla, Crepis paludosa, Filipendula ulmaria, Fragaria vesca, F. viridis, Geum rivale, G. urbanum, Malus domestica, Potentilla anserina, P. arenaria, P. argentea, P. erecta, Prunus avium, P. padus, P. serotina, P. spinosa, Pyrus communis, Rosa canina, R. rugosa, R. sherardii, Rubus caesius, R. idaeus, R. saxatilis, Sorbus aucuparia; ***Rubiaceae*****:** *Galium aparine, G. mollugo, G. odoratum, G. palustre, G. schultesii, G. sylvaticum, G. uliginosum, G. verum*; ***Salicaceae***: *Populus ×canadensis, P. tremula, Salix aurita, S. caprea, S. cinerea, S. fragilis, S. purpurea*; ***Saxifragaceae***: *Chrysosplenium alternifolium*; ***Scrophulariaceae***: *Digitalis purpurea, Lathraea squamaria, Linaria vulgaris, Melampyrum nemorosum, M. pratense, Scrophularia nodosa, S. umbrosa, Verbascum densiflorum, V. nigrum, Veronica anagalis-aqutica, V. arvensis, V. beccabunga, V. chamaedrys, V. officinalis, V. serpyllifolia, V. spicata*; ***Solanaceae*****:** *Solanum dulcamara*; ***Thelypteridaceae*****:** *Thelypteris palustris*; ***Thymelaceae***: *Daphne mezereum*; ***Tiliaceae***: *Tilia cordata, T. platyphyllos*; ***Typhaceae*****:** *Typha latifolia*; ***Ulmaceae*****:** *Ulmus glabra*; ***Urticaceae*****:** *Uritca dioica, U. urens*; ***Valerianaceae*****:** *Valeriana dioica, V. officinalis*; ***Violaceae*****:** *Viola canina, V. mirabilis, V. palustris, V. reichenbachiana, V. riviniana, V. tricolor.*

Plant communities

The following plant communities were identified in the area of the examined reserve:

Class: *Alnetea glutinosae* Br.-Bl. et R. Tx. 1943
Order: *Alnetalia glutinosae* R. Tx. 1937
Alliance: *Alnion glutinosae* (Malcuit 1929) Meijer Dress 1936
Association: *Ribeso nigri-Alnetum* Sol.-Górn. (1975) 1987
Association: *Salicetum pentandro-cinereae* (Almq. 1929) Pass. 1961
Class: *Querco-Fagetea* Br.-Bl. et Vlieger 1937
Order: *Fagetalia sylvaticae* Pawł. in Pawł. et al. 1928
Alliance: *Alno-Ulmion* Br.-Bl. et R. Tx. 1943
Association: *Stellario nemorum-Alnetum glutinosae* Lohm. 1957
Alliance: *Carpinion betuli* Issler 1931 em. Oberd. 1957
Association: *Tilio cordatae-Carpinetum betuli* Tracz. 1962
Subassociation: *Tilio cordaetae-Carpinetum betuli calamagrostietum*
Subassociation: *Tilio cordaetae-Carpinetum betuli typicum*
Subassociation: *Tilio cordaetae-Carpinetum betuli stachyetosum*
Class: *Phragmitetea* R. Tx. et Prsg 1942
Order: *Phragmitetalia* Koch 1926
Alliance: *Phragmition* Koch 1926
Association: *Phragmitetum australis* (Gams 1927) Schmale 1939

Apart from the above-mentioned communities, three forest anthropogenic communities (communities with domination of *Pinus sylvestris, Betula pendula, Larix decidua* and *L. ×eurolepis* or *Picea abies* on lime-oak-hornbeam forest site) occurred here as well as a meadow community from the *Molinio-Arrhenatheretea* R. Tx. 1937 class.

Stellario nemorum-Alnetum glutinosae which can be found directly along the riverbed of the Łyna River in the area of springs turned out to be the most valuable forest community of the examined reserve (Fig. 1). This riparian forest was characterised by the domination of *Alnus glutinosa* in the stand and in its poorly developed shrub floor, *Prunus padus* was found to be most dominant. The ground floor was rich and majority of species mentioned for this association by Matuszkiewicz (2007) occurred in it. *Stellaria nemorum* appeared from species characteristic for this association and *Chaerophyllum aromaticum*, *Equisetum pratense* and *Melandrium rubrum* species were considered as outstanding. Several dozen of species characteristic for the *Alno-Ulmion alliance*, *Fagetalia sylvaticae* order and *Querco-Fagetea* class occurred in the undergrowth.

Ribeso nigri-Alnetum phytocoenoses were usually well developed and showed no traces of anthropopressure. They occurred along the Łyna River on small areas with stagnating water which were found adjacent to riparian forests (Fig. 1). The stand was made up of *Alnus glutinosa* (characteristic for alder swamp forests) with a small admixture of *Prunus padus* (species which distinguishes the association). Species most common for the shrub layer included: *Ribes nigrum* (characteristic species), *Prunus padus* and *Corylus avellana*. The undergrowth was very rich in species and usually had a cluster-small valley nature typical for this swamp forest. Majority of plants forming a species combination characteristic for this alder swamp forest were found in the relevés. They included species from the classes *Alnetea glutinosae* (*Lycopus europaeus, Thelypteris palustris* and *Solanum dulcamara*) and *Querco-Fagetea* (*Chrysosplenium alternifolium, Circaea alpina, Impatiens noli-tangere*). In wettest places, species from the *Phragmitetea* class (*Iris pseudacorus, Peucedanum palustre, Galium palustre, Scutellaria galericulata, Carex acutiformis, C. pseudocyperus, Equisetum fluviatile, Phragmites australis*) as well as plants from the *Molinio-Arrhenatheretea* class (*Lysimachia vulgaris, Stachys palustris, Deschampsia caespitosa, Lythrum salicaria, Caltha palustris, Filipendula ulmaria, Myosotis palustris, Symphytum officinale, Cirsium oleraceum* and *Poa trivialis*) occurred. In addition, some species from the *Vaccinio-Piceetea* class (*Vaccinium myrtillus* and *Picea abies*) and *Scheuchzerio-Caricetea fuscae* class (*Carex nigra* and *Viola palustris*) were also identified.

Best preserved, scarce phytocoenoses of *Tilio cordatae-Carpinetum betuli* were found in 344 i and k subcompartments, as well as in belts of different width extending along the Łyna River just beyond zones occupied by *Stellario nemorum-Alnetum glutinosae* and *Ribeso nigri-Alnetum* (Fig. 1). Even though lime-oak-hornbeam forest sites took up major parts of the reserve area, usually forest communities with pine, less frequently with birch, spruce and larch with admixture of hornbeam, oaks, maple, aspen, hybrid black poplar as well as alder could be found growing on them. The undergrowth of those communities was found degraded in various degrees but in many places sites of lime-oak-hornbeam forest plants could be found.

Two species characteristic for lime-oak-hornbeam forest association (i.e. *Euonymus verrucosus* and *Galium*

schultesii) were found. Anthropogenic deformations of lime-oak-hornbeam forest associations consisted, mainly, in pinetization which led to soil degradation (acidification) and, consequently, to degeneration (impoverishment) of the species composition of all forest layers. Stand and shrub layers showed signs of worst degeneration, while the undergrowth floor was damaged much less. In lime-oak-hornbeam forests oaks, maples and limes should be the dominating species in the upper stand layer with hornbeam dominant in the lower layer but in the examined reserve hornbeam with pine formed the dominant mixture with a small share of oak, maple and lime. Usually, the multi-species shrub layer was quite impoverished here. Frequently, only common hazel appeared in the collected relevés. On the other hand, nearly all species connected with the three sub-associations of the lime-oak-hornbeam forest reported by Matuszkiewicz (2007) occurred in the undergrowth. In relevés taken from lime-oak-hornbeam forests, species linked with *Tilio cordaetae-Carpinetum betuli* typicum forests occurred most numerously, namely: *Aegopodium podagraria*, *Ajuga reptans*, *Anemone nemorosa*, *Asarum europaeum*, *Carex digitata*, *Galium odoratum*, *Dryopteris filix-mas, D. carthusiana*, *Galeobdolon luteum*, *Hepatica nobilis*, *Lathyrus vernus*, *Majanthemum bifolium*, *Milium effusum*, *Oxalis acetosella*, *Paris quadrifolia*, *Poa nemoralis*, *Polygonatum multiflorum*, *Stellaria holostea* or *Viola reichenbachiana*. The most impoverished subassociation, *Tilio cordaetae-Carpinetum betuli calamagrostietum* forest distinguished itself with the presence in the undergrowth of species of lowest site requirements (*Calamagrostis arundinacea*, *Convallaria majalis*, *Festuca ovina*, *Luzula pilosa*, *Melampyrum pratense*, *Poa pratensis*, *Pteridium aquilinum*, *Rubus saxatilis*, *Vaccinium myrtillus*, *Trientalis europaea*). On the other hand, in the most fertile patches of *Tilio cordaetae-Carpinetum betuli stachyetosum* forest, apart from species listed for typical lime-oak-hornbeam forests, species indicating fertile sites also appeared, i.e. *Anemone ranunculoides*, *Athyrium filix-femina*, *Ficaria verna*, *Geum urbanum*, *Impatiens noli-tangere*, *Paris quadrifolia*, *Pulmonaria obscura*, *Stachys sylvatica*, *Stellaria nemorum* or *Urtica dioica*.

A small, poorly developed *Salicetum pentandro-cinereae* patch was found on a mid-forest meadow situated in the 344 l section and was accompanied by reed rush (Fig. 1). *Salix cinerea* and *S. aurita* occurred in the shrub layer. In wetter places, *Phragmites australis* was the dominant species in the undergrowth. *Carex acutiformis* and *Galium palustre* were also found growing there. In a higher situated and less moist zone bordering with the community with pine and larch on the lime-oak-hornbeam forest site, the herbaceous layer consisted, primarily, of species representing the *Artemisietea* class, e.g.: *Rubus caesius*, *Geum urbanum*, *Urtica dioica* and *Molinio-Arrhenatheretea* class, e.g.: *Deschampsia caespitosa*, *Cirsium oleraceum* and *C. palustre*.

The *Phragmitetum australis* association occurred in a less moist variant and comprised multi-species patches occurring on sites situated at higher elevations which were flooded only periodically. Here, meadow species from the *Molinio-Arrhenatheretea* class and *Molinietalia* order such as: *Lathyrus pratensis*, *Poa trivialis*, *Lysimachia vulgaris*, *Deschampsia caespitosa*, *Cirsium palustre*, *C. oleraceum*, *Lotus uliginosus* or *Lychnis flos-cuculi* were represented numerously.

A meadow community from the *Molinio-Arrhenatheretea* class located in the 344 l (Fig. 1) subcompartment appears to be a very interesting and valuable element of semi-natural vegetation of the examined reserve. The meadow is not used (cut) and, therefore, is overgrown with encroaching patches of *Phragmitetum australis* and willow from *Salicetum pentandro-cinereae*. Patches of sedges, mainly *Carex acutiformis*, can also be found in places. Species from different syntaxa grow here. The *Calthion palustris* association is represented, among others, by: *Cirsium oleraceum*, *Crepis paludosa*, *Lathyrus palustris*, *Myosotis palustris*, *Poa palustris*, *Polygonum bistorta* or *Scirpus sylvaticus*, while the *Molinietalia caeruleae* order is represented here by: *Angelica sylvestris*, *Cirsium oleraceum*, *C. palustre*, *Deschampsia caespitosa*, *Galium uliginosum*, *Lotus uliginosus* and *Lychnis flos-cuculi*. Species from the *Molinio-Arrhenatheretea* class such as: *Alopecurus pratensis*, *Avenula pubescens*, *Festuca pratensis*, *Holcus lanatus*, *Lathyrus pratensis*, *Phleum pratense*, *Poa pratensis*, *P. trivialis*, *Prunella vulgaris*, *Ranunculus acer* and others are fairly numerous. The *Stellarietea mediae* class is represented by *Galeopsis speciosa* and the *Nardo-Callunetea* class – by *Danthonia decumbens*, *Valeriana dioica*, *Galium aparine*, *Impatiens noli-tangere* and *Urtica dioica* were also found to occur there.

DISCUSSION

The investigated reserve possesses a considerable value both with respect to its flora, as well as vegetation. At the present time, its diverse and species-rich flora embraces 409 taxa of vascular plants derived from 235 genera and 70 families. Similar results were reported by Szczecińska (2002) – 363 species and Pisarek et al. (2002) – 454 species.

The scale of anthropogenic flora malformations of the examined object is negligible. Nearly 90% of all taxa growing here are plants of indigenous origin associated with forest and shrub autogenic communities. Slight anthropopressure is noticeable in the predominance of apophytes (50%) permanently prevailing on strongly transformed sites over spontaneophytes (39%) which do not exhibit tendencies to take up such habitats. Rare species of alien origin comprise, primarily, archeophytes and kenophytes permanently settled in our flora.

The floristic values of the reserve are enhanced by numerous sites of species covered by legal protection (*Daphne mezereum*, *Hepatica nobilis* and *Polypodium vulgare*; the species covered by strict protection and the remaining eight are under partial protection) as well as the presence of 13 species classified as rare and threatened in this region. Despite the fact that many of them can be found growing singly, nevertheless their populations in the reserve are relatively numerous and are in good condition. In the discussed region, Szczecińska (2002) listed 18 protected species and eight rare and threatened plants, while Pisarek et al. (2002) – 27 and 11 such species, respectively.

In places indicated by Pisarek et al. (2002), we failed to find sites of *Dactylorhiza incarnata*, *D. maculata*, *D. majalis*, *Listera ovata*, *Lilium martagon*, or three species rare in the region: *Fragaria moschata*, *Hierochloë australis* and *Stellaria longifolia*. Moreover, *Petasites spurius* reported by Kobędzina (1949) was not found in the reserve, or *Potentilla alba*, *Pulmonaria angustifolia* and *Ranunculus polyanthemos*, reported in the Plan ochrony... (1988). The disappearance of orchids was most probably caused by the overgrowing of the meadow on which they could be found by expansive plants such as reed and shrub willows. Causes of the disappearance of *Petasites spurius* sites from the ravine extending along the Łyna River are difficult to establish. The hypothesis put forward by Pisarek et al. (2002) suggesting that the species was pushed out from the site by excessive shadowing or declining efficiency of the springs seems plausible. *Potentilla alba*, *Pulmonaria angustifolia* and *Ranunculus polyanthemos* are xerothermic species associated with unstable light oak forests which, with the passage of time, as a result of natural succession processes, transform into other communities (Matuszkiewicz 2001, Matuszkiewicz 2007). Deterioration of lighting and thermal conditions results in a withdrawal of entire phytocoenoses of *Potentillo albae-Quercetum* forests together with plant species characteristic for them. The failure to find sites with the remaining, valuable species can be attributed, mainly, to the large area of their occurrence and only a few sites on which single specimens occurred. Last but not least, some species, for example *Lilium martagon* or *Listera ovata* do not appear in their sites in each growing season.

In the area of the studied reserve, the total of nine plant communities were distinguished, including: three forest autogenic or autogenic-like communities, three forest anthropogenic communities and three non-forest communities. Despite the fact that majority of the reserve area is taken up by lime-oak-hornbeam sites, usually anthropogenic communities with *Pinus sylvestris*, less frequently with *Betula pendula*, *Picea abies* and *Larix decidua* with admixture of hornbeam, oaks, maple, aspen, hybrid black poplar, as well as alder could be found growing on them. Patches of very well developed associations of *Stellario nemorum-Alnetum glutinosae*, *Ribeso nigri-Alnetum*, *Tilio cordatae-Carpinetum betuli* (especially subass. typicum and *stachyetosum*), as well as the meadow community of the *Molinio-Arrhenatheretea* class present the highest natural value. They constitute a sanctuary for many rare, threatened and legally protected plant species. *Tilio cordatae-Carpinetum betuli* (code 9170) and *Stellario nemorum-Alnetum glutinosae* (code 91E0) are covered by protection under the framework of the Dyrektywa... (1992), whereas the two above-mentioned association and *Ribeso nigri-Alnetum* as well as *Salicetum pentandro-cinereae* are protected in Poland by the Rozporządzenie... (2001). The most valuable and the rarest association found in the examined reserve is *Stellario nemorum-Alnetum glutinosae*. In Poland it was reported by several authors only from lowland sites, from young glacial areas and from the Roztocze. Faliński (1961) described it from the Mazury Great Lakes District. The association is poorly identified and it also lacks good characteristic species on a greater than local scale (Matuszkiewicz 2001, Matuszkiewicz 2007). The condition necessary for the preservation of the phytocoenoses of the valuable *Stellario nemorum-Alnetum glutinosae* association is, first and foremost, to maintain water relations existing in the reserve.

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