

Regeneration of vegetation in manor park in Laskowice (Dąbrowa Forest District)

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Abstract. Laskowice is a village located in Kujawsko-Pomorskie Voivodeship, in Świecie Upland near Świecie. On the edges of the village there is a manor-palace complex established by Franz von Gordon in the first half of the 19th century. Since the palace was destroyed in 1945, the maintenance of the park was ceased. Currently the object is administrated by Dąbrowa Forest District.

The aim of the study was to determine the direction of vegetation transformation of the park in the light of lack of use. Lack of human interference within examined object has initiated regeneration processes. At present the vegetation of the park refers to structure and species composition of natural forest plant communities. Phytosociological research carried out in 2015 and 2016 revealed the presence of following associations: *Ficario-Ulmetum*, *Fraxino-Alnetum* and *Tilio-Carpinetum*. Shrub vegetation of *Rhamno-Prunetea* class develops in places. Non-forest vegetation of meadows (*Arrhenatheretum elatioris*) and nitrophilous edges (*Urtico-Aegopodietum*) are present. In case of analyzed object the physiognomy and species composition of forest communities differs from typical forms. An attention is paid to a strongly developed layer of brushwood. There is a lack of some characteristic species, alien species are present in treestand and shrub layers. A large share in phytocoenoses of *Ficario-Ulmetum* and *Tilio-Carpinetum* has *Sambucus nigra* and in case of the first association also alien species – *Philadelphus coronarius* and *Symphoricarpos albus*. Values of calculated indices of synanthropization confirm the regeneration of forest communities: index of natural character achieves value $\geq 40\%$ and synanthropization index ranges from 48.78% for *Tilio-Carpinetum* to 60.00% for *Fraxino-Alnetum*.

Key words: forest vegetation, *Ficario-Ulmetum*, *Fraxino-Alnetum*, *Tilio-Carpinetum*, index of natural character, synanthropization index, apophytization index.

1. Introduction

The manor park in Laskowice occupies area of 8.84 ha. It is located in Świecie Upland mesoregion near Świecie. It encompasses subdivision 253i within Dąbrowa Forest Division (Regional Directorate of State Forests in Toruń), Laskowice Forest Circle, Gródek District. It is located in the northern part of the village by Laskowickie Lake. It is situated on the right side of Park Street that constitutes voivodeship road no 272 linking Laskowice and Jezewo.

The palace in neo-Gothic style was erected in 1840–1860 by Franz von Gordon – a Scot, that was the owner of Laskowice since 1828. The park in english style was established in the first half of the 19th century by using natural elements of landscape. The palace was situated on a hill (Fig. 1), with a view extending to the Zamkowe Lake. In the front of the building, from the northern side, there was a courtyard with a fountain and a tennis court. On the north-eastern part manor buildings were erected and vegetable garden was established on the north-western part. The park was dissected by several gravel paths. Only remnants of the palace and a few-storey manor build-

ing from 1948 has preserved up to the present (Chudecki, 1994; von Weitzel-Zenker, 2002; http://amzpbig.com/maps/2476_Jaschewo_1910.jpg).

In park's wooded lands apart from alien species mainly native species were planted (Chudecki, 1994; Paszek & Gawenda-Kempczyńska, 2016). The palace was destroyed in 1945. Since then a maintenance was ceased, that caused gradual naturalizing of the plant cover. At the end of 20th century revitalization actions of the park were taken (Chudecki, 1994), but with no positive effects. The geobotanical research of this area was scarce and it concerned mainly, as in case of the majority of similar objects, dendroflora's inventory with special regard to monumental trees (Didyk, 2013).

Manor parks constitute an essential element of arable landscape of Poland. Some of them are under management of State Forests (Pietrzak & Zawadka, 2009; Wildner-Nurek, 2010). At present most of them is not maintained and left for regeneration processes leading to the development of plant communities referring to natural forest communities. However, the majority of carried out research in such objects concerns flora's inventory with special regard to exotic taxa and nature monuments, while phytosociological research is carried out less often (Borowski et al., 2007; Bacieczko & Wołejko, 2011; Kułak & Sender,

2011; Fornal-Pieniak & Ollik, 2013). Therefore the aim of the study herein is a characterization of plant communities for future revitalization of the park. Moreover, an attempt of defining the direction of changes in the light of cessation of use was made, and it is assumed that the vegetation of the park is regenerating.

2. Methods

A classical phytosociological method was used for the elaboration of plant communities. The field works were made in 2015 and 2016. Plant communities were determined on a basis of phytosociological relevés by using Braun-Blanquet's method. Sums of average cover values of main elements of plant communities were set out in a synthetic table (according to Dzwonko, 2007). Species were grouped into geographic-historical groups (Mirek et al., 2002; Tokarska-Guzik, 2012). The full phytosociological documentation was deposited in Department of Biology and Pharmaceutical Botany, Ludwik Rydygier Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń.

The classification of plant communities as well as species belonging to phytosociological classes were adopted

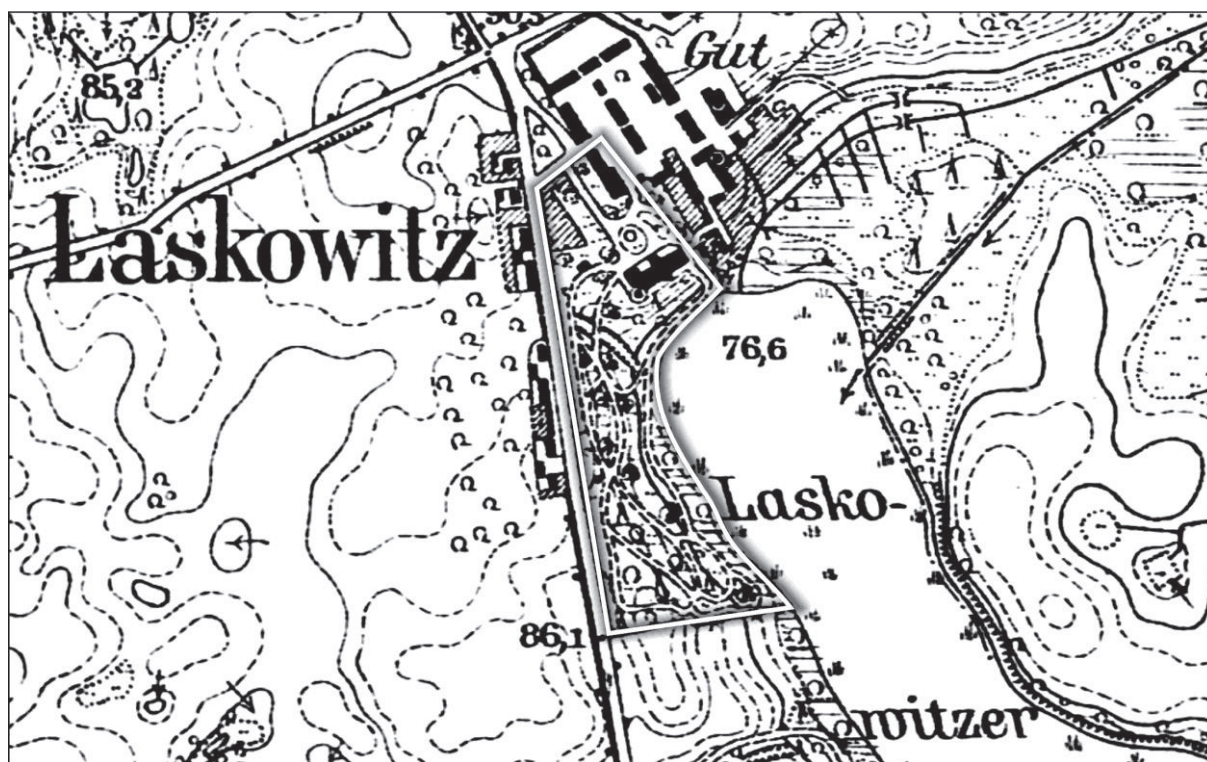


Figure 1. Historical map of the manor park (source: http://amzpbig.com/maps/2476_Jaschewo_1910.jpg). White line – present boundary of the park

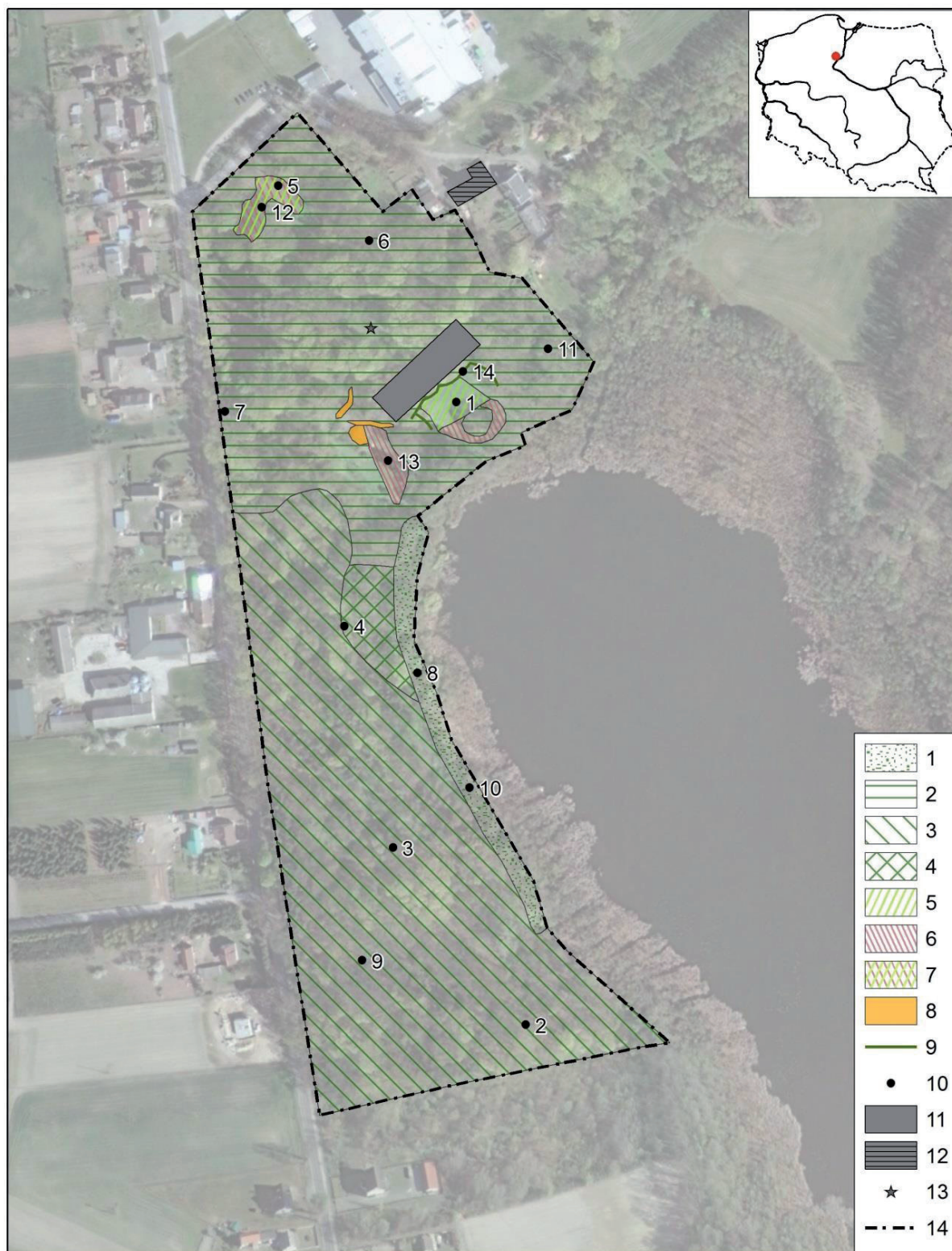


Figure 2. Actual vegetation (explanations: 1 – *Fraxino-Alnetum*, 2 – *Ficario-Ulmetum minoris*, 3 – *Tilio-Carpinetum typicum* 4 – *Tilio-Carpinetum corydaletosum*, 5 – *Arrhenatheretum elatioris*, 6 – *Urtico-Aegopodietum*, 7 – mosaic of *Arrhenatheretum elatioris* and *Urtico-Aegopodietum*, 8 – *Clematis vitalba* community, 9 – *Parthenocissus inserta* and *Clematis vitalba* community, 10 – localities and numbers of the phytosociological relevés, 11 – ruins of the palace, 12 – preserved manor buildings, 13 – remains of the fountain, 14 – boundary of the park)

according to Matuszkiewicz (2001), while species nomenclature according to Mirek et al. (2002). The map of real vegetation was performed by using ArcGIS software. A diagram of socio-ecological share of groups was made for each community. Anthropogenic indices (Chmiel, 1993): index of natural character, proper synanthropization index and apophytization index were calculated for each of the plant communities. Natura 2000 sites were determined on a basis of Journal of Laws (Obwieszczenie M.Ś. z dn. 30 października 2014).

3. Results

Seven plant community units at level of association or undefined community were noted within the manor park in Laskowice (Fig. 2). Forest communities of *Quercus-Fagetum* are dominant there. There are: *Fraxino-Alnetum* developing in vicinity of the Zamkowe Lake and *Ficario-Ulmetum minoris* developing in the northern part of the park, which belong to *Alno-Ulmion* alliance. *Tilio cordatae-Carpinetum betuli* which belongs to *Carpinion betuli* alliance develops in the southern part. Two subassociations were determined – typical *Tilio-Carpinetum typicum* and moist *Tilio-Carpinetum corydaletosum*. Non-forest vegetation occupies a small area within the park. It is represented by the *Arrhenatheretum elatioris* (*Molinio-Arrhenatheretea* class) and *Urtico-Aegopodietum* (*Artemisietea vulgaris* class), dominated by *Aegopodium podagraria*. Plant communities of *Rhamno-Prunetea* class: *Clematis vitalba* community as well as *Parthenocissus inserta* and *Clematis vitalba* community have developed along the road and paths near park ruins, on the edges of forest communities.

Fraxino-Alnetum forms over a dozen meters wide belt along the boundary of the Zamkowe Lake. The community was determined on a basis of the occurrence of distinguishing species *Alnus glutinosa* and *Padus avium* and more abundant, than in case of *Ficario-Ulmetum*, share of characteristic species of *Fagetalia sylvaticae* alliance, including the presence of nitrophilous *Impatiens noli-tangere* (Table 1). The two-layer treestand is mainly made of *Alnus glutinosa*, *Fraxinus excelsior* and *Acer pseudoplatanus*. Geographically alien *Aesculus hippocastanum* is present in some places. A shrub layer with a high density (80%) is dominated by *Sambucus nigra*. In this layer there are also present: *Padus avium* and saplings. *Aegopodium podagraria* and *Galeobdolon luteum* are dominant in the middle of vegetation season. *Ficaria verna*, *Anemone ranunculoides*, *Adoxa moschatellina* and *Corydalis cava* grow in spring.

The treestand of *Ficario-Ulmetum* is usually monolayer and is characterised by high tree density. Depending on the phytocoenosis, it is comprised of: *Fraxinus excelsior*, *Acer platanoides* and *Fagus sylvatica* with a smaller share

of other taxa. *Sambucus nigra* is dominant in a shrub layer where species not occurring in analyzed phytocoenoses: *Symphoricarpos albus* and *Philadelphus coronarius* have also a large share. A presence of *Aesculus hippocastanum* was also noted in one phytocoenosis. *Aegopodium podagraria* has a large share in a herb layer, reaching in cover up to 80% during the middle of the vegetation season. In spring occur: *Ficaria verna*, *Anemone ranunculoides* and *Gagea minima*.

Tilio cordatae-Carpinetum betuli occurs in the southern part of the object. The *Carpinion betuli* alliance is represented by *Tilia cordata*, *Carpinus betulus* and *Stellaria holostea*. Species characteristic for *Fagetalia sylvaticae* order are abundant. The treestand is double-layer and it is composed mainly by *Tilia cordata*. There are also present: *Fagus sylvatica*, *Acer pseudoplatanus*, *Acer platanoides*, *Fraxinus excelsior*, *Betula pendula* and alien species: *Quercus rubra* and *Pseudotsuga menziesii*. *Sambucus nigra* is dominant in the shrub layer, similarly as in the case of the rest of forest communities. *Lonicera xylosteum* and saplings are also present in the majority of phytocoenoses. *Galeobdolon luteum*, *Poa nemoralis* and *Stellaria holostea* occur in the middle of the vegetation season, while in spring: *Anemone ranunculoides*, *Anemone nemorosa* and *Corydalis cava*. A large share of the last of the species mentioned above allowed to distinguish the subassociation *Tilio-Carpinetum corydaletosum*. *Aegopodium podagraria* has a large share in phytocoenoses of this community.

Communities like *Parthenocissus inserta* and *Clematis vitalba* community as well as *Clematis vitalba* community, developed near the former palace, along trampled paths. A herb layer with a small cover develops under the dense canopy of *Parthenocissus inserta* and *Clematis vitalba*. Meadow species like *Arrhenatherum elatius*, *Carex hirta*, *Ranunculus acris*, *Dactylis glomerata*, *Poa pratensis* and *Veronica chamaedrys* grow aside from saplings and deciduous shrubs like *Euonymus europaeus*, *Fraxinus excelsior* and *Acer platanoides*.

Arrhenatheretum elatioris develops on the slope of the hill, where palace was located, and in northern part of the park. This community occurs in mosaic with *Urtico-Aegopodietum*. Meadow species of *Arrhenatheretalia* order: *Arrhenatherum elatius*, *Achillea millefolium* and *Dactylis glomerata* are dominant in phytocoenoses of *Arrhenatheretum elatioris*. The class of ruderal vegetation *Artemisietea vulgaris* is represented abundantly, of which the most abundant are: *Aegopodium podagraria*, *Urtica dioica* and *Glechoma hederacea*. The herb layer cover in analyzed phytocoenoses is 100%.

Species of *Artemisietea vulgaris* class are dominant in phytocoenoses of *Urtico-Aegopodietum* association, of which the largest share have: *Aegopodium podagraria*, *Urtica dioica* and *Anthriscus sylvestris*. *Arrhenatherum*

Table 1. Total cover of species occurring in plant communities (F-A – *Fraxino-Alnetum*, F-U – *Ficario-Ulmetum minoris*, T-C – *Tilio-Carpinetum*, Par.-Cle. – *Parthenocissus inserta* and *Clematis vitalba* community, Arr. – *Arrhenatheretum elatioris*, U-A – *Urtico-Aegopodietum*) and classification of species into geographical-historical groups (Ar – archeophyte, Kn – kenophyte, Sp – spontaneophyte, Ap – apophyte)

Plant community	F-A	F-U	T-C	Par.-Cle.	Arr.	U-A	Geographical-historical group
Number of relevés	2	3	4	1	2	2	
Area of relevés [m ²]	100	100	100	24	25	25	
Average cover of tree layer a ₁ [%]	42.5	85	67.5	-	-	-	
Average cover of tree layer a ₂ [%]	10	5	<5	-	-	-	
Average cover of shrub layer b [%]	80	40	47.5	90	-	-	
Average cover of herb layer c [%]	75	83.3	80	20	100	100	
Average cover of bryophytes layer [%]	<5	<5	<5	-	<5	<5	
Mean number of species	36	39	44	16	48	28	
ChAll. <i>Alno-Ulmion</i>							
<i>Alnus glutinosa</i> a ₁	30	2.5	2.5	-	-	-	Sp
<i>Padus avium</i> b	2.6	-	2.5	-	-	-	Sp
<i>Padus avium</i> c	5	-	2.5	-	-	-	Sp
<i>Ficaria verna</i>	77.5	90.1	0.1	-	15	-	Ap
<i>Circaea alpina</i>	0.1	-	-	-	-	-	Sp
<i>Festuca gigantea</i>	0.1	0.1	-	-	-	-	Sp
<i>Gagea lutea</i>	-	2.6	0.1	-	-	-	Sp
<i>Plagiomnium undulatum</i> d	0.1	0.1	-	-	-	-	-
ChAll. <i>Carpinion betuli</i>							
<i>Tilia cordata</i> a ₁	-	2.5	140	-	-	-	Ap
<i>Tilia cordata</i> b	-	-	5	-	-	-	Ap
<i>Tilia cordata</i> c	0.2	-	0.2	-	-	-	Sp
<i>Carpinus betulus</i> a ₂	15	-	2.5	-	-	-	Sp
<i>Stellaria holostea</i>	-	-	2.5	-	-	-	Sp
ChO. <i>Fagetalia sylvaticae</i>							
<i>Acer pseudoplatanus</i> a ₁	15	-	40	-	-	-	Ap
<i>Acer pseudoplatanus</i> a ₂	-	-	2.5	-	-	-	Ap
<i>Acer pseudoplatanus</i> b	17.5	5.1	10	-	-	-	Ap
<i>Acer pseudoplatanus</i> c	2.6	2.5	2.6	-	2.5	-	Ap
<i>Fagus sylvatica</i> a ₁	-	87.5	-	-	-	-	Sp
<i>Fagus sylvatica</i> c	-	0.1	-	-	-	-	Sp
<i>Ulmus glabra</i> b	-	15	-	-	-	-	Sp
<i>Ulmus glabra</i> c	-	2.6	-	-	-	-	Sp

<i>Anemone ranunculoides</i>	30	17.5	17.6	-	-	-	Sp
<i>Galeobdolon luteum</i>	52.5	-	35	-	-	-	Sp
<i>Impatiens noli-tangere</i>	2.6	-	-	-	-	-	Sp
<i>Pulmonaria obscura</i>	2.6	-	-	-	-	-	Sp
<i>Gagea minima</i>	-	17.5	2.5	-	-	-	Sp
<i>Corydalis cava</i>	15	-	62.5	-	-	-	Sp
<i>Adoxa moschatellina</i>	15	-	2.5	-	-	-	Sp
<i>Viola reichenbachiana</i>	-	-	0.2	-	-	-	Sp
<i>Dryopteris filix-mas</i>	-	-	0.1	-	-	-	Sp
<i>Atrichum undulatum</i> d	-	-	0.1	-	-	-	-
ChCl. Quercu-Fagetea							
<i>Acer platanoides</i> a ₁	-	87.5	37.6	-	-	-	Ap
<i>Acer platanoides</i> a ₂	-	2.5	2.5	-	-	-	
<i>Acer platanoides</i> b	5	5	20	-	-	-	
<i>Acer platanoides</i> c	2.6	17.5	55.1	2.5	2.5	-	
<i>Fraxinus excelsior</i> a ₁	15.1	77.5	15	-	-	-	Ap
<i>Fraxinus excelsior</i> a ₂	-	15	-	-	-	-	
<i>Fraxinus excelsior</i> b	-	-	-	2.5	-	-	
<i>Fraxinus excelsior</i> c	2.5	0.1	7.5	0.1	2.5	-	
<i>Euonymus europaea</i> b	-	17.5	-	15	-	-	Ap
<i>Euonymus europaea</i> c	0.1	5	5.2	2.5	-	-	
<i>Corylus avellana</i> c	-	0.1	-	-	-	-	Sp
<i>Anemone nemorosa</i>	17.5	-	17.5	-	-	-	Sp
<i>Lonicera xylosteum</i> b	-	-	20	-	-	-	Sp
<i>Lonicera xylosteum</i> c	-	-	5	-	-	-	
<i>Poa nemoralis</i>	-	-	2.5	-	-	-	Sp
<i>Viola riviniana</i>	-	-	0.1	-	-	-	Sp
ChCl. Rhamno-Prunetea							
<i>Sambucus nigra</i> b	150	77.5	152.6	-	-	-	Ap
<i>Sambucus nigra</i> c	5	7.5	10	-	-	-	
<i>Clematis vitalba</i> b	-	-	-	15	-	-	Kn
<i>Clematis vitalba</i> c	-	2.5	15	2.5	-	-	
ChCl. Artemisietea vulgaris							
<i>Aegopodium podagraria</i>	125	190	175	-	15	150	Ap
<i>Urtica dioica</i>	0.1	0.2	-	-	0.1	90	Ap
<i>Geranium robertianum</i>	2.6	-	5	-	-	-	Ap
<i>Geum urbanum</i>	2.5	2.6	0.1	0.1	-	-	Ap

<i>Chelidonium majus</i>	-	2.6	2.6	-	-	-	Ap
<i>Galium aparine</i>	-	5	10	-	-	-	Ap
<i>Viola odorata</i>	-	17.5	-	-	0.1	-	Ap
<i>Galeopsis pubescens</i>	0.1	-	0.1	-	-	-	Ap
<i>Glechoma hederacea</i>	-	2.5	-	-	15.1	5	Ap
<i>Chaerophyllum temulum</i>	-	2.5	0.1	-	-	-	Sp
<i>Anthriscus sylvestris</i>	-	0.1	2.5	-	0.1	17.5	Ap
<i>Impatiens parviflora</i>	-	-	15	-	-	-	Kn
<i>Lamium album</i>	-	-	-	-	2.6	2.5	Ar
<i>Equisetum arvense</i>	-	-	-	-	2.5	0.1	Ap
<i>Arctium lappa</i>	-	-	-	-	0.1	-	Ap
<i>Artemisia vulgaris</i>	-	-	-	-	2.5	-	Ap
<i>Tanacetum vulgare</i>	-	-	-	-	2.5	-	Ap
<i>Impatiens glandulifera</i>	-	-	-	-	-	2.5	Kn
<i>Calystegia sepium</i>	-	-	-	-	-	2.5	Ap
ChO. Arrhenatheretalia							
<i>Arrhenatherum elatius</i>	-	-	-	2.5	87.5	17.5	Ap
<i>Achillea millefolium</i>	-	-	-	-	17.5	0.1	Ap
<i>Dactylis glomerata</i>	-	-	-	0.1	17.5	0.1	Ap
<i>Taraxacum officinale coll.</i>	-	0.1	-	-	2.5	2.5	Ap
<i>Tragopogon pratensis</i>	-	-	-	-	0.1	-	Ap
ChCl. Molinio-Arrhenatheretea							
<i>Rumex acetosa</i>	-	-	-	-	2.5	-	Ap
<i>Carex hirta</i>	-	-	-	2.5	0.1	-	Ap
<i>Lathyrus pratensis</i>	-	-	-	-	0.1	-	Sp
<i>Lolium perenne</i>	-	-	-	-	2.5	-	Ap
<i>Phleum pratense</i>	-	-	-	-	2.5	-	Ap
<i>Plantago lanceolata</i>	-	-	-	-	2.5	-	Ap
<i>Poa pratensis</i>	-	-	-	0.1	2.5	2.5	Ap
<i>Ranunculus repens</i>	0.1	-	-	-	2.5	-	Ap
<i>Trifolium repens</i>	-	-	-	-	15	-	Ap
<i>Trifolium pratense</i>	-	-	-	-	-	0.1	Ap
<i>Veronica chamaedrys</i>	-	2.5	0.1	0.1	2.6	0.1	Sp
<i>Ranunculus acris</i>	-	-	-	2.5	0.1	2.5	Ap
<i>Poa trivialis</i>	-	-	-	-	-	2.5	Ap
<i>Stellaria graminea</i>	-	-	-	-	-	0.1	Sp

ChCl. Stellarietea mediae							
<i>Stellaria media</i>	-	-	-	-	2.5	2.5	Ap
<i>Geranium pusillum</i>	-	-	-	-	0.1	-	Ar
<i>Lamium purpureum</i>	-	-	-	-	-	2.5	Ar
<i>Atriplex patula</i>	-	-	-	-	-	0.1	Ap
<i>Lapsana communis</i>	-	-	-	-	-	0.1	Ap
ChCl. Agropyretea intermedio-repentis							
<i>Convolvulus arvensis</i>	-	-	-	-	2.5	-	Ap
<i>Elymus repens</i>	-	-	-	-	2.5	-	Ap
<i>Poa angustifolia</i>	-	-	-	-	2.5	-	Ap
ChCl. Nardo-Callunetea							
<i>Agrostis vulgaris</i>	-	-	-	-	15	2.5	Ap
<i>Carex pilulifera</i>	-	-	-	2.5	-	-	Ap
<i>Danthonia decumbens</i>	-	-	-	-	2.5	-	Sp
Others							
<i>Aesculus hippocastanum a₁</i>	37.5	-	-	-	-	-	
<i>Aesculus hippocastanum a₂</i>	15	-	-	-	-	-	Kn
<i>Aesculus hippocastanum c</i>	2.5	-	-	-	-	-	
<i>Aesculus hippocastanum b</i>	-	2.5	-	-	-	-	
<i>Quercus robur a₁</i>	-	0.1	5	-	-	-	
<i>Quercus robur b</i>	-	-	-	2.5	-	-	Sp
<i>Quercus robur c</i>	-	0.2	0.1	-	2.5	0.1	
<i>Picea abies a₂</i>	-	15	-	-	-	-	Sp
<i>Symphoricarpos albus b</i>	-	5	-	-	-	-	Kn
<i>Hedera helix b</i>	-	-	2.5	-	-	-	Sp
<i>Hedera helix c</i>	15	15	102.5	-	-	-	
<i>Ribes uva-crispa c</i>	2.5	2.5	-	-	-	-	Kn
<i>Prunus cerasifera c</i>	0.1	-	-	-	-	-	Kn
<i>Betula pendula a₁</i>	-	-	15	-	-	-	Ap
<i>Robinia pseudoacacia a₁</i>	-	-	15	-	-	-	Kn
<i>Ribes rubrum b</i>	-	-	0.1	-	-	-	Kn
<i>Parthenocissus inserta b</i>	-	-	-	87.5	-	-	Kn
<i>Parthenocissus inserta c</i>	-	-	-	15	-	-	
<i>Veronica hederifolia</i>	-	30	2.5	-	-	-	Ap
<i>Moehringia trinervia</i>	-	2.5	2.6	-	-	-	Sp
<i>Oxalis acetosella</i>	2.5	-	-	-	-	-	Ap

<i>Dryopteris dilatata</i>	0.1	-	-	-	-	-	Sp
<i>Dryopteris carthusiana</i>	0.1	-	-	-	-	-	Sp
<i>Astragalus glycyphyllos</i>	-	-	-	15	-	-	Sp
<i>Galium album</i>	-	-	-	2.5	15	-	Ap
<i>Medicago sativa</i>	-	-	-	-	2.5	-	Kn
<i>Galium verum</i>	-	-	-	-	2.5	-	Sp
<i>Prunus domestica</i>	-	-	-	-	0.1	-	Kn
<i>Capsella bursa-pastoris</i>	-	-	-	-	0.1	-	Ar
<i>Conyza canadensis</i>	-	-	-	-	0.1	-	Kn
<i>Erigeron annuus</i>	-	-	-	-	2.5	2.5	Kn
<i>Plantago major</i>	-	-	-	-	2.5	-	Ap
<i>Verbascum nigrum</i>	-	-	-	-	2.5	-	Sp
<i>Symphytum officinale</i>	-	-	-	-	-	0.1	Sp
<i>Brachythecium rutabulum</i> d	2.5	2.7	0.1	-	2.5	5	-
<i>Eurhynchium hians</i> d	0.1	2.6	-	-	-	0.1	-
<i>Hypnum cupressiforme</i> d	0.1	-	-	-	-	-	-
<i>Plagiomnium cuspidatum</i> d	-	0.1	-	-	-	-	-
<i>Brachythecium velutinum</i> d	-	-	0.1	-	-	-	-

elatius and other meadows species are fairly numerous apart from them.

Species belonging to *Quercus-Fagetum* class are dominant in associations: *Fraxino-Alnetum* – 19 species (54%) and *Tilio-Carpinetum* – 24 species (54%). In *Ficario-Ulmetum* the share of species from this class is smaller and amounts to 39% (15 taxa). Non-forest species, mainly from *Artemisietea vulgaris* class have a large share in all localities (Fig. 3).

In non-forest vegetation of the park species characteristic for these units are dominant. In *Arrhenatheretum elatioris*, aside from 16 species of *Molinio-Arrhenatheretea* class (33%), species from six other classes are present, including the most numerous of *Artemisietea vulgaris* class (10%). Species of *Molinio-Arrhenatheretea*, *Stellarietea mediae* and *Nardo-Callunetea* classes occur in *Urtico-Aegopodietum*, apart from the species of *Artemisietea vulgaris* class (36%) (Fig. 4).

The index of natural character (N) of the forest communities is: 40.00% for *Ficario-Ulmetum*, 46.87% for *Fraxino-Alnetum* and 51.22% for *Tilio-Carpinetum* (Table 2). This index is lower in non-forest communities, ranging from 12.76% (*Arrhenatheretum elatioris*) to

18.75% (*Parthenocissus inserta* and *Clematis vitalba* community). Synanthropization index among forest community reached the lowest value for *Tilio-Carpinetum* (48.76%) and the highest for *Ficario-Ulmetum* (60.00%). This index is over 80% for non-forest communities. The value of the synanthropization index in forest communities is influenced by the presence of kenophytes: *Aesculus hippocastanum*, *Clematis vitalba*, *Impatiens parviflora*, *Prunus cerasifera*, *Ribes rubrum*, *Ribes uva-crispa*, *Robinia pseudoacacia*, *Symphoricarpos albus*. *Tilio-Carpinetum* had the lowest value of apophytization index (39.02%) and *Arrhenatheretum elatioris* the highest (72.34%).

Associations *Tilio-Carpinetum*, *Ficario-Ulmetum*, *Fraxino-Alnetum* and *Arrhenatheretum elatioris* represents 4 types of Natura 2000 sites – respectively type: 9170, *91E0, 91F0, 6510 (Herbich, 2004a, b).

4. Discussion

The current state of the vegetation in the park in Laskowice results mainly from diversified habitat condition

(lie of the land, lake vicinity) and lack of maintenance causing progression of regeneration. As in case of other non-maintained parks with a landscape character there occurs a restoration of forest communities in accordance with the habitat. *Tilio-Carpinetum* occupies the greatest area in the park. It is the most often documented community of non-maintained village parks (Fornal-Pieniak & Wysocki, 2006; Fornal-Pieniak & Ollik, 2013; Kucharski & Chmielec-

ki, 2014. *Ficario-Ulmetum* (Kulak & Sender, 2011) and *Fraxino-Alnetum* (Borysiak et al., 2011a; Sobisz & Szmyt, 2015) are mentioned uncommonly.

The plant communities occurring in the park in Laskowice may be determined through the presence of characteristic species. An attention should be paid on physiognomy and species composition of forest communities diverging from typical forms. A strongly developed shrub layer brings attention primarily. There is a lack of some charac-

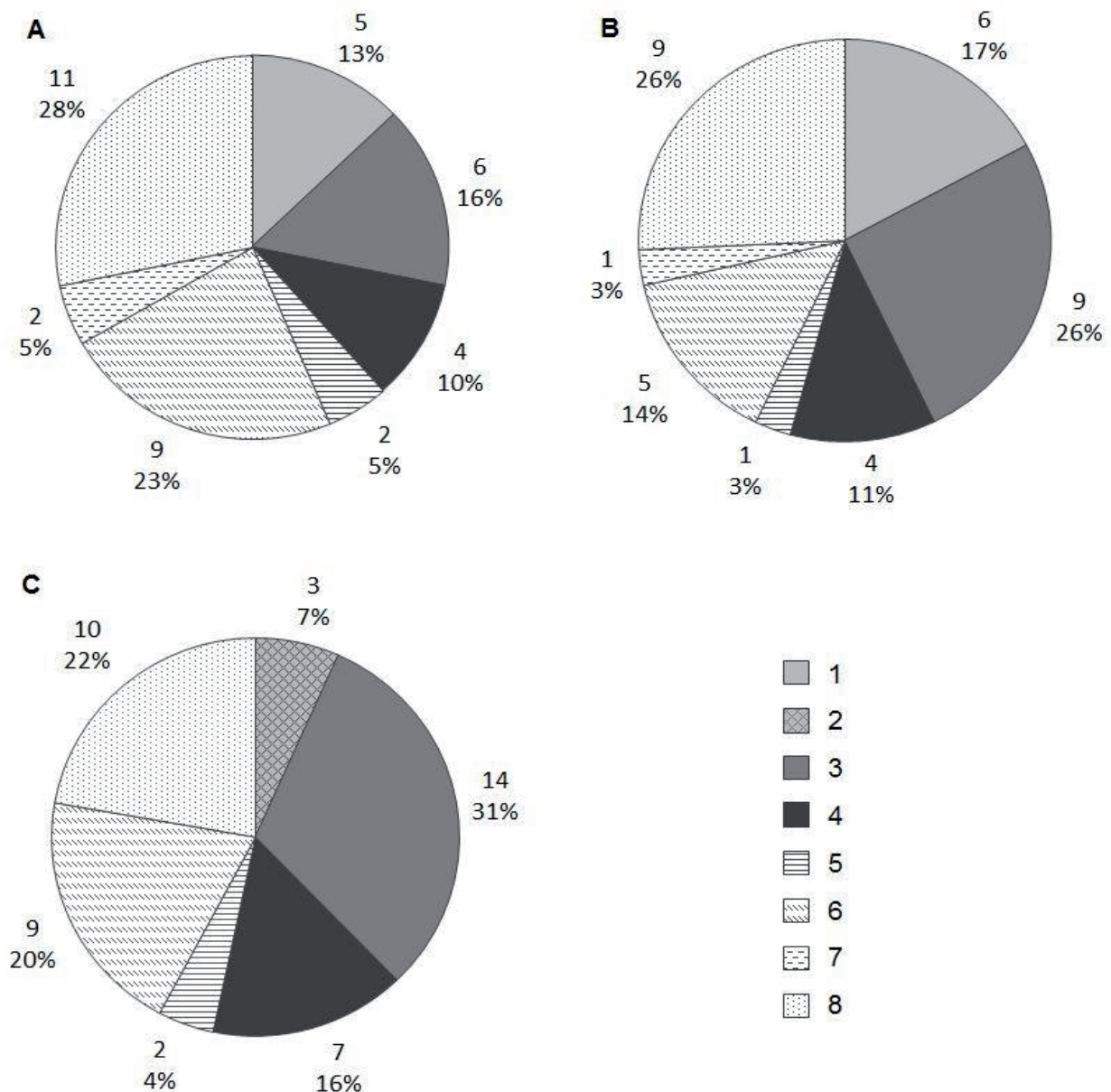


Figure 3. Number and percentage share of species from phytosociological classes in forest plant communities (A – *Ficario-Ulmetum*, B – *Fraxino-Alnetum*, C – *Tilio-Carpinetum*; 1 – *Alno-Ulmion*, 2 – *Carpinion betuli*, 3 – *Fagetalia sylvaticae*, 4 – *Quercus-Fagetea*, 5 – *Rhamno-Prunetea*, 6 – *Artemisietea vulgaris*, 7 – *Molinio-Arrhenatheretea*, 8 – others)

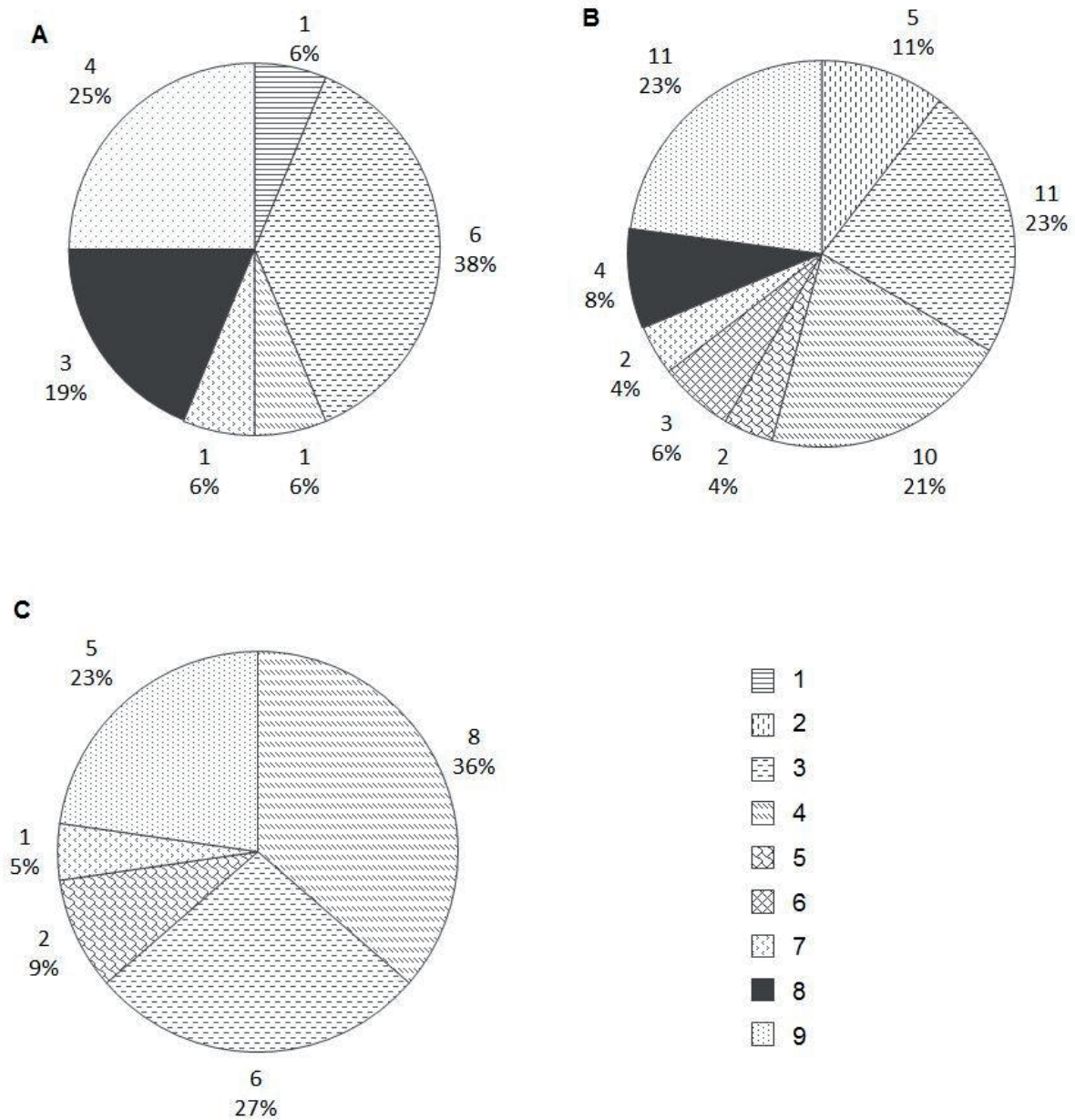


Figure 4. Number and percentage share of species from phytosociological classes in non-forest plant communities (A – *Parthenocissus inserta* and *Clematis vitalba* community, B – *Arrhenatheretum elatioris*, C – *Urtico-Aegopodietum*; 1 – *Rhamno-Prunetea*, 2 – *Arrhenatheretalia*, 3 – *Molinio-Arrhenatheretea*, 4 – *Artemisietea vulgaris*, 5 – *Stellarietea mediae*, 6 – *Agropyretea intermedio-repentis*, 7 – *Nardo-Callunetea*, 8 – *Quercu-Fagetea*, 9 – others)

Table 2. Anthropogenic indices of plants communities (F-A – *Fraxino-Alnetum*, F-U – *Ficario-Ulmetum minoris*, T-C – *Tilio-Carpinetum*, Par.-Cle. – *Parthenocissus inserta* and *Clematis vitalba* community, Arr. – *Arrhenatheretum elatioris*, U-A – *Urtico-Aegopodietum*)

Indices	F-A	F-U	T-C	Par.-Cle.	Arr.	U-A
Index of natural character (%)	46.87	40.00	51.22	18.75	12.76	15.38
Synanthropization index (%)	53.53	60.00	48.78	81.25	87.23	84.61
Apophytization index (%)	43.75	48.57	39.02	68.75	72.34	69.23

teristic species and geographically alien species are present in treestand and shrub layer.

Phytocoenoses *Ficario-Ulmetum* and *Tilio-Carpinetum* are characterized with a large share of *Sambucus nigra* and in case of the first association also *Philadelphus coronarius*, *Symphoricarpos albus* and *Aegopodium podagraria* in a herb layer. Other objects have also a similar character. The analysis of vegetation of village parks of Sandomierz Basin allowed to distinguish *Tilio-Carpinetum* association i.a. in two forms – with a small share of distinguishing species and *Tilio-Carpinetum* with *Sambucus nigra* and *Aegopodium podagraria* (Fornal-Pieniak & Wysocki, 2006). Dombrowicz (1994) paid attention on fruticetisation (i.a. by *Sambucus nigra*), as a main form of degeneration of village parks near Bydgoszcz. *Sambucus nigra* and *Philadelphus coronarius* are also the most frequently occurring shrubs in manor park in Sobianowice (Pudelska & Biesak, 2016). It should be underlined, that fruticetisation is one on the main forms of degeneration of linden-oak-hornbeam forests in Poland and *Rubus* are yet common taxa causing development of shrubs (Wozniwoda, 2007).

The presence of shrub communities of *Rhamno-Prunetea* class is typical for overgrowing parks. *Parthenocissus inserta* and *Clematis vitalba* community developed on the edges of the park ruins. No information about the presence of this community was found in literature, although the occurrence of both species in other manor parks was noted (Kucharski & Chmielecki, 2014; Sobisz & Szmyt, 2015).

Meadow communities from *Molinio-Arrhenatheretea* class and ruderal from *Artemisietea vulgaris* occupy a small area in the park and they were documented from places, which during functioning of the palace and park were deprived of trees. It is a fragment of the park by the entrance gate, where a tennis court was probably located and subsequently a playground. The second non-forest place is a slope, where the palace was erected. A mosaic of communities from these two classes has currently developed in that place. Non-forest vegetation of the park is less degraded than forest vegetation and has a more typical species composition (Matuszkiewicz, 2001). Non-forest communities are rarely described from manor complexes (Kułak & Sender, 2011; Borysiak et al., 2011a).

The values of the index of natural character and the synanthropization index of the forest community in manor park in Laskowice indicate their regeneration, although the presence of alien species still remains. The index of natural character of forest community of manor park in Laskowice is $\geq 40\%$. In comparison, this indicator calculated for NE Wielkopolska reserves is 45.5% (Kutyna et al., 2013). *Tilio-Carpinetum* has the lowest synanthropization index (48.78%), and *Ficario-Ulmetum* the highest (60.00%). For comparison, the synanthropisation index of forest habitats distant about 10 m from the mid-forest car parks in the

Wkrzańska and Bukowa Primeval Forests is 68.8% for coniferous habitats and 66.1% for forest habitats (Kutyna et al., 2010). The lower values of the index of natural character and the higher index of synanthropization in the non-forest communities are due to their anthropogenic syngensis. Synanthropization index of *Arrhenatheretum elatioris* of manor park is 87.23%. A similar value of this index (81.0%) was obtained for the same community occurring in meadows in the larger Wielkopolska river valleys (Kryszak, 2004).

A large share of ruderal species in manor park in Laskowice may result from a high habitat trophy due to build-up rural areas and the presence of numerous dirt paths, frequented by man (Latowski & Zieliński, 2001). In village parks an abundance of *Aegopodium podagraria* is common. Its large share was also noted in park ruins in Granowo (Borysiak et al., 2011b) and in village parks of Sandomierz Basin (Fornal-Pieniak & Wysocki, 2006).

Neglected manor parks in rural landscape constitute environmentally valuable ecological islands (Latowski & Zieliński, 2001) and their unquestionable quality is an occurrence of Natura 2000 sites (Borysiak et al., 2011a).

Revitalization activities are planned in manor park in Laskowice, aiming at restoration of recreational function of this place, but with preserving the current vegetation character. The removal of a shrub layer is planned in phytocoenosis of *Ficario-Ulmetum*. Phytocoenosis of *Tilio-Carpinetum* is planned to be left with no activities but with keeping the existing walking alleys. Proceeding natural regeneration of these communities with concurrent, minimally invasive revitalization activities, gives an opportunity to improve the state of deformed forest phytocoenoses. Whereas non-forest phytocoenoses with an anthropogenic derivation are suggested to be regularly mowed (Paszek & Gawenda-Kempczyńska, 2016).

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