

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE
FACULTY OF ENVIRONMENTAL SCIENCES
DEPARTMENT OF ECOLOGY

**THE FLORISTIC SURVEY OF
FLOODPLAIN FORESTS BŘEST
AND RASINA IN CENTRAL
MORAVIA**

BACHELOR THESIS

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ZADÁNÍ BAKALÁŘSKÉ PRÁCE

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Název práce

Floristický průzkum lužních lesů Břest a Rasina na střední Moravě

Název anglicky

Floristic survey of floodplain forests Břest and Rasina in central Moravia

Cíle práce

Cílem práce je posoudit aktuální stav diverzity cévnatých rostlin v lužních lesích Břest a Rasina poblíž Chropýňského luhu. Tato území dosud unikala významnější floristické pozornosti. Získaná data o současném výskytu cévnatých rostlin budou porovnána s údaji o výskytech rostlin v minulosti na základě excerptce floristické literatury. Součástí práce také budou komentáře k výskytu vzácnějších druhů, doplněné doporučeními k jejich ochraně.

Metodika

V průběhu vegetační sezóny budou lokality Břest a Rasina opakovaně navštíveny, aby byly zachyceny jednotlivé fenologické aspekty vývoje vegetace. Budou zaznamenány všechny nalezené druhy cévnatých rostlin. Zároveň bude provedena excerptce lokální floristické literatury, včetně nepublikovaných zápisků místních floristů. Výsledkem bude kompletní přehled současných a historických údajů o výskytech cévnatých rostlin na obou lokalitách. U vzácnějších cévnatých rostlin budou uvedeny komentáře k rozšíření a jejich ochraně v širším kontextu České republiky.

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Declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References.

Olomouc, 20 March 2022

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ABSTRACT

The main objective of this bachelor thesis is to assess the current diversity of vascular plants in the Břest and Rasina floodplain forests in central Moravia, Czech Republic. The area had not been systematically studied before. A floristic survey of the 350-hectare study area was carried out in the 2021 vegetation season. The research site was surveyed multiple times to cover all phenological aspects and target peak identification periods of the vegetation, in order to boost the likelihood of detecting species. The resulting list of plant species identified was compared against historical findings from the area, retrieved from floristic literature, databases, and most importantly, the unpublished archives of the leading local botanist Hynek Zavřel. New locations of rare and endangered plant species – *Orchis pallens* and *Epipactis purpurata* – were identified within the survey, highlighting the underestimated value of these degrading floodplain forests. The occurrence of rare taxons is discussed in comments. In conclusion, adequate conservation and management measures were proposed for selected endangered and vulnerable herbaceous plants.

Keywords: Rasina, Břest, floristic survey, vascular plants, floodplain forests

ABSTRAKT

Hlavním cílem bakalářské práce je zhodnocení aktuálního stavu diverzity cévnatých rostlin v lužních lesích Rasina a břestský les na střední Moravě. Na území nebyl dosud proveden rozsáhlejší botanický výzkum. V roce 2021 během vegetační sezóny proběhl na území pokrývajícím 350 ha floristický průzkum. Dané území bylo několikrát navštíveno tak, aby byly pokryty všechny fenologické fáze a zachyceno období nejvhodnější pro určování rostlin. Výsledný seznam cévnatých rostlin, které byly na území nalezeny, je porovnán s historickými údaji z daného území. Tyto údaje byly získány rešerší odborné literatury a vygenerovány z databází, přičemž nejdůležitějším pramenem byly dosud nepublikované soukromé zápisky předního moravského floristy, Hynka Zavřela. Zásadním přínosem celé práce je objevení nové lokality silně ohroženého taxonu *Orchis pallens*, a rovněž nově pro oblast byl zaznamenán *Epipactis purpurata*. Nález těchto vzácných druhů svědčí o hodnotě opomíjeného území. Součástí práce jsou také komentáře k výskytu vzácnějších druhů. Závěr obsahuje doporučení k ochraně jejich stanovišť.

Klíčová slova: Rasina, Břest, floristický průzkum, cévnaté rostliny, lužní lesy

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1. INTRODUCTION

1.1 FLOODPLAIN FOREST

The natural environment of today is marked by a steep decline in original and natural habitats. One of the last few remaining ones is the floodplain forest. It is an azonal ecosystem affected by the following two principal ecological factors: periodical flooding and high levels of groundwater (Madera 2001). These plant communities are found in lowland areas adjacent to large rivers, where groundwater levels in sections further away from the river bed are approximately 1 metre below ground on average, while in the case of channelized rivers the levels reach 2-3 metres below ground. The soils are typically heavy, high-nutrient loamy and clayey or clayey fluvisols or gleysols (Chytrý 2010).

The climate of Eastern Europe has been affected by a continuous increase in temperature and highly variable precipitation rates. The steady growth of temperature, despite the long-term stable precipitation rates, is associated with land surface drying increase (Hruška et al. 2020). The groundwater level is therefore lower and flooding less frequent (González 2012).

The current diversity reflects the past anthropogenic use of land. Central Moravia was forested between the end of Last Glacial Period and the arrival of agriculture in the Neolithic period. This is when humans began cutting trees around their settlements to make way for pastures and fields (Miklín et al. 2016). Woodland was grazed and logged for fuel and construction up until late nineteenth century. While deforestation led to a gradual loss of woods' water retention capacity, it fostered, together with said woodland grazing, coppicing, and the deforestation-induced flooding a broad range of habitats.

These are lost nowadays due to a number of reasons: canopy cover increase associated with abandonment of woodland grazing; forestry intensification with an emphasis on the production of high-quality timber and introduction of high-yield non-native tree species; and preference for clearcutting management including mechanical soil preparation (Staněk et al. 2020). The result is a homogenous, regularly harvested forest.



Figure 1 Degraded section of the Břest Forest, Segment III, photographed on 18 September 2021.

The species composition of floodplain forests is largely influenced by the entire river catchment area. It reflects the centuries-long migration of species disseminules by water and of the influx of material the river has accumulated (Řepka 2009). Floodplain flora therefore often includes alpine species in addition to the typical hydrophilic and mezophilic species. The shrub layer is often near absent in overbrowsed forests (Chytrý 2010). Sediments, eutrophication, and the rapid decomposition of organic matter have led to an increase in nutrients and nitrogen excess in the last decades (Řepka 2009). All of this affects the condition and composition of floodplain zone vegetation.

1.2 FLORISTIC SURVEY

This thesis deals with the flora of two floodplain forests in the Morava River basin, namely the Břest Forest and Rasina Forest in Central Moravia, the Czech Republic. Based on own floristic survey, it aims to explore the current condition of the local plant diversity and summarize available floristic data concerning the research site. Plant surveys are a key methodological approach used to assess the abundance and diversity of plants and to estimate the health of the given habitat. Given their longitudinal tradition, multiple data are available, allowing for longitudinal monitoring of biodiversity trends.

The flora of the above floodplain forests has, however, escaped any substantial floristic attention. The study area, set in a heavily farmed region has not been systematically studied to date and remains largely under-researched. The thesis evaluates the local diversity and distribution of vascular plant species in order to contribute to the knowledge of the change of local communities over time. The author's own field survey builds on a review of preceding botanical records in the area.

The history of the Břest Forest and Rasina Forest dates back centuries, as evident from the Josephinian Land Surveys (CENIA 2022). The oldest botanical records from the two forests are from the first half of the 19th century (AOPK ČR 2022). The first renowned botanists to have explored the Břest Forest were František Zavřel and Josef Úlehla, followed by Eduard Palla, Heinrich Laus, and Jan Zahradník. The oldest data available of Rasina Forest were recorded by František Zavřel, Palla, Heinrich Laus, Richard Picbauer, Čestmír Deyl, and Alois Zlatník. All these plant records are isolated random field notes.

For the purposes of the present thesis, only larger-scale surveys of vascular plants were considered. In this context, Rasina Forest has been explored by Hynek Zavřel between 1930 and 1967, by Pavel Král in 1967, Čestmír Deyl in 1973, Radomír Řepka in 1985, Jiří Danihelka in 2000 as part of the 2000 Kroměříž floristic survey by the Czech Botanical Society, and by Jana Černá in 2012 as part of the nation-wide project of habitat mapping. The Břest Forest, being smaller and further away from the more botanically exposed areas, has been surveyed more comprehensively only, again, by Hynek Zavřel, by Zdeněk Prudič in 1959 and Zdena Otýpková in 2008.

The objective of author's large-scale floristic survey of the Rasina and Břest floodplain forests is to make a full list of current species detected, using the random meander technique. As no comprehensive study of the research site has been made, it also aims to summarize the fragmented data and knowledge about the area and comment on the findings. Comparison against historical records, much enhanced by the

unparalleled access to Hynek Zavřel's unpublished archives, will help identify diversity trends in the area. Finally, the occurrence of rare species is commented and relevant management measures proposed, where applicable.

2. MATERIAL AND METHODS

The study area comprises two forest units set in the Upper Morava basin near the Chropyně Floodplain Forest, and managed by ALSOL Forest Service: the Břest Forest and Rasina Forest. The study area is in the northeast corner of the Pannonian thermophyticum phytogeographical region (21. Haná phytogeographic district). Its proximity to the Carpathian mesophyticum region contributes to the local plant diversity (Grulich 2003). The area covers a flat part of the alluvial plane of the Morava River. The bedrock is made of alluvial sediments, terrace sand and gravel (Hradílek 2003). The prevalent type of soil is gleyic fluvisol. The average elevation is 193 m a.s.l. and the study area is classified as a first forest vegetation zone according to the Czech Forest Classification system (Kusbach et al., 2017). The average annual temperature is 8.6°C.

The Břest Forest spreads on the right bank of a small river called Moštěnka, between the towns of Břest, Skaštice and Chropyně, and its southern part is intersected by a small water channel. There is also a small waterworks. The Břest Forest has an area of 100 ha. It is a floodplain forest with dryer sections transitioning between a hardwood and softwood floodplain woodland.

The larger Rasina Forest is 2 km northwest of the Břest Forest, covers roughly 250 ha, and is divided by two distinct railway lines. The primary structure is a transition between a floodplain forest and hardwood oak-hornbeam forest classified under the *Carici pilosae-Carpinetum* group of associations (Novák 2020).

Both the forests are commercial woodlands. Potential natural vegetation is the *Quercus-Ulmetum* association (GEOPORTAL 2022).

2.1 PRIMARY DATA COLLECTION

The floristic survey of the two forest units was conducted in the 2021 vegetation season. The study area was divided into segments (18 in Rasina and 13 in Břest) based on forest service roads, pathways, rail tracks, and forest margins. Each of these segments was surveyed several times throughout the vegetation season in order to describe the individual phenological aspects of all herbaceous species identified.

Selected voucher specimens are stored in the author's herbarium. The names of the vascular plants are based on Klíč ke květeně České republiky [Key to the Flora of the Czech Republic] (Kaplan et al. 2019).

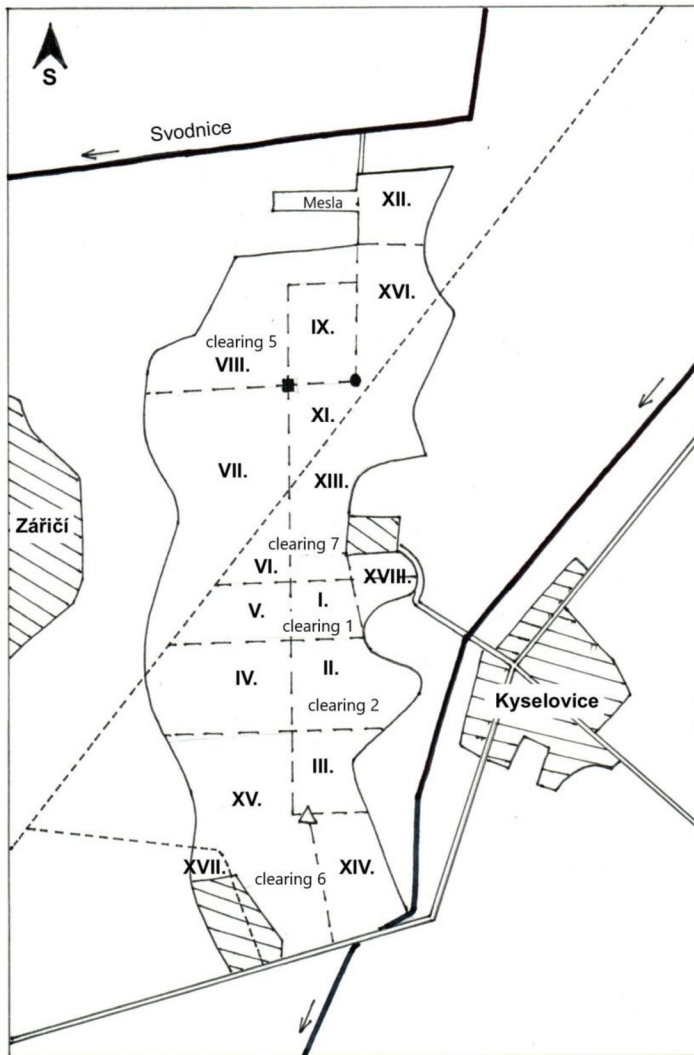


Figure 2 Segments in Rasina Forest

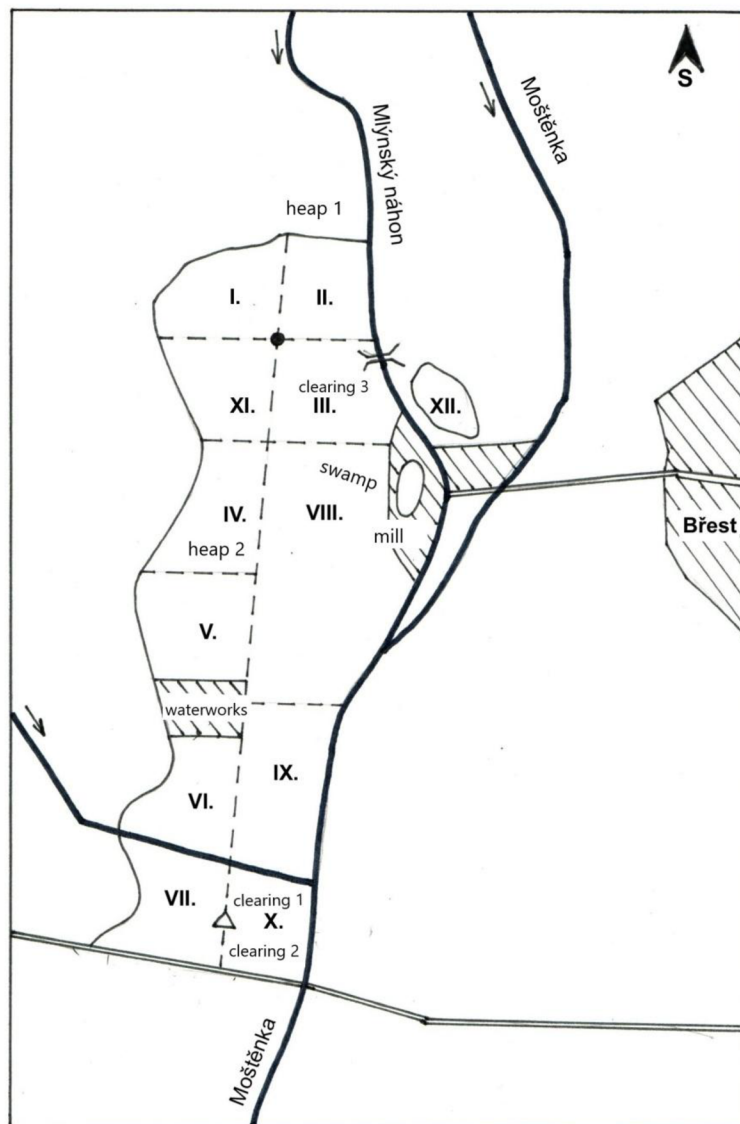


Figure 3 Segments in the Břest Forest

2.2 DATA ANALYSIS

The primary data were recorded for each segment and subsequently compared against large-scale historical field records from the area, retrieved from the Pladias and NDOP databases, previous floristic surveys, and Hynek Zavřel's unpublished personal archives. A list of all vascular plants found in the study area was made in alphabetical order. An asterisk indicates a positive finding, while specific years are given for Hynek Zavřel's field records, given the fact that the unique source spans the period of roughly 40 years.

Any species in the study area, which is on the red list of threatened vascular plants (Grulich 2017), is assigned the relevant category in the table. The categories are as follows: C1 – critically endangered taxon; C2 – endangered taxon; C3 – vulnerable taxon; C4 – near threatened taxon.

2.2.1 PERSONAL ARCHIVES OF HYNEK ZAVŘEL

One of the leading botanists collecting in the area of interest was Hynek Zavřel, a teacher most active between the early 1930s and the late 1960s. While he published articles in his lifetime, not all of his floristic field records around Moravia have been made available to the public. His personal archives are stored in the Moravian Museum in Brno, Czech Republic. Records retrieved from said archives have been kindly lent to the author of the present article by Viktor Pluhař. They contain previously unpublished records of Zavřel's floristic surveys of both the Břest and Rasina forests between 1930 and 1967.

3.1 RESULTS AND DISCUSSION

Changes in land use, logging, flow regulation, and climate change have all contributed to the degradation of present-day floodplain forests (Horner et al. 2012). The study area is set in a densely populated landscape of fertile, heavily farmed fields. Existing woodlands in the region mark the sites which were historically too wet to be farmed. The proximity of human settlements suggests the study area served as a source of wood and for grazing.

Compared to the other forested areas along the central part of the Morava River basin (Kroměříž Forest District), Rasina Forest was historically distinguished by an increased abundance of hornbeam, while the Břest Forest was used extensively by local citizens for nettle harvesting in the 20th century (Vlastimil Dřimal, 19 February 2022, pers.comm.). As the two units under study are commercial forests, their current vegetation composition does not reflect native tree species. This, together with increasing fragmentation of central European forests (Begon 2021), which in turn decreases diversity, is reflected in their understory composition.

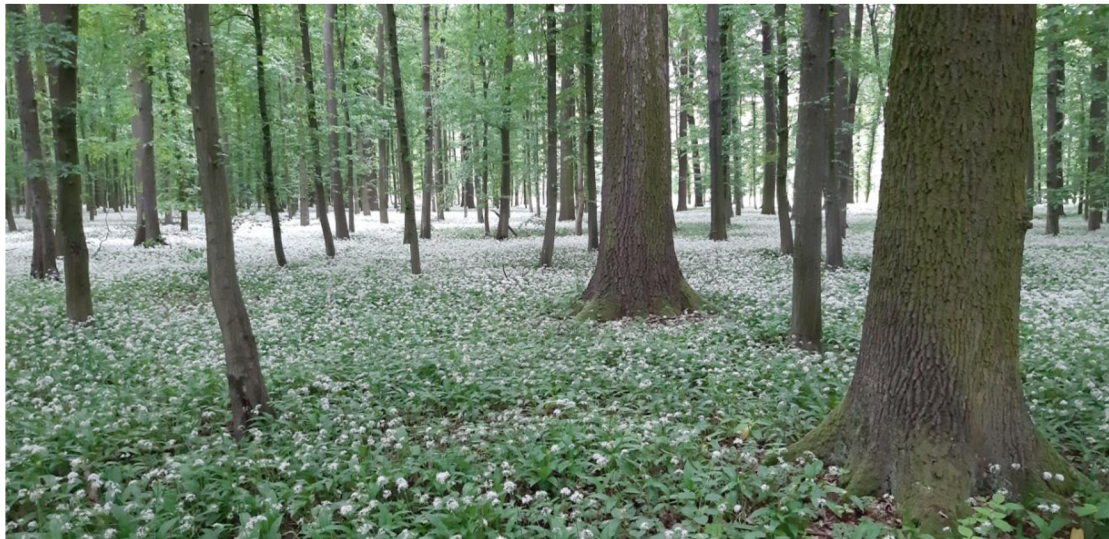


Figure 4 *Allium ursinum* in Rasina Forest, Segment VIII, photographed on 15 April 2021.

3.1 TOTAL NUMBER OF SPECIES

The overall area of the forests under study was 350 hectares. The 2021 survey found a total of 271 taxa in Rasina Forest, of which 25 were woody and 246 herbaceous species. The Břest Forest was found to contain 222 species of plants, of which 22 were woody and 200 herbaceous species.

Together with records retrieved from historical resources, the total number of all plant species in the two forest units combined over time amounts to 457, of which are 47 woody and 410 herbaceous species.

A large number of species was not confirmed in the 2021 survey, and conversely, many species had not been described until 2021. This may be due to several reasons (Hradílek 2007):

Although the 2021 survey was carried out to the best ability of the author, some of the species may have been overlooked, particularly those occurring in small numbers. Field botanists exploring the study area prior to 2021 had been driven by other goals than to conduct a comprehensive floristic survey of the area, such as habitat mapping and forest type identification (Jana Černá, Zdeněk Prudič, for example) or simply random field records (Zavřel, Řepka etc.).

Secondly, some of the species have disappeared due to natural changes in the forest structure such as total tree and shrub canopy cover, stand age, and logging (Šebesta 2021).

And finally, the increasing levels of eutrophication (Machar 2001), different farming and fertilization methods, the filling of ponds and wet ditches (Trávníček 1996), and the declining groundwater levels are most likely the decisive factors behind the disappearance of, for example, *Gladiolus imbricatus*, found on the edge of the Břest Forest by Hynek Zavřel in 1931 (Zavřel, unpublished). Likewise the absence of *Lindernia procumbens*, another finding by Hynek Zavřel dated to 1931 is probably caused by the drop in the Morava basin groundwater levels.

Much of the new, previously non-recorded species found in the 2021 survey are ruderal adventive taxa (such as *Oxalis stricta*, *Conyza canadensis*, *Datura stramonium*, *Lactuca serriola*, *Amaranthus retroflexus*, *Echinochloa crus-galii*, etc.). These were mostly recorded in exposed, built-up or farmed areas of the forests under study. Forest fragmentation fosters the occurrence of strong competitors, and highly specialized and often endangered plants species are competitively excluded (Klaus 2011).

3.2 OVERVIEW OF HISTORICAL AND CURRENT RECORDS

Below follows Table 1 representing all large-scale historical and current floristic surveys of the two floodplain forests conducted since the 1930s until present.

Table 1 List of vascular plant species detected in the study area between 1930 and 2021 (source: author)

SPECIES	RASINA						BŘEST					
	Zavřel 1930-1967	Král 1967	Deyl 1973	Řepka 1985	Danihelka 2003	Černá 2012	Černínová 2021	Zavřel 1930-1967	Prudič 1959	Otypková 2008	Černínová 2021	Red list of CR (Grulich 2017)
<i>Acer campestre</i>	1958	*			*	*	*	1952	*	*	*	
<i>Acer negundo</i>										*		
<i>Acer platanoides</i>		*					*					
<i>Acer pseudoplatanus</i>	1958				*	*	*		*	*	*	
<i>Achillea collina</i>					*							
<i>Achillea millefolia</i>							*				*	
<i>Adoxa moschatellina</i>						*						
<i>Aegopodium padagraria</i>		*			*	*	*	1952	*	*	*	
<i>Aesculus hippocastanum</i>					*	*	*				*	
<i>Aethusa cynapioides</i>								1958				C4a
<i>Aethusa cynapium</i>			*		*							
<i>Agrimonia eupatoria</i>			*		*		*				*	
<i>Agrostis capillaris</i>		*						s.d.			*	
<i>Agrostis stolonifera</i>									*			
<i>Ajuga genevensis</i>							*				*	
<i>Ajuga reptans</i>		*				*	*	1933	*		*	
<i>Alliaria petiolata</i>	1933	*			*	*	*	1952		*	*	
<i>Allium oleraceum</i>							*	1957				

<i>Allium scorodoprasum</i>						*	1957			*	
<i>Allium ursinum</i>	1936	*			*	*	1953		*	*	C4a
<i>Alnus glutinosa</i>		*			*			*		*	
<i>Alnus incana</i>	1967										
<i>Alopecurus aequalis</i>						*				*	
<i>Alopecurus pratensis</i>						*		*		*	
<i>Amaranthus retroflexus</i>						*				*	
<i>Amaranthus sp.</i>										*	
<i>Anagallis arvensis</i>						*				*	
<i>Anemone nemorosa</i>					*	*	s.d.			*	
<i>Anemone ranunculoides</i>					*	*		*	*	*	
<i>Angelica sylvestris</i>			*	*							
<i>Anthemis arvensis</i>						*				*	
<i>Anthriscus nitidus</i>	1932, 1933, 1958				*	*					
<i>Anthriscus sylvestris</i>		*			*	*	1952, 1953	*	*	*	
<i>Antirrhinum majus</i>						*					
<i>Arabidopsis thaliana</i>						*					
<i>Arctium lappa</i>		*		*		*	1957	*		*	
<i>Arctium minus</i>						*	1957			*	
<i>Arctium xmixtum</i>							s.d.				
<i>Arctium tomentosum</i>				*						*	
<i>Arenaria serpyllifolia</i>						*					
<i>Arrhenatherum elatior</i>							s.d.			*	
<i>Artemisia vulgaris</i>				*		*				*	
<i>Arum cylindraceum</i>		*		*	*	*			*	*	C4a
<i>Arum maculatum</i>							1965				C3
<i>Asarum europaeum</i>					*	*					
<i>Asperugo procumbens</i>										*	C3
<i>Astragalus glycyphyllos</i>			*	*		*	1953, 1957			*	
<i>Athyrium filix-femina</i>						*					
<i>Atriplex patula</i>				*						*	
<i>Atriplex rosea</i>	1959										
<i>Avena fatua</i>										*	
<i>Avena sativa</i>										*	

<i>Avenella flexuosa</i>		*											
<i>Avenula pubescens</i>								1953					
<i>Ballota nigra</i>										*	*		
<i>Betonica officinalis</i>								s.d.					
<i>Betula pendula</i>		*				*	*				*		
<i>Brachypodium pinnatum</i>			*				*				*		
<i>Brachypodium sylvaticum</i>	1967	*	*		*	*	*	1957	*	*	*		
<i>Briza media</i>								s.d.					
<i>Bromus benekenii</i>			*	*	*	*	*						
<i>Bromus erectus</i>								1953					
<i>Bromus hordeaceus</i>							*				*		
<i>Bromus racemosus</i>	1958, 1967												C1t
<i>Bromus ramosus</i> agg.		*											
<i>Bromus sterilis</i>							*			*	*		
<i>Bromus tectorum</i>							*				*		
<i>Calamagrostis arundinaceae</i>							*				*		
<i>Calamagrostis epigejos</i>		*			*	*	*	s.d., 1957			*		
<i>Callitriche hamulata</i>										*			
<i>Callitriche palustris</i> agg.											*		
<i>Calystegia sepium</i>							*			*			
<i>Campanula trachelium</i>	1958				*	*	*	1931		*	*		
<i>Capsella bursa-pastoris</i>							*	s.d.			*		
<i>Cardamine impatiens</i>							*						
<i>Cardamine parviflora</i>	1931, 1966, 1933							1931, 1966					C1b
<i>Cardamine pratensis</i>													
<i>Carduus acanthoides</i>							*						
<i>Carduus crispus</i>					*	*	*	1933			*		
<i>Carex acuta</i>	1967		*						*		*		
<i>Carex acutiformis</i>							*						
<i>Carex brizoides</i>						*	*						
<i>Carex buekii</i>								1965					C4a
<i>Carex divulsa</i>							*				*		C3
<i>Carex elongata</i>				*									
<i>Carex hirta</i>							*				*		
<i>Carex leporina</i>				*									

<i>Carex muricata</i> agg.				*	*	*						
<i>Carex otomana</i>				*		*						C4a
<i>Carex ovalis</i>						*						
<i>Carex pairae</i>	1967							1953				
<i>Carex pallescens</i>	1932, 1967			*		*						
<i>Carex pendula</i>									*			C4a
<i>Carex pilosa</i>		*		*	*	*					*	
<i>Carex praecox</i>								s.d.				
<i>Carex remota</i>				*		*					*	
<i>Carex riparia</i>	1967				*	*		1932		*		C4a
<i>Carex spicata</i>				*		*					*	
<i>Carex sylvatica</i>	s.d.	*			*	*	*	s.d., 1953			*	
<i>Carex tomentosa</i>	s.d.											
<i>Carex vesicaria</i>											*	
<i>Carex vulpina</i>				*								
<i>Carpinus betulus</i>	1958, 1967	*			*	*	*				*	
<i>Centaurea cyanus</i>											*	
<i>Centaurea jacea</i> agg.							*					
<i>Centaurea jacea</i>								s.d.				
<i>Centaureum erythraea</i>							*					
<i>Cerastium arvense</i>							*					
<i>Cerastium caespitosa</i>	1967							s.d., 1953				
<i>Cerastium holosteoides</i>							*					
<i>Cerastium lucorum</i>					*		*	1953			*	C4a
<i>Chaerophyllum aromaticum</i>					*							
<i>Chaerophyllum bulbosum</i>							*	1953		*		
<i>Chaerophyllum temulum</i>							*			*	*	
<i>Chelidonium majus</i>					*			s.d.			*	
<i>Chenopodium album</i> agg.											*	
<i>Chenopodium album</i>							*					
<i>Chenopodium ficifolium</i>											*	
<i>Chenopodium hybridum</i>							*				*	
<i>Chenopodium</i>											*	

<i>polyspermum</i>													
<i>Cichorium intybus</i>						*					*		
<i>Circaea lutetiana</i>		*				*	1957	*			*		
<i>Cirsium arvense</i>	1967					*	s.d.						
<i>Cirsium canum</i>						*							
<i>Cirsium oleraceum</i>							1957				*		
<i>Cirsium palustre</i>					*			*					
<i>Cirsium vulgare</i>					*	*					*		
<i>Clinopodium vulgare</i>			*		*	*					*		
<i>Colchicum autumnale</i>	1967	*	*		*	*	1952		*		*		
<i>Convallaria majalis</i>	1967	*			*	*	1952						
<i>Convolvulus arvensis</i>						*							
<i>Convolvulus sepium</i>							1957						
<i>Conyza canadensis</i>						*					*		
<i>Cornus sanguinea</i>	1967	*				*	s.d.	*	*				
<i>Corydalis cava</i>		*				*	1931				*		
<i>Corydalis solida</i>						*					*	C4a	
<i>Corylus avellana</i>		*				*	1931				*		
<i>Crataegus monogynae</i>	1958, 1967										*		
<i>Crataegus sp.</i>		*				*		*					
<i>Crepis biennis</i>											*		
<i>Cuscuta europaea</i>					*		1957						
<i>Dactylis glomerata</i>						*	s.d.		*		*		
<i>Dactylis glomerata</i> subsp. <i>lobata</i>	1958, 1967												
<i>Dactylis polygama</i>		*			*	*		*	*		*		
<i>Datura stramonium</i>											*		
<i>Deschampsia cespitosa</i>		*	*			*		*			*		
<i>Descurainia sophia</i>											*		
<i>Dianthus armeria</i>					*							C4a	
<i>Dianthus deltoides</i>							s.d.						
<i>Digitaria sanguinalis</i>						*							
<i>Digitaria sanguinalis</i> var. <i>pectiniformis</i>						*							
<i>Digitaria sanguinalis</i> var. <i>sanguinalis</i>											*		
<i>Dipsacus fullonum</i>					*	*							
<i>Dipsacus pilosus</i>							s.d.					C3	
<i>Dryopteris carthusiana</i>						*							
<i>Dryopteris filix-mas</i>						*							
<i>Echinochloa crus-galii</i>						*					*		

<i>Echium vulgare</i>						*						
<i>Elymus caninus</i>								*			*	
<i>Elymus repens</i>				*		*						
<i>Epilobium adenocaulon</i>											*	
<i>Epilobium ciliatum</i>						*						
<i>Epilobium hirsutum</i>											*	
<i>Epipactis purpurata</i>						*						C3
<i>Equisetum arvense</i>						*					*	
<i>Eragrostis albensis</i>						*						
<i>Erigeron annuus</i>				*		*						
<i>Erigeron annuus</i> subsp. <i>septentrionalis</i>											*	
<i>Erysimum cheiranthoides</i>											*	
<i>Euonymus verrucosus</i>						*						
<i>Eupatorium cannabinum</i>				*		*						
<i>Euphorbia cyparissias</i>			*									
<i>Euphorbia helioscopia</i>											*	
<i>Euphorbia illirica</i>								1953				C3
<i>Euphorbia palustris</i>								1953				
<i>Euphorbia platyphyllos</i>											*	
<i>Euphorbia stricta</i>											*	C3
<i>Fagopyrum esculentum</i>											*	
<i>Fallopia convolvulus</i>											*	
<i>Fallopia dumetorum</i>	1958			*								
<i>Festuca gigantea</i>						*			*		*	
<i>Festuca heterophylla</i>	1958					*						
<i>Festuca pratensis</i>						*		1935			*	
<i>Festuca rupicola</i>	1967							1930				
<i>Festuca sylvatica</i>						*						
<i>Ficaria verna</i>		*				*	*	1930		*	*	
<i>Filipendula ulmaria</i>								1931, 1957	*		*	
<i>Filipendula ulmaria</i> subsp. <i>ulmaria</i>			*									
<i>Filipendula vulgaris</i>			*					1930				
<i>Fragaria moschata</i>	1967			*		*						
<i>Fragaria vesca</i>	1931, 1967	*				*		1931				

<i>Frangula alnus</i>	1967	*			*			1931				
<i>Fraxinus excelsior</i>	1958, 1967	*			*	*	*	1933	*	*	*	
<i>Gagea lutea</i>						*	*	1930			*	
<i>Galanthus nivalis</i>							*	1931, 1935			*	C3
<i>Galega officinalis</i>					*		*					C4a
<i>Galeobdolon luteum</i>							*				*	
<i>Galeobdolon luteum</i> agg.	1958	*						1930, 1952	*			
<i>Galeobdolon montanum</i>	1967				*	*	*					
<i>Galeopsis bifida</i>							*					
<i>Galeopsis pubescens</i>							*					
<i>Galeopsis speciosa</i>							*		*			
<i>Galeopsis tetrahit</i>							*	1957			*	
<i>Galinsoga parviflora</i>								1958				
<i>Galinsoga quadriradiata</i>					*		*				*	
<i>Galium album</i>							*				*	
<i>Galium aparine</i>	1967	*				*	*	1932		*	*	
<i>Galium boreale</i>								1930				
<i>Galium mollugo</i> agg.							*				*	
<i>Galium odoratum</i>	s.d., 1958	*			*	*	*	s.d.				
<i>Galium sylvaticum</i>					*		*					
<i>Galium verum</i>								s.d.				
<i>Geranium columbinum</i>							*					
<i>Geranium dissectum</i>							*				*	
<i>Geranium palustre</i>											*	
<i>Geranium pratense</i>							*					
<i>Geranium pusillum</i>							*				*	
<i>Geranium pyrenaicum</i>							*				*	
<i>Geranium robertianum</i>					*		*			*	*	
<i>Geum urbanum</i>	1958	*			*		*	1931	*	*	*	
<i>Gladiolus imbricatus</i>								1935				C2b
<i>Glechoma hederacea</i>	1931, 1958	*				*			*	*	*	
<i>Glyceria maxima</i>							*				*	
<i>Gnaphalium</i>					*							

<i>uliginosum</i>												
<i>Hacquetia epipactis</i>					*		1931, 1952, 1953	*				C4a
<i>Hedera helix</i>	1967	*	*		*	*						
<i>Helianthus tuberosus</i>											*	
<i>Helmintha echioides</i>							1931					
<i>Hieracium murorum</i>	1967											
<i>Hieracium sabaudum</i>	1967											
<i>Hieracium levicaule</i>	1967											
<i>Hieracium sphondylium</i>											*	
<i>Hordeum vulgare</i>											*	
<i>Humulus lupulus</i>						*						
<i>Hypericum hirsutum</i>	1958				*	*	1931, 1957				*	
<i>Hypericum perforatum</i>		*			*	*					*	
<i>Impatiens noli-tangere</i>		*			*	*						
<i>Impatiens parviflora</i>					*	*			*	*		
<i>Inula britannica</i>						*						
<i>Inula salicina</i>							1930					C4a
<i>Iris pseudacorus</i>	1958, 1967		*		*	*	1953	*			*	
<i>Iris sibirica</i>							1965					C3
<i>Isopyrum thalictroides</i>							1930, 1952				*	C4a
<i>Juncus bufonius</i> agg.											*	
<i>Juncus effusus</i>					*	*					*	
<i>Juncus tenuis</i>					*							
<i>Knautia arvensis</i> subsp. <i>arvensis</i>						*						
<i>Lactuca serriola</i>						*					*	
<i>Lamium album</i>						*	1953				*	
<i>Lamium maculatum</i>	1931, 1958, 1967	*			*	*	1931	*	*	*	*	
<i>Lamium purpureum</i>						*					*	
<i>Lapsana communis</i>					*	*	1957	*			*	

<i>Lathyrus pratensis</i>			*		*		*	1930				
<i>Lathyrus vernus</i>		*			*	*	*	1931				
<i>Lemna minor</i>										*	*	
<i>Leontodon hispidus danubialis</i>								1931				
<i>Linaria vulgaris</i>							*					
<i>Lindernia procumbens</i>								1931				C1t
<i>Lilium martagon</i>	1967	*	*		*	*	*					C4a
<i>Lolium multiflorum</i>							*				*	
<i>Lolium perenne</i>							*				*	
<i>Loranthus europaeus</i>					*		*				*	C4a
<i>Lotus corniculatus</i>							*				*	
<i>Lychnis flos-cuculi</i>	1967				*		*					
<i>Lycopus europaeus</i>							*				*	
<i>Lysimachia nemorum</i>		*					*					
<i>Lysimachia nummularia</i>	1958, 1967	*			*	*	*		*		*	
<i>Lysimachia vulgaris</i>		*			*			s.d., 1931, 1957				
<i>Lythrum salicaria</i>						*	*			*		
<i>Maianthemum bifolium</i>	1967	*				*		1952, 1953				
<i>Malus xdasycphylla</i>					*							
<i>Malus sylvestris</i>						*	*	1958				
<i>Malus sylvestris</i> agg.											*	
<i>Medicago lupulina</i>							*				*	
<i>Melampyrum nemorosum</i>								1931, 1953, 1957				
<i>Melampyrum nemorosum</i> var. <i>nemorosum</i>	1958, 1967						*					
<i>Melica nutans</i>	1931, 1958, 1967	*			*	*	*				*	
<i>Melilotus altissimus</i>								1931				
<i>Melilotus officinalis</i>							*				*	

<i>Mercurialis perennis</i>	1958, 1967	*			*	*		1952	*		*	
<i>Microrrhinum minus</i>											*	
<i>Milium effusum</i>	1958, 1967	*			*	*	*	1953	*	*	*	
<i>Moehringia trinervia</i>	1930, 1967						*	1930				
<i>Muscari</i> sp.							*					
<i>Mycelis muralis</i>										*		
<i>Myosotis arvensis</i>							*				*	
<i>Myosotis sparsiflora</i>							*	1931				C4
<i>Myosotis stricta</i>							*					
<i>Myosotis sylvatica</i>		*						1931				
<i>Myosoton aquaticum</i>					*		*				*	
<i>Neottia nidus-avis</i>	1967							1953				C4a
<i>Orchis pallens</i>						*	*					C2b
<i>Oxalis acetosella</i>							*					
<i>Oxalis stricta</i>							*				*	
<i>Papaver rhoeas</i>							*				*	
<i>Paris quadrifolia</i>	1958	*				*	*	1931, 1953	*		*	
<i>Persicaria hydropiper</i>					*		*				*	
<i>Persicaria lapatifolia</i> subsp. <i>lapatifolia</i>							*					
<i>Phacelia tanacetifolia</i>											*	
<i>Phalaris arundinacea</i>					*		*		*	*	*	
<i>Phleum pratense</i>					*		*	1935			*	
<i>Phragmites australis</i>	1967										*	
<i>Picea abies</i>						*	*				*	
<i>Picea excelsior</i>	1967											
<i>Picea pungens</i>					*							
<i>Pinus</i> sp.							*					
<i>Pisum sativum</i>											*	
<i>Plantago lanceolata</i>							*					
<i>Plantago major</i>							*				*	
<i>Plantago media</i>							*					
<i>Platanthera bifolia</i>							*					C3
<i>Platanthera chlorantha</i>								1931				C3
<i>Poa annua</i>					*		*				*	
<i>Poa nemoralis</i>	1967	*				*	*				*	
<i>Poa palustris</i>			*		*						*	

<i>Poa pratensis</i>	1967					*				*	
<i>Poa trivialis</i>					*	*				*	
<i>Polygonatum multiflorum</i>	1931, 1958, 1967	*	*		*	*	*	1931, 1952	*		*
<i>Polygonum aviculare</i>						*				*	
<i>Populus xcanadensis</i>						*			*		
<i>Populus alba</i>	1958					*		1958			*
<i>Populus tremula</i>	1958, 1967	*			*	*	*		*		*
<i>Portulaca oleracea</i>											*
<i>Potentilla anserina</i>					*						*
<i>Potentilla argentea</i>							*				
<i>Potentilla reptans</i>							*				*
<i>Potentilla supina</i>							*				
<i>Primula elatior</i>	1967	*				*	*				
<i>Prunella vulgaris</i>					*		*				*
<i>Prunus avium</i>	1967					*					
<i>Prunus cerasifera</i>											*
<i>Prunus fruticosa</i>					*						
<i>Prunus padus</i>							*				*
<i>Prunus spinosa</i>	1967		*				*				
<i>Pulmonaria obscura</i>	1958				*	*	*	1934, 1952	*		*
<i>Pulmonaria officinalis</i>		*				*				*	
<i>Quercus petrae</i>						*	*			*	*
<i>Quercus robur</i>	1958, 1967	*			*	*	*	1932	*	*	*
<i>Quercus rubra</i>						*	*				
<i>Ranunculus acris</i>	1933						*				
<i>Ranunculus auricomus</i> agg.						*					
<i>Ranunculus auricomus</i>	1931							1931, 1952			
<i>Ranunculus lanuginosus</i>	1967	*	*		*	*	*	1952	*		
<i>Ranunculus polyanthemos</i>	1967										
<i>Ranunculus repens</i>	1932, 1967						*	1932			*

<i>Rhamnus cathartica</i>						*	1932				
<i>Robinia pseudoaccacia</i>				*	*	*					
<i>Rorippa sylvestris</i>										*	
<i>Rosa canina</i>	1967						1933			*	
<i>Rubus caesius</i>	1958, 1967	*			*	*		*	*	*	
<i>Rubus fruticosus</i> agg.						*					
<i>Rubus idaeus</i>		*				*					
<i>Rumex xduftii</i>					*						
<i>Rumex acetosa</i>						*					
<i>Rumex crispus</i>						*					
<i>Rumex obtusifolius</i>					*	*					
<i>Rumex sanguineus</i>					*		1956			*	
<i>Salix</i> sp.						*		*			
<i>Salix caprea</i>					*						
<i>Salix fragilis</i>										*	
<i>Sambucus nigra</i>	1958	*				*			*	*	
<i>Saponaria officinalis</i>					*						
<i>Scrophularia nodosa</i>	1958, 1967	*	*			*	1932			*	
<i>Scutellaria galericulata</i>			*								
<i>Selinum carvifolium</i>	1958		*				1930				
<i>Senecio erraticus</i>					*						C3
<i>Senecio germanicus</i>					*	*					
<i>Senecio nemorensis</i>	1958										
<i>Senecio ovatus</i>						*					
<i>Senecio sylvaticus</i>						*					
<i>Senecio vulgaris</i>						*					
<i>Serratula tinctoria</i>							1931				C4a
<i>Setaria pumila</i>										*	
<i>Setaria viridis</i>						*				*	
<i>Silene baccifera</i>											C3
<i>Silene dioica</i>	1967										
<i>Silene latifolia</i> subsp. <i>alba</i>					*					*	
<i>Silene vulgaris</i>										*	
<i>Silybum marianum</i>										*	
<i>Sinapis arvensis</i>										*	
<i>Sisymbrium loeselii</i>										*	
<i>Sisymbrium officinale</i>						*				*	
<i>Solanum nigrum</i>						*				*	
<i>Solanum tuberosum</i>										*	

<i>Solidago canadensis</i>						*				*	
<i>Solidago gigantea</i>				*		*					
<i>Sonchus arvensis</i>						*				*	
<i>Sonchus asper</i>						*				*	
<i>Sonchus oleraceus</i>						*				*	
<i>Sorbus aucuparia</i>	1967									*	
<i>Stachys alpina</i>	1967			*		*					C3
<i>Stachys palustris</i>				*		*				*	
<i>Stachys sylvatica</i>	1958, 1967	*			*	*	*	1930	*	*	
<i>Stellaria holostea</i>	1967	*			*	*	*	1931			
<i>Stellaria media</i>						*				*	
<i>Stellaria nemorosa</i>						*					
<i>Symphytum officinale</i>	1967	*	*			*			*	*	*
<i>Symphytum tuberosum</i> agg.		*									
<i>Symphytum tuberosum</i>	1967					*	*	1930		*	*
<i>Tanacetum vulgare</i>					*	*					
<i>Taraxacum</i> sp.						*					
<i>Thlaspi arvense</i>	1967					*					*
<i>Tilia cordata</i>	1958, 1967	*			*	*	*	1934	*	*	*
<i>Tilia xeuropaea</i>						*					*
<i>Tilia platyphyllos</i>								1958			
<i>Torilis japonica</i>	1958				*	*					*
<i>Trapa natans</i>	1952										C1b
<i>Trifolium alpestre</i>						*					
<i>Trifolium campestre</i>						*					
<i>Trifolium dubium</i>											*
<i>Trifolium hybridum</i>						*					*
<i>Trifolium pratense</i>						*					*
<i>Trifolium repens</i>	1967					*					
<i>Tripleurospermum</i> <i>inodorum</i>						*					*
<i>Trisetum flavescens</i>						*					
<i>Triticum</i> sp.						*					
<i>Tulipa xgesneriana</i>						*					
<i>Tussilago farfara</i>	1931				*	*		1931			*
<i>Typha latifolia</i>									*		
<i>Ulmus glabra</i>	1952, 1958, 1967				*						

<i>Ulmus minor</i>		*			*						
<i>Ulmus</i> sp.									*		
<i>Urtica dioica</i>	1958, 1967	*			*	*		*	*	*	
<i>Valeriana officinalis</i>	1958						s.d.				
<i>Valerianella locusta</i>						*	s.d.				
<i>Verbascum blattaria</i>							s.d.				C2b
<i>Verbascum phlomoides</i>						*					
<i>Verbascum thapsus</i>						*					
<i>Verbena officinalis</i>						*					C3
<i>Veronica arvensis</i>										*	
<i>Veronica chamaedrys</i> agg.								*			
<i>Veronica chamaedrys</i>				*		*	s.d.		*	*	
<i>Veronica hederifolia</i>										*	C4b
<i>Veronica officinalis</i>		*				*					
<i>Veronica persica</i>						*				*	
<i>Veronica serpyllifolia</i>						*					
<i>Veronica sublobata</i>						*					
<i>Viburnum opulus</i>			*			*	1932, 1952			*	
<i>Vicia angustifolia</i>						*					
<i>Vicia cracca</i>						*	s.d.			*	
<i>Vicia dumetorum</i>			*			*	1931				C4a
<i>Vicia hirsuta</i>						*					
<i>Vicia sepium</i>				*		*	s.d.			*	
<i>Vicia tetrasperma</i>						*				*	
<i>Vinca minor</i>						*					
<i>Viola</i> sp.								*			
<i>Viola arvensis</i>						*					
<i>Viola hirta</i>							1931				
<i>Viola mirabilis</i>	1967		*			*					C4a
<i>Viola odorata</i>					*		1935, 1958			*	
<i>Viola reichenbachiana</i>	1967	*			*	*				*	
<i>Viola riviniana</i> agg.										*	
<i>Viola riviniana</i>					*			*	*		
<i>Viola sylvatica</i>							1931				
<i>Viscum album</i>										*	

<i>Xanthium strumarium</i>	1954							1954, 1959, 1961				C1t
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An interesting association was found in the most valuable parts of Rasina Forest, consisting of *Orchis pallens*, *Lilium martagon*, *Hypericum hirsutum*, *Vicia dumetorum*, *Astragalus glycyphyllos*, *Circaea lutetiana*, and *Stachys sylvatica*.

3.3 COMMENTS ON SELECTED SPECIES

Only red-listed species confirmed in the 2021 survey are commented on. Management methods are proposed for selected endangered and vulnerable taxa.

Asperugo procumbens – C3

No previous record for the study area. Madwort occurs in arable fields, vineyards, on rough and waster ground, on roadsides. It is a casual, growing in warm regions. It is rare in central Moravia, often found in botanically unattractive habitats (Komárek 2017). In the Břest Forest it occurred in a single location in Segment IV (49.3493600N, 17.4056697E) – a heap of winter-feeding hidden under a canvas. The site was later populated by *Silybum marianum*, *Tritica sp.* and *Avena fatua*. Given the temporary nature of the species' occurrence, no management measures are proposed.



Figure 5 *Asperugo procumbens* in the Břest Forest, Segment IV, photographed on 30 May 2021.

Carex divulsa – C3

Grey sedge occurs in densely shaded or moderately shaded forests, and prefers disturbances (Kaplan 2016a). Most often it grows in hardwood floodplain forests, oak-hornbeam or beech forests in southern Moravia along the Morava and Dyje rivers and in the Moravian Carpathians. *C. divulsa* had been collected in the study area by Petr Albrecht in 2000 (PLADIAS 2022). The taxon was found to be scattered throughout the study area, often favouring interior wood-borders and openings. Management: reduction of non-native woody plants and increased diversity of native tree species.

Cerastium lucorum – C4a

It is found in a range of woodland types. It is most frequent in floodplain and deciduous forests, along forest paths and roads in moist areas. It is scattered to locally common in northern, central and eastern Bohemia, and more common in central Moravia, particularly north of Brno and in the Carpathians (Kaplan 2016b). *Cerastium lucorum* was found to be rare to scattered around both Rasina and the Břest forests, mostly along forest paths and roads.

Epipactis purpurata – C3

No previous record for the study area. Violet helleborine is a shade-tolerant species of densely shaded oak-hornbeam and beech woodland, less frequently in mixed forests, floodplain and spruce-fir forests. The habitats typically have a sparse herbaceous layer (Jersáková 2004). The species is nearly absent in western Bohemia, while isolated populations occur in northeast Bohemia. The highest concentration of the taxon is in southeast Moravia. It is rare in central Moravia (botany.cz 2022). The 2021 survey identified a total of three specimens in Rasina, two in Segment XVIII (49.3814442N, 17.3853278E) and one in Segment XIII (49.3832603N, 17.3819803E). Management: As the taxon is sensitive to changes in humidity, woodland clearance has caused a decline in *E. purpurata*. Only minimal interventions in the tree canopy should be made, all the more in the case of high-nutrient soils such as those of the study area, where any new opening promotes the growth of shrubs and competitive herbs.



Figure 6 *Epipactis purpurata* in Rasina Forest, Segment XVIII, photographed on 26 July 2021.

***Euphorbia stricta* – C3**

No previous record for the study area. Upright spurge is a ruderal species occurring along water courses, on wet grassland, roadsides. It has an affinity for high-nutrient moist soils. The majority of its populations in the Czech Republic are

concentrated in the Beskydy Mts. (Chrték 1992). It travels from these habitats down to central and southeast Moravia, where it is very rare though. A single fertile specimen was found in a wet exposed ditch habitat on the Rasina wood-border, near Mesla, Segment XII. It grew in the vicinity of *Galega officinalis* (49.3926464N, 17.3827528E).

***Galega officinalis* – C4a**

Goat's rue is a ruderal bushy perennial, colonising waste ground and anthropogenic habitats in general, as well as wet meadows (PLADIAS 2022). It is an archeophyte in the Czech Republic, with scattered distribution mainly in the warmer parts of the Czech Republic. It is more common in south Moravia (Chrtková 1995). In 2021 it was found in two locations in Rasina (Segments XV and XII), the first was the roadside/fence of a clearing and the other a wet exposed ditch, where Rasina is very open, bordering with grassland.

***Galanthus nivalis* – C3**

Common snowdrop is scattered around the whole Czech Republic, primarily scree woodlands, moist, oak-hornbeam, beech forests, and other shaded places. In central Moravia, it is found mostly in floodplain forests (Komárek 2017). There are abundant populations of *Galanthus nivalis* in the Břest Forest, in Segments II, III, IX, IV, VIII, IX, X., while the species is rare in Rasina (a few tufts found in Segment XVIII). Management: It is generally threatened by loss of habitat, illegal harvesting, and climate change. Restoration of the native tree composition and selective logging are recommended.

***Isopyrum thalictroides* – C4a**

The species colonises moist deciduous woodland, gorges, and shrubland. In the Czech Republic it is scattered in Moravia and eastern Bohemia, with isolated small populations in the rest of the country. It is scattered to rare in central Moravia, with prevalent occurrence in floodplain forests (Komárek 2017). The population of *Isopyrum thalictroides* in the Břest Forest is stable but small, concentrating mostly in Segment XI.

***Lilium martagon* – C4a**

Turk's cap lily colonises open deciduous and mixed woodland. It is scattered in central Moravia, with preference for calcareous deposits. While Komárek proposes that it is absent from floodplain forests (Komárek 2017), PLADIAS classifies it as uncommon there, and specifies its typical habitats as subalpine vegetation and a wide variety of woodlands. *Lilium martagon* is scattered to common in Rasina Forest. Interestingly enough, not a single flowering specimen was found throughout the 2021 vegetation season as all the stalks had been removed by deer. Yet this does not seem to jeopardize the local population.

***Myosotis sparsiflora* – C4a**

This lowland herb is found in river basins in central Bohemia and in central and south Moravia, in floodplain forests, oak-hornbeam forests, wet meadows and fields. It prefers wet habitats, particularly those on clayey, high-nutrient deposits (botany.cz 2022a; Komárek 2017). A few specimens of *Myosotis sparsiflora* were found in the 2021 survey in Rasina, at an exposed habitat following the SŽDC railway track, Segment XVII. The population was stable along the entire track in the direction of the town of Chropyně.

***Platanthera bifolia* – C3**

No previous record for the study area. Lesser butterfly orchid is a plant of wide ecological amplitude, growing in dry to moderately wet meadows, grassland, as well as shrubland, open woodland, and forest edges. It has suffered a decline due to drainage, logging, and agricultural intensification. It is now considered scattered to rare globally. In central Moravia it is a scattered species of beech and oak-hornbeam woods (Komárek 2017). A single, fertile specimen was found in Rasina as part of the 2021 survey, on a wood-border, near *Orchis pallens*, Segment XIII (49.3834558N, 17.3827100E). *P. bifolia* prospers in open woodland, management should therefore involve selective logging, not clearfell.



Figure 7 *Platanthera bifolia* in Rasina Forest, Segment XIII, photographed on 25 May 2021.

Stachys alpina – C3

Limestone woundwort is found in floodplain forests, oak-hornbeam and scree woods, pastures, along forest roads, and in subalpine tall-forb grasslands (Komárek 2017). The locations of *Stachys alpina* in the Czech Republic mostly comprise east-northeast Moravia (PLADIAS 2022), but it is increasingly common in central Moravia as well. The species was collected in the study area by Hynek Zavřel in 1967 and by Jiří Danihelka in 2000 (see Table 1). In 2021, the species was found in Segments XIII,

XVII, and XII of Rasina Forest, occurring predominantly along forest roads and interior wood openings.

Vicia dumetorum – C4a

It is a perennial species of the Fabaceae family, with an affinity for warm climate regions. It is often found in open forests or on woodland borders, in shrubland or along roads and paths. Although it is a rare species for central Moravia (Komárek 2017), the oldest herbarium item from the study area dates back to 1931 (Hynek Zavřel, unpublished). The plant is uncommon in Rasina Forest, settling along forest roads and interior woodland borders, in moist spots in Segments XIII and XVII.

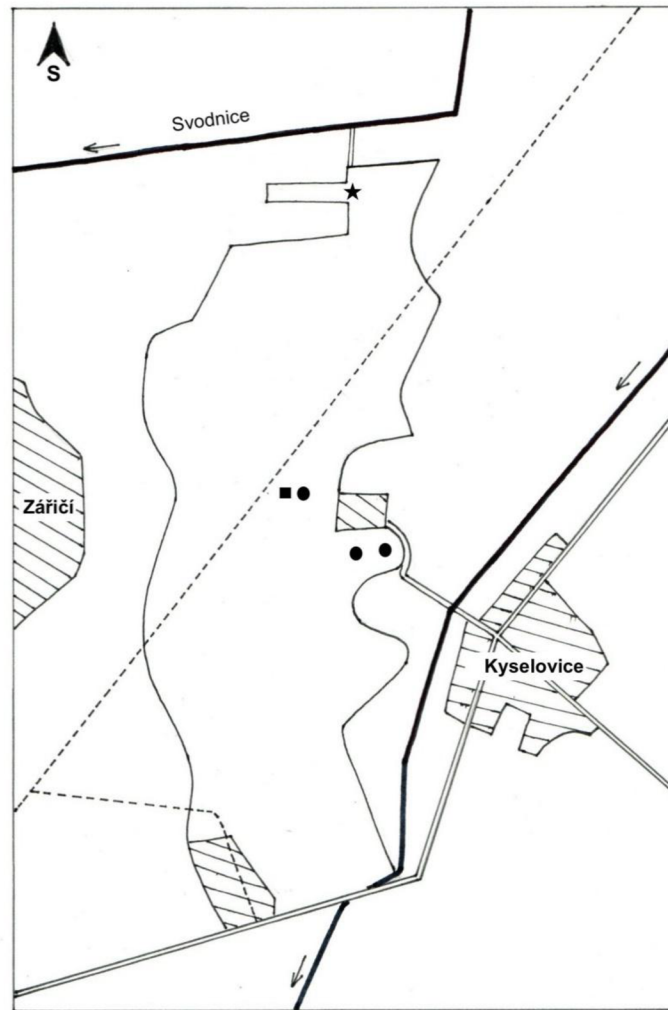


Figure 8 Distribution of *Epipactis purpurata* (circle), *Euphorbia stricta* (star), and *Platanthera bifolia* (square) in Rasina Forest

3.2.1 ORCHIS PALLENS – C2b

The pale orchid prefers open deciduous woodlands, chiefly oak-hornbeam forests, although it may also be found in shrubland and scree forests, and mesophile grassland. In the Czech Republic, the range of the species is centred in the Carpathian Moravia and dwindles towards the west, with only isolated occurrences in Bohemia (Jersáková 2004).

A new location of *Orchis pallens* was discovered during the 2021 floristic survey, in Rasina Forest, Segment XIII (see Fig. 4; 49.3825617N, 17.3820661E). The species had been reported from the forest unit by Jana Černá in 2012 (see Table 1), approximately 800m north of the 2021 finding, involving a few specimens. The population found on 15 May 2021 comprised roughly 200 fertile specimens covering a single site of estimated 15x20 square metres. It was located between a woodland border along a clearing (of a spruce-fir stand) and an unpaved road deeper in the forest.



Figure 9 *Orchis pallens* in Rasina Forest, Segment XIII, photographed on 15 May 2021.

Management: Forest populations of *Orchis pallens* appear, as Jersáková points out, to suffer by an increasingly dense tree cover. The degree of shade may be adjusted by selective logging and the elimination of shrub layer (Jersáková 2004). The priority should be to remove non-native and colonising woody species, and to leave juvenile shrub specimen to ensure the continuity of the community. Minor frequent interventions are preferred to major measures, as these could promote a biomass increase, arrival of invasive species and colonisers, and significantly alter the light and humidity of the habitat.

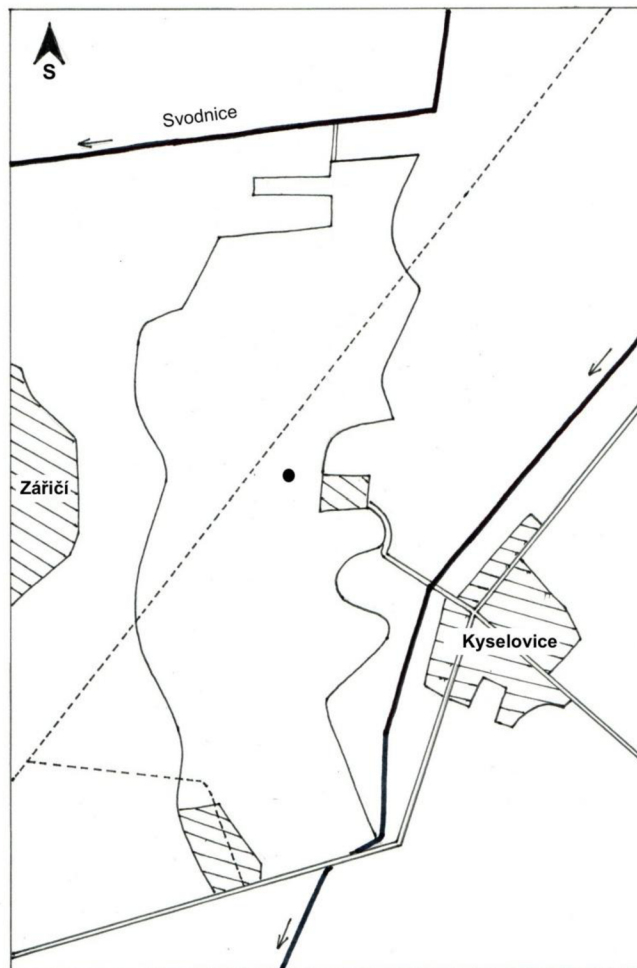


Figure 10 Distribution of *Orchis pallens* (circle) in Rasina.Forest

4. CONCLUSION

The main objectives set out at the beginning of the thesis were: a plant species survey of two previously under-researched floodplain forests, including a full list of the species detected; a review of and comparison against the backdrop of historical floristic findings in the area; brief identification of changes in the community composition.

A detailed floristic survey of the 350-hectare study area was carried out in the 2021 vegetation season. The resulting lists for each forest unit are in Appendices. Rasina alone was found to hold a total of 271 taxa, of which 25 were woody and 246 herbaceous species. The smaller Břest Forest was found to house 222 species of plants, of which 22 were woody and 200 herbaceous species. The figures alone are of little informative value. What is more interesting is the comparison of the plant species composition over time. Overall, the study area was found to have contained 457 taxons, of which are 47 woody and 410 herbaceous species between 1930 and 2021. The historical review of local floristic findings was substantially improved by the lucky chance of gaining access to the hitherto unpublished archives of Hynek Zavřel, a leading Moravian botanist, who collected in the area between 1930 and 1967. Table 1 reveals which species have disappeared, while showing, on the other hand, currently a much higher number of species in general. This fact is not appreciated in the case of floodplain forests, as the new taxons are mostly neophytes and alien species.

The 2021 survey of the Rasina and Břest floodplain forests has, however, also yielded welcome findings. The most noteworthy was probably a new location of *Orchis pallens*. Its fertile population of several hundreds was detected in a single segment of Rasina Forest, where the forest is open, bordering with a recent clearing. The species is endangered and declining in the Czech Republic due to loss of habitat, increasing eutrophication and succession, and decreasing groundwater levels.

Another remarkable new finding for the study area was *Epipactis purpurata*. Three fertile specimens of this rare and vulnerable plant were found in Rasina Forest, one about 20 metres from the *Orchis pallens* site, in Segment XIII, and two in Segment XVIII, a shaded part of the forest.

The detection of such rare species in the study area suggests the forests have been unjustly underestimated. At the same time, the species list provided is undoubtedly incomplete, merely outlining the current diversity. Only longitudinal floristic inventory assessments would show the degree to which it transforms and develops over time. It would also be interesting to compare the two forest units in terms of their soil

composition, influx of agrochemicals, and groundwater levels, to try to explain the difference in their plant composition and fitness.

In terms of adequate conservation measures, the choices are limited given the commercial nature of the study area. The current large-scale clear-felling forestry management is detrimental to the local herbaceous diversity. As some of the rare and endangered species growing in the study area show shade affinity while others prefer open forests, a safe all-around measure promoting their fitness would be to implement close to nature forestry methods, such as low-intensity selective logging, restocking using native tree species, deer reduction, presence of veteran trees and deadwood, reintroduction of coppicing and woodgrazing. The results of this survey will serve for future comparison and assessment of the long-term effects of eutrophication, forestry management methods, and climate change on the local flora.

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APPENDICES

Appendix 1: List of species identified – the 2021 survey

(source: author)

RASINA				
SPECIES	DATE	SEGMENT	ABUNDANCE	RED LIST
<i>Acer campestre</i>	15.5.2021	X, XVII, II		
<i>Acer platanoides</i>	15.5.2021	X, XIII		
<i>Acer pseudoplatanus</i>	15.5.2021	X, XIII		
<i>Achillea millefolia</i>	25.5.2021	XIII crossroads leading from main road to horse farm		
<i>Aegopodium padagraria</i>	15.5.2021	II, XIII	abundant	
<i>Aesculus hippocastanum</i>	26.7.2021	■	1 individual	
<i>Agrimonia eupatoria</i>	28.5.2021	XII path along wood edge toward Mesla, XVII, XI	rare	
<i>Ajuga genevensis</i>	5.6.2021	clearing 6		
<i>Ajuga reptans</i>	15.5.2021	VIII	common	
<i>Alliaria petiolata</i>	15.5.2021		scattered	
<i>Allium oleraceum</i>	26.7.2021	XIII near <i>Orchis pallens</i>		
<i>Allium scorodoprasum</i>	28.5.2021	left edge of Mesla, clearing 6		
<i>Allium ursinum</i>	15.5.2021	II, VI, VIII, IX, X,	abundant	C4a
<i>Alopecurus aequalis</i>	16.6.2021	clearing 3		
<i>Alopecurus pratensis</i>	15.5.2021	I road, III	scattered	
<i>Amaranthus retroflexus</i>	26.7.2021	clearing 6, 7	common	
<i>Anagallis arvensis</i>	6.7.2021	XVII, clearing 6	scattered	
<i>Anemone nemorosis</i>	15.5.2021	II, clearing 6		
<i>Anemone ranunculoides</i>	15.5.2021	II		
<i>Anthemis arvensis</i>	6.7.2021	I road, V road		
<i>Anthriscus sylvestris</i>	26.7.2021	XIII		
<i>Antirrhinum majus</i>	13.6.2021	clearing 6		
<i>Arabidopsis thaliana</i>	10.9.2021	XVII		
<i>Arctium minor</i>	6.7.2021	I road		
<i>Arenaria serpyllifolia</i>	6.7.2021	XVII	rare	

<i>Artemisia vulgaris</i>	25.5.2021	I crossroads before rail		
<i>Arctium lappa</i>	26.7.2021	XIII		
<i>Arum cylindraceum</i>	1.8.2021	all segments	scattered to abundant	
<i>Asarum europaeum</i>	25.5.2021	II to the left from gate	rare	
<i>Astragalus glycyphyllos</i>	5.6.2021	clearing 6, road I/V		
<i>Athyrium filix-femina</i>	16.6.2021	XIII - near clearing 7 under juvenile spruce	1 individual	
<i>Betula pendula</i>	26.7.2021	XIII	scattered	
<i>Brachypodium pinnatum</i>	6.7.2021	III field, III		
<i>Brachypodium sylvaticum</i>	5.6.2021	Mesla, II		
<i>Bromus benekenii</i>	6.7.2021	III	rare	
<i>Bromus hordeaceus</i>	25.5.2021	XVII	locally common	
<i>Bromus sterilis</i>	16.6.2021	III pheasantry		
<i>Bromus tectorum</i>	25.5.2021	■, clearing 6, clearing 3	rare	
<i>Calamagrostis arundinaceae</i>	6.7.2021	road	common	
<i>Calamagrostis epigejos</i>	16.6.2021	III field behind pheasantry, road along clearing 6, XIII	abundant	
<i>Calystegia sepium</i>	28.5.2021	Mesla, III field	scattered	
<i>Campanula trachelium</i>	28.5.2021	Mesla, clearing 6, XIV, Δ	rare	
<i>Capsella bursa-pastoris</i>	25.5.2021	crossroads before rail, XVII		
<i>Cardamine impatiens</i>	5.6.2021	clearing 6, XIV	common	
<i>Carduus acanthoides</i>	16.6.2021	clearing 6	rare	
<i>Carduus crispus</i>	6.7.2021	I crossroads, clearing 7	scattered	
<i>Carex acutiformis</i>	15.5.2021	XI		
<i>Carex brizoides</i>	5.6.2021	XVII, I crossroads - a thick growth on the left	locally common	
<i>Carex divulsa</i>	26.7.2021	XVIII, XIII	common	C3
<i>Carex hirta</i>	6.7.2021	XVII		
<i>Carex muricata</i> agg.	16.6.2021	III field		
<i>Carex otomana</i>	16.6.2021	II		C4a

<i>Carex pallescens</i>	5.6.2021	clearing 6, clearing 3	scattered to common	
<i>Carex pilosa</i>	15.5.2021	XIII		
<i>Carex remota</i>	16.6.2021	II		
<i>Carex spicata</i>	5.6.2021	clearing 6, III field, XVIII	common	
<i>Carex sylvatica</i>	15.5.2021	XIII	abundant	
<i>Carpinus betulus</i>	15.5.2021	II, XVII, VIII woodborder		
<i>Centaurea jacea</i> agg.	16.6.2021	clearing 6		
<i>Centaureum erythraea</i>	6.7.2021	XVII	3 fertile individuals	
<i>Cerastium arvense</i>	8.5.2021	clearing 6		
<i>Cerastium holosteoides</i>	28.5.2021	XII clearing		
<i>Cerastium lucorum</i>	16.6.2021	III field, I crossroads		C4a
<i>Chaerophyllum aromaticum</i>	26.7.2021	■		
<i>Chaerophyllum bulbosum</i>	25.5.2021	■		
<i>Chaerophyllum temulum</i>	25.5.2021	■	rare	
<i>Chenopodium album</i>	26.7.2021	XIII clearing 7	common	
<i>Chenopodium hybridum</i>	1.8.2021	■		
<i>Cichorium intybus</i>	26.7.2021	I crossroads		
<i>Circaea lutetiana</i>	26.7.2021	XIII		
<i>Cirsium arvense</i>	5.6.2021	clearing 6, I road	scattered to common	
<i>Cirsium canum</i>	29.7.2021	road XIII, clearing 6		
<i>Cirsium vulgare</i>	6.7.2021	XVII, clearing 7		
<i>Clinopodium vulgare</i>	23.6.2021	clearing 6, I crossroads , XI	rare	
<i>Colchicum autumnale</i>	15.5.2021		abundant	
<i>Convallaria majalis</i>	15.5.2021	VII, ■, clearing 6	locally common	
<i>Convolvulus arvensis</i>	16.6.2021	III field		
<i>Conyza canadensis</i>	26.7.2021	I crossroads		
<i>Cornus sanguinea</i>	15.5.2021	II		
<i>Corydalis cava</i>	15.5.2021	XVIII, XIII	common	
<i>Corydalis solida</i>	26.7.2021	XVIII	scattered	
<i>Corylus avellana</i>	15.5.2021			
<i>Crataegus</i> sp.	28.5.2021			
<i>Dactylis glomerata</i>	5.6.2021	clearing 6	scattered	
<i>Dactylis polygama</i>	28.5.2021	Mesla, clearing 6, II, XIII	abundant	
<i>Deschampsia cespitosa</i>	6.7.2021	Δ, VII		

<i>Digitaria sanguinalis</i>	6.7.2021	III field		
<i>Digitaria sanguinalis</i> var. <i>pectiniformis</i>	1.8.2021	rails		
<i>Dipsacus fullonum</i>	1.8.2021	Mesla meadow, probably planted		
<i>Dryopteris carthusiana</i>	26.7.2021	XIII near clearing 7	2 individuals	
<i>Dryopteris filix-mas</i>	17.6.2021	X wet ditch		
<i>Echinochloa crus-galii</i>	26.7.2021	clearing 7	scattered	
<i>Echium vulgare</i>	6.7.2021	XVII	1 individual	
<i>Elymus repens</i>	16.6.2021	III field	rare	
<i>Epilobium ciliatum</i>	16.6.2021	clearing 6	rare	
<i>Epipactis purpurata</i>	26.7.2021	XIII, XVIII	3 fertile individuals	C3
<i>Equisetum arvense</i>	5.6.2021	rails , XVII	locally abundant	
<i>Eragrostis albensis</i>	1.8.2021	rails		
<i>Erigeron annuus</i>	13.6.2021	XIII road, clearing 6, I crossroads	scattered, locally abundant	
<i>Euonymus verrucosus</i>	16.6.2021	III pheasantry	1 individual	
<i>Eupatorium cannabinum</i>	26.7.2021	clearing 7, road VII/VIII, IX	scattered	
<i>Euphorbia stricta</i>	1.8.2021	Mesla	1 fertile individual	C3
<i>Festuca gigantea</i>	26.7.2021	XIII		
<i>Festuca pratensis</i>	5.6.2021	Mesla		
<i>Festuca sylvatica</i>	26.7.2021	XIII		
<i>Ficaria verna</i>	15.5.2021		abundant	
<i>Fragaria moschata</i>	15.5.2021	II, VII, ■, XVII, VII	locally scattered to common	
<i>Fragaria vesca</i>	15.5.2021	XII, clearing 6, •	abundant	
<i>Fraxinus excelsior</i>	15.5.2021	all segments	abundant	
<i>Gagea lutea</i>	15.5.2021			
<i>Galanthus nivalis</i>	26.7.2021	XVIII	rare	
<i>Galega officinalis</i>	26.7.2021	XV road, Mesla	rare	C4a
<i>Galeobdolon luteum</i>	15.5.2021	X, II,	abundant	
<i>Galeobdolon montanum</i>	28.5.2021	Mesla, II		
<i>Galeopsis bifida</i>	26.7.2021	XIII clearing 7	abundant	
<i>Galeopsis pubescens</i>	16.6.2021	road, ■, XI	abundant	
<i>Galeopsis speciosa</i>	26.7.2021	clearing 7	rare	
<i>Galeopsis tetrahit</i>	1.8.2021	all segments	scattered	

<i>Galinsoga quadriradiata</i>	1.8.2021	■	scattered	
<i>Galium album</i>	5.6.2021	clearing 6		
<i>Galium aparine</i>	15.5.2021		abundant	
<i>Galium mollugo</i> agg.	16.6.2021	III field		
<i>Galium odoratum</i>	15.5.2021	XI, VII, II, clearing 6, XIII	abundant	
<i>Galium sylvaticum</i>	1.8.2021	road	scattered	
<i>Geranium columbinum</i>	6.7.2021	XVII		
<i>Geranium dissectum</i>	5.6.2021	clearing 6, XVII	rare	
<i>Geranium pratense</i>	6.7.2021	XVII	1 individual	
<i>Geranium pusillum</i>	6.7.2021	XVII		
<i>Geranium pyrenaicum</i>	10.9.2021	XVII		
<i>Geranium robertianum</i>	15.5.2021	XIII road	scattered	
<i>Geum urbanum</i>	15.5.2021	II, XIII	abundant	
<i>Glyceria maxima</i>	28.5.2021	Mesla		
<i>Hedera helix</i>	15.5.2021		abundant	
<i>Hippocastanum aesculum</i>	15.5.2021	VII	1 individual	
<i>Humulus lupulus</i>	5.6.2021	clearing 6	rare to scattered	
<i>Hypericum hirsutum</i>	15.5.2021	VII road, clearing 6, road along clearing 5	scattered	
<i>Hypericum perforatum</i>	5.6.2021	clearing 6, III field		
<i>Impatiens parviflora</i>	28.5.2021	XIII	scattered	
<i>Inula britannica</i>	26.7.2021	clearing 6		
<i>Iris pseudacorus</i>	15.5.2021	XIII road, XI, XI rail		
<i>Juncus effusus</i>	16.6.2021	I/V road ditch, III field, VIII	rare	
<i>Knautia arvensis</i> subsp. <i>arvensis</i>	6.7.2021	XVII	several fertile individuals	
<i>Lactuca serriola</i>	5.6.2021	clearing 6, III field, road	scattered, locally common	
<i>Lamium album</i>	15.5.2021	VII road, clearing 6		
<i>Lamium maculatum</i>	15.5.2021	XII, Mesla, III pheasantry	abundant	
<i>Lamium purpureum</i>	28.5.2021	clearing 6, III pheasantry		
<i>Lapsana communis</i>	17.6.2021	along roads	scattered	
<i>Lathyrus pratensis</i>	30.5.2021	clearing 6 road, III field, XIII	scattered, locally abundant	
<i>Lathyrus vernus</i>	15.5.2021	clearing 6	scattered	

<i>Lilium martagon</i>	1.5.2021	XIII, ■, Mesla, VII	scattered to abundant	C4a
<i>Linaria vulgaris</i>	16.6.2021	III field	rare	
<i>Lolium multiflorum</i>	16.6.2021	pheasantry		
<i>Lolium perenne</i>	16.6.2021	pheasantry		
<i>Loranthus europaeus</i>	26.7.2021	XIII, XVIII	scattered	
<i>Lotus corniculatus</i>	5.6.2021	clearing 6		
<i>Lychnis flos-cuculi</i>	30.5.2021	clearing 6	rare, 3 individuals	
<i>Lycopus europaeus</i>	30.5.2021	road along clearing 6	rare	
<i>Lysimachia nemorum</i>	16.6.2021	III field		
<i>Lysimachia nummularia</i>	15.5.2021	XIII		
<i>Lythrum salicaria</i>	1.8.2021	rails	rare	
<i>Malus sylvestris</i>	26.7.2021	XVIII, clearing 6	scattered	
<i>Medicago lupulina</i>	5.6.2021	clearing 6, XVII	locally common	
<i>Melampyrum nemorosum</i> var. <i>nemorosum</i>	17.6.2021	VII road, V near crossroads	rare	
<i>Melica nutans</i>	15.5.2021	XIII, II, III field	scattered	
<i>Melilotus officinalis</i>	16.6.2021	road, XIII		
<i>Milium effusum</i>	15.5.2021	II, along the road		
<i>Moehringia trinervia</i>	28.5.2021	Mesla	rare	
<i>Muscari</i> sp.	15.5.2021	II path from gate to clearing 2	1 tuft	
<i>Myosotis arvensis</i>	5.6.2021	clearing 6, along roads, XIII road, XVII, rails	locally abundant	
<i>Myosotis sparsiflora</i>	5.6.2021	XVII		
<i>Myosotis stricta</i>	4.5.2021	XVII	abundant	
<i>Myosoton aquaticum</i>	16.6.2021	II, I crossroads	rare	
<i>Orchis pallens</i>	15.5.2021	XIII	locally abundant	C2b
<i>Oxalis acetosella</i>	25.5.2021	■, clearing 6, II	rare	
<i>Oxalis stricta</i>	5.6.2021	clearing 6, road along clearing 5	scattered	
<i>Papaver rhoeas</i>	5.6.2021	VIII clearing 7, III pheasantry		
<i>Paris quadrifolia</i>	15.5.2021		abundant	
<i>Persicaria hydropiper</i>	1.8.2021	rails		
<i>Persicaria lapatifolia</i> subsp. <i>lapatifolia</i>	26.7.2021	clearing 7	scattered	
<i>Phalaris arundinacea</i>	17.6.2021	VII wet ditch near		

		Zarici exit		
<i>Phleum pratensis</i>	6.7.2021			
<i>Picea abies</i>	26.7.2021	XIII	2 seedlings	
<i>Plantago lanceolata</i>	25.5.2021	I crossroads		
<i>Plantago major</i>	6.7.2021	Δ		
<i>Plantago media</i>	25.5.2021	I crossroads		
<i>Platanthera bifolia</i>	25.5.2021	XIII	2 fertile individuals	C3
<i>Poa annua</i>	5.6.2021	clearing 6		
<i>Poa nemoralis</i>	15.5.2021	XIII, XII, I, II, IV, X, V, VI	abundant	
<i>Poa pratensis</i>	25.5.2021	■, field		
<i>Poa trivialis</i>	15.5.2021	II		
<i>Polygonatum multiflorum</i>	15.5.2021	clearing 6, II	common	
<i>Polygonum aviculare</i>	16.6.2021	III pheasantry , I and II road	scattered	
<i>Populus tremula</i>	25.5.2021	I crossroads	rare	
<i>Potentilla argentea</i>	26.7.2021	clearing 6		
<i>Potentilla reptans</i>	6.7.2021	XVII		
<i>Potentilla supina</i>	26.7.2021	clearing 6	rare	
<i>Primula elatior</i>	26.7.2021	XIII	scattered	
<i>Prunella vulgaris</i>	6.7.2021	road I/V	scattered	
<i>Prunus padus</i>	6.7.2021	II		
<i>Prunus spinosa</i>	16.6.2021	III field	rare	
<i>Pulmonaria obscura</i>	15.5.2021	II, X, XIII	abundant	
<i>Quercus petrae</i>	16.6.2021	II	planted stand	
<i>Quercus robur</i>	5.6.2021	clearing 6	planted stand	
<i>Ranunculus acris</i>	5.6.2021	clearing 6		
<i>Ranunculus lanuginosus</i>	15.5.2021	XII	scattered	
<i>Ranunculus repens</i>	25.5.2021	I crossroads, clearing 6, XVII		
<i>Rhamnus cathartica</i>	15.5.2021	II		
<i>Robinia pseudoacacia</i>	15.5.2021		scattered	
<i>Rorippa sylvestris</i>	6.7.2021	Δ		
<i>Rubus caesium</i>	6.7.2021	II, I, VII, VIII	common	
<i>Rubus fruticosus</i> agg.	6.7.2021	XVIII		
<i>Rubus idaeus</i>	26.7.2021		common	
<i>Rumex acetosa</i>	5.6.2021	clearing 6		
<i>Rumex crispus</i>	16.6.2021			
<i>Rumex obtusifolius</i>	25.5.2021	I crossroads and path, clearing 7	rare to scattered	
<i>Salix</i> sp.	6.7.2021			

<i>Scrophularia nodosa</i>	5.6.2021	clearing 6	scattered	
<i>Senecio germanicus</i>	26.7.2021	XIII	2 individuals	
<i>Senecio ovatus</i>	1.8.2021	VI/VIII	rare	
<i>Senecio sylvaticus</i>	26.7.2021	clearing 7	rare	
<i>Senecio vulgaris</i>	5.6.2021	clearing 6	common	
<i>Setaria viridis</i>	6.7.2021	■, clearing 7	locally abundant	
<i>Sisymbrium officinale</i>	6.7.2021	Δ		
<i>Solanum nigrum</i>	1.8.2021	■	rare	
<i>Solidago canadensis</i>	10.9.2021	I and II road		
<i>Solidago gigantea</i>	16.6.2021	III pheasantry ,XI	rare	
<i>Sonchus arvensis</i>	6.7.2021	XIII road	scattered	
<i>Sonchus asper</i>	5.6.2021	clearing 6, ■	scattered	
<i>Sonchus oleraceus</i>	26.7.2021	XIII road		
<i>Stachys alpina</i>	16.6.2021	road - VI, XIII, XII	rare to scattered	C3
<i>Stachys palustris</i>	6.7.2021	road I/V, rails	scattered	
<i>Stachys sylvatica</i>	15.5.2021	clearing 1 along road, clearing 6, II	common	
<i>Stellaria holostea</i>	15.5.2021	II	scattered abundant	
<i>Stellaria media</i>	26.7.2021	XVII		
<i>Stellaria nemorosa</i>	5.6.2021	clearing 5, along fence		
<i>Symphytum officinale</i>	5.6.2021	XIII		
<i>Symphytum tuberosum</i>	15.5.2021	II	scattered	
<i>Tanacetum vulgare</i>	1.8.2021	■		
<i>Taraxacum sp.</i>	15.5.2021			
<i>Thlaspi arvense</i>	16.6.2021	III field		
<i>Tilia cordata</i>	15.5.2021	XVII, III pheasantry , XIII		
<i>Tilia xeuropaea</i>	26.7.2021			
<i>Torilis japonica</i>	1.8.2021			
<i>Trifolium alpestre</i>	30.5.2021	road along clearing 6		
<i>Trifolium campestre</i>	6.7.2021	XVII	abundant	
<i>Trifolium hybridum</i>	5.6.2021	clearing 6		
<i>Trifolium pratense</i>	25.5.2021	I crossroads	rare	
<i>Trifolium repens</i>	30.5.2021			
<i>Tripleurospermum inodorum</i>	30.5.2021	III field , clearing 2, Δ		

<i>Trisetum flavescens</i>	16.6.2021	III field	a single growth of ca, 40 individuals	
<i>Triticum</i> sp.	5.6.2021	clearing 6 road		
<i>Tulipa xgesneriana</i>	25.5.2021	II forest path between gate and clearing 2	1 fertile individual	
<i>Tussilago farfara</i>	26.7.2021	XVIII road	rare	
<i>Valerianella locusta</i>	5.6.2021	rails	rare	
<i>Verbascum phlomoides</i>	6.7.2021	road XV	1 individual	
<i>Verbascum thapsus</i>	6.7.2021	Δ	1 individual	
<i>Verbena officinalis</i>	26.7.2021	I crossroads	6 individuals	C3
<i>Veronica chamaedrys</i>	8.5.2021	clearing 1, VII road, clearing 6	scattered	
<i>Veronica officinalis</i>	5.6.2021	clearing 6	rare	
<i>Veronica persica</i>	5.6.2021	clearing 6, road along clearing 5	abundant	
<i>Veronica serpyllifolia</i>	25.5.2021	I crossroads; road along clearing 3	rare	
<i>Veronica sublobata</i>	15.5.2021	road, X XI, clearing 1		
<i>Viburnum opulus</i>	15.5.2021	I road	1 individual	
<i>Vicia angustifolia</i>	6.7.2021			
<i>Vicia cracca</i>	16.6.2021	clearing 6, XVII,XV	scattered	
<i>Vicia dumetorum</i>	30.5.2021	XVII, XIII	rare	C4a
<i>Vicia hirsuta</i>	5.6.2021	clearing 6		
<i>Vicia sepium</i>	15.5.2021	road along clearing 1	scattered	
<i>Vicia tetrasperma</i>	25.5.2021	■, clearing 6, III field, XVII		
<i>Viola arvensis</i>	4.5.2021	XVII, clearing 6, III field	abundant	
<i>Viola reichenbachiana</i>	4.5.2021	IV, clearing 6, XVIII	scattered, locally abundant	

BŔEST				
SPECIES	DATE	SEGMENT	ABUNDANCE	RED LIST
<i>Acer campestre</i>	9.5.2021	mill, waterworks	common	
<i>Acer pseudoplatanus</i>	9.5.2021			
<i>Achillea millefolium</i>	9.5.2021	IX road, waterworks	rare	
<i>Aesculus hippocastanum</i>	25.5.2021	II	1 individual	
<i>Agrimonia eupatoria</i>	30.5.2021	waterworks	rare	
<i>Agrostis capillaris</i>	25.7.2021		scattered	
<i>Ajuga genevensis</i>	9.5.2021	XIII	scattered	
<i>Ajuga reptans</i>	30.5.2021			
<i>Alliaria petiolata</i>	9.5.2021		rare	
<i>Allium scorodoprasum</i>	30.5.2021			
<i>Allium ursinum</i>	9.5.2021	all segments	common	C4a
<i>Alnus glutinosa</i>	19.6.2021	heap 1	4 individuals	
<i>Alopecurus aequalis</i>	25.5.2021	III swamp	locally common	
<i>Alopecurus pratensis</i>	19.6.2021	IX road		
<i>Amaranthus retroflexus</i>	4.7.2021	II, heap 1		
<i>Amaranthus sp.</i>	9.8.2021			
<i>Anagallis arvensis</i>	19.6.2021	•	2 individuals	
<i>Anemone nemorosa</i>	9.5.2021		common	
<i>Anemone ranunculoides</i>	9.5.2021		common	
<i>Anthemis arvensis</i>	19.6.2021			
<i>Anthriscus sylvestris</i>	25.5.2021	II, heap 2		
<i>Arctium lappa</i>	25.7.2021	waterworks		
<i>Arctium minus</i>	9.8.2021			
<i>Arctium tomentosum</i>	25.5.2021	II		
<i>Arrhenatherum elatior</i>	30.5.2021	waterworks		
<i>Artemisia vulgaris</i>	30.5.2021	heap 2		
<i>Arum cylindraceum</i>	9.5.2021		common	
<i>Asperugo procumbens</i>	30.5.2021	heap 2	rare	C3
<i>Astragalus glycyphyllos</i>	30.5.2021	waterworks - woodborder		
<i>Atriplex patula</i>	21.10.2021	•		
<i>Avena fatua</i>	19.6.2021	heap 1		
<i>Avena sativa</i>	4.7.2021	waterworks		
<i>Ballota nigra</i>	4.6.2021	clearing 2, VIII road	rare	
<i>Betula pendula</i>	9.5.2021			
<i>Brachypodium pinnatum</i>	25.7.2021	II		

<i>Brachypodium sylvaticum</i>	4.7.2021	mill	common	
<i>Bromus hordeaceus</i>	19.6.2021	heap 1		
<i>Bromus sterilis</i>	16.5.2021	X, VII road		
<i>Bromus tectorum</i>	19.6.2021	heap 1, clearing 2		
<i>Calamagrostis arundinacea</i>	25.5.2021	mill	common	
<i>Calamagrostis epigejos</i>	4.7.2021	•, mill, heap, Δ	locally common	
<i>Callitriche palustris</i> agg.	21.10.2021			
<i>Campanula trachelium</i>	25.5.2021		scattered	
<i>Capsella bursa-pastoris</i>	9.5.2021	clearing 1, heap 2		
<i>Cardamine impatiens</i>	19.6.2021	•	rare	
<i>Carduus crispus</i>	4.7.2021	waterworks, Δ	scattered to common	
<i>Carex acuta</i>	30.5.2021	VI road		
<i>Carex divulsa</i>	9.8.2021		scattered	
<i>Carex hirta</i>	16.5.2021	II, II, clearing 1		
<i>Carex pilosa</i>	30.5.2021	IV		
<i>Carex remota</i>	25.5.2021	VIII, II		
<i>Carex spicata</i>	25.7.2021	mill, II	scattered	
<i>Carex sylvatica</i>	25.5.2021	all segments	common	
<i>Carex vesicaria</i>	4.6.2021	waterworks		
<i>Carpinus betulus</i>	25.5.2021			
<i>Centaurea cyanus</i>	25.7.2021	•, Δ	rare	
<i>Cerastium lucorum</i>	4.7.2021	•		
<i>Chaerophyllum temulum</i>	30.5.2021	II		
<i>Chelidonium majus</i>	9.5.2021	hl road	rare	
<i>Chenopodium album</i> agg.	4.7.2021	•		
<i>Chenopodium ficifolium</i>	4.7.2021	clearing 3		
<i>Chenopodium hybridum</i>	4.7.2021	Δ	rare	
<i>Chenopodium polyspermum</i>	9.8.2021	Δ	rare	
<i>Cichorium intybus</i>	25.7.2021	waterworks		
<i>Circaea lutetiana</i>	4.7.2021	IV road, mill	locally common	
<i>Cirsium oleraceum</i>	4.6.2021			
<i>Cirsium vulgare</i>	9.8.2021	Δ	locally common	
<i>Clinopodium vulgare</i>	25.7.2021	waterworks	rare	
<i>Colchicum autumnale</i>	9.5.2021		common	
<i>Conyza canadensis</i>	4.7.2021	heap 2, II	rare	
<i>Corydalis cava</i>	9.5.2021		common	

<i>Corydalis solida</i>	9.5.2021			C4a
<i>Corylus avellana</i>	25.5.2021		scattered	
<i>Crateagus monogyna</i>	25.5.2021			
<i>Crepis biennis</i>	4.7.2021	along Mynsky nahon, III/VIII	rare	
<i>Dactylis glomerata</i>	25.5.2021	waterworks		
<i>Dactylis polygama</i>	25.5.2021	X road, II		
<i>Datura stramonium</i>	10.9.2021	III	rare	
<i>Deschampsia cespitosa</i>	4.7.2021	•		
<i>Descurainia sophia</i>	19.6.2021	X, •		
<i>Digitaria sanguinalis</i> var. <i>sanguinalis</i>	21.10.2021	mill	rare	
<i>Echinochloa crus-galii</i>	4.7.2021	•		
<i>Elymus caninus</i>	4.7.2021			
<i>Epilobium adenocaulon</i>	4.7.2021		rare	
<i>Epilobium hirsutum</i>	4.7.2021	heap 1	1 individual	
<i>Equisetum arvensis</i>	25.5.2021	swamp	locally common	
<i>Erigeron annuus</i> subsp. <i>septentrionalis</i>	25.7.2021	heap 2		
<i>Erysimum cheiranthoides</i>	4.7.2021	I		
<i>Euphorbia helioscopia</i>	19.6.2021	X	rare	
<i>Euphorbia platyphyllos</i>	21.10.2021	heap 1	1 individual	
<i>Fagopyrum esculentum</i>	4.7.2021	IV road	1 individual	
<i>Fallopia convolvulus</i>	25.5.2021	mill	rare	
<i>Festuca gigantea</i>	4.7.2021	•, waterworks		
<i>Festuca pratensis</i>	4.7.2021	II, waterworks	scattered	
<i>Ficaria verna</i>	9.5.2021		common	
<i>Filipendula ulmaria</i>	4.7.2021	mill	3 individuals	
<i>Fraxinus excelsior</i>	9.5.2021			
<i>Gagea lutea</i>	9.5.2021		common	
<i>Galanthus nivalis</i>	9.5.2021	II, XI	scattered	C3
<i>Galeobdolon luteum</i>	9.5.2021			
<i>Galeopsis tetrahit</i>	4.7.2021	•		
<i>Galinsoga quadriradiata</i>	4.7.2021	•	common	
<i>Galium album</i>	25.5.2021	waterworks		
<i>Galium aparine</i>	9.5.2021			
<i>Galium mollugo</i> agg.	4.7.2021	waterworks		
<i>Geranium dissectum</i>	25.7.2021	•, IV road, heap 2	rare to scattered	
<i>Geranium palustre</i>	19.6.2021	II	isolated large growth	

<i>Geranium pusillum</i>	30.5.2021	waterworks	rare	
<i>Geranium pyrenaicum</i>	30.5.2021	waterworks		
<i>Geranium robertianum</i>	9.5.2021		rare	
<i>Geum urbanum</i>	25.5.2021	waterworks, clearing 2		
<i>Glechoma hederacea</i>	9.5.2021	XIII, mill, clearing 2		
<i>Glyceria maxima</i>	9.5.2021	clearing 2		
<i>Helianthus tuberosus</i>	21.10.2021	mill	1 growth	
<i>Hieracium sphondylium</i>	4.7.2021	II		
<i>Hordeum vulgare</i>	30.5.2021	heap 2 (feed)	several individuals	
<i>Hypericum hirsutum</i>	19.6.2021	waterworks		
<i>Hypericum perforatum</i>	9.5.2021			
<i>Impatiens parviflora</i>	25.5.2021	II, waterworks, mill	locally common	
<i>Iris pseudacorus</i>	4.6.2021	clearing 2, •		
<i>Isopyrum thalictroides</i>	9.5.2021		scattered	C4a
<i>Juncus bufonius</i> agg.	19.6.2021	•		
<i>Juncus effusus</i>	25.5.2021	swamp		
<i>Lactuca serriola</i>	25.7.2021	waterworks	scattered	
<i>Lamium album</i>	25.7.2021		scattered	
<i>Lamium maculatum</i>	9.5.2021		common	
<i>Lamium purpureum</i>	30.5.2021	X road, clearing 2		
<i>Lapsana communis</i>	30.5.2021		rare	
<i>Lemna minor</i>	19.6.2021	Mlynsky nahon, swamp	locally common	
<i>Lolium multiflorum</i>	19.6.2021	heap 1		
<i>Lolium perenne</i>	4.6.2021	V road	rare	
<i>Loranthus europaeus</i>	12.10.2021	II, I, IV		
<i>Lotus corniculatus</i>	4.7.2021	•		
<i>Lycopus europaeus</i>	25.5.2021	mill	rare	
<i>Lysimachia nummularia</i>	9.5.2021	swamp, clearing 2		
<i>Malus domestica</i>	19.6.2021	II	1 individual	
<i>Medicago lupulina</i>	30.5.2021	•, mill	common	
<i>Melica nutans</i>	4.7.2021	II	rare	
<i>Melilotus officinalis</i>	4.7.2021	•		
<i>Mercurialis perennis</i>	9.5.2021	XIII, IV	locally common	
<i>Microrrhinum minus</i>	19.6.2021	•		
<i>Milium effusum</i>	9.5.2021	clearing 2		
<i>Myosotis arvensis</i>	9.5.2021	XIII hl road,	rare	

		waterworks		
<i>Myosoton aquaticum</i>	4.7.2021	heap 2, Δ	locally scattered	
<i>Oxalis stricta</i>	25.5.2021	waterworks		
<i>Papaver rhoeas</i>	25.7.2021	heap 2	rare	
<i>Paris quadrifolia</i>	9.5.2021		scattered	
<i>Persicaria hydropiper</i>	19.6.2021	mill, •, swamp	rare	
<i>Phacelia tanacetifolia</i>	30.5.2021	heap 2	1 individual	
<i>Phalaris arundinaceae</i>	4.7.2021	III, mill, heap 1	scattered to common	
<i>Phleum pratense</i>	4.7.2021	II		
<i>Phragmites australis</i>	25.5.2021	mill	locally abundant	
<i>Picea abies</i>	25.7.2021			
<i>Pisum sativum</i>	30.5.2021	heap 2, clearing 2	several individuals	
<i>Plantago major</i>	30.5.2021	•		
<i>Poa annua</i>	9.5.2021	clearing 1, 2, Δ	locally common	
<i>Poa nemoralis</i>	25.5.2021		common	
<i>Poa palustris</i>	25.5.2021	waterworks, mill		
<i>Poa pratensis</i>	30.5.2021	VIII road		
<i>Poa trivialis</i>	25.5.2021	mill, clearing 2, Δ		
<i>Polygonatum multiflorum</i>	9.5.2021			
<i>Polygonum aviculare</i>	30.5.2021	waterworks, VIII road, clearing 2, II, •		
<i>Populus alba</i>	4.6.2021			
<i>Populus tremula</i>	4.6.2021			
<i>Portulaca oleracea</i>	25.7.2021	waterworks, mill		
<i>Potentilla anserina</i>	19.6.2021	II	common	
<i>Potentilla reptans</i>	30.5.2021			
<i>Prunella vulgaris</i>	30.5.2021	waterworks, VIII road	rare	
<i>Prunus cerasifera</i>	4.7.2021	III woodborder, II	rare	
<i>Prunus padus</i>	19.6.2021	XIII		
<i>Pulmonaria obscura</i>	9.5.2021			
<i>Quercus petrae</i>	4.6.2021	waterworks	1 individual	
<i>Quercus robur</i>	9.5.2021	IX road		
<i>Ranunculus repens</i>	9.5.2021	•	rare	
<i>Rorippa sylvestris</i>	4.7.2021	II		
<i>Rubus caesius</i>	30.5.2021	clearing 1,	common	

		waterworks		
<i>Rumex sanguinalis</i>	25.5.2021	I		
<i>Salix fragilis</i>	25.5.2021		rare	
<i>Sambucus nigra</i>	25.5.2021	waterworks	rare	
<i>Scrophularia nodosa</i>	4.6.2021	clearing 2		
<i>Setaria pumila</i>	4.7.2021	•		
<i>Setaria viridis</i>	19.6.2021	•		
<i>Silene latifolia</i> subsp. <i>alba</i>	25.7.2021		rare	
<i>Silene vulgaris</i>	30.5.2021	waterworks		
<i>Silybum marianum</i>	25.7.2021	heap 2		
<i>Sinapis arvensis</i>	30.5.2021	waterworks, X road, clearing 2	rare	
<i>Sisymbrium loeselii</i>	4.6.2021	X road	rare	
<i>Sisymbrium officinale</i>	30.5.2021	waterworks, •	rare	
<i>Solanum nigrum</i>	25.7.2021	•, along road	common	
<i>Solanum tuberosum</i>	25.7.2021	heap 2		
<i>Solidago canadensis</i>	9.8.2021	Δ	locally scattered	
<i>Sonchus arvensis</i>	25.7.2021	•	scattered	
<i>Sonchus asper</i>	21.10.2021		scattered to common	
<i>Sonchus oleraceus</i>	19.6.2021	X woodborder, clearing 3, Δ		
<i>Sorbus aucuparia</i>	25.5.2021	II	seedling	
<i>Stachys palustris</i>	4.7.2021	waterworks	1 large growth	
<i>Stellaria media</i>	30.5.2021	clearing 2, VIII, •, mill	rare	
<i>Symphytum tuberosum</i>	9.5.2021		scattered	
<i>Thlaspi arvense</i>	30.5.2021	heap 2, II	rare	
<i>Tilia cordata</i>	9.5.2021			
<i>Tilia xeuropaea</i>	25.7.2021	mill	common	
<i>Torilis japonica</i>	9.8.2021		scattered	
<i>Trifolium dubium</i>	30.5.2021	waterworks, •	rare	
<i>Trifolium hybridum</i>	25.7.2021	•		
<i>Trifolium pratense</i>	30.5.2021	waterworks	rare	
<i>Tripleurospermum inodorum</i>	30.5.2021	heap 2, •, near <i>Iris pseudacorus</i>	scattered	
<i>Tussilago farfara</i>	25.7.2021	heap 1, mill	rare	
<i>Ulmus laevis</i>	19.6.2021	mill		
<i>Urtica dioica</i>	9.5.2021		abundant	
<i>Veronica arvensis</i>	30.5.2021	waterworks	rare	

<i>Veronica chamaedrys</i>	25.5.2021	II, clearing 2		
<i>Veronica hederifolia</i>	9.5.2021		rare to locally common	
<i>Veronica persica</i>	9.5.2021	VIII road, •		
<i>Viburnum opulus</i>	25.5.2021	mill	1 individual	
<i>Vicia cracca</i>	19.6.2021	heap 1		
<i>Vicia sepium</i>	25.5.2021	II woodborder	rare	
<i>Vicia tetrasperma</i>	4.7.2021			
<i>Viola odorata</i>	30.5.2021	waterworks		
<i>Viola reichenbachiana</i>	9.5.2021	waterworks	scattered	
<i>Viola riviniana</i>	25.5.2021	II		
<i>Viola riviniana</i> agg.	12.5.2021	X		
<i>Viscum album</i>	25.5.2021	mill		