Vascular flora of Jelenovac Forest Park (Zagreb, Croatia)

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Abstract

A floristic study of Jelenovac Forest Park, located in Zagreb city centre, was conducted during the vegetation season of 2019. In total, 255 vascular plant taxa were recorded, divided into 75 plant families, of which *Compositae* (12.55%), *Rosaceae* (7.06%) and *Poaceae* (6.67%) are the most represented. The spectrum of life-forms indicates the dominance of hemicryptophytes (43.14%) and phanerophytes (27.45%). The chorological analysis shows a domination of Eurasian floral element (27.45%), followed by large share of widespread (22.35%) and cultivated and adventitious plants (18.04%). Only one threatened, three strictly protected and as many as 12 invasive plant taxa were found. Comparison of flora of Jelenovac with similar urban and suburban areas of Zagreb conglomeration yielded diverse results, but still reflecting the common biogeographical position and influence of temperate climate and indicating a comparatively high anthropogenic influence.

Keywords: biodiversity, floral elements, life-forms, urban flora

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Sažetak

Floristično istraživanje Park šume Jelenovac u centru grada Zagreba provedeno je tijekom vegetacijske sezone 2019. Zabilježeno je ukupno 255 biljnih svojti podijeljenih u 75 biljnih porodica od kojih su *Compositae* (12,55 %), *Rosaceae* (7,06 %) i *Poaceae* (6,67 %) najzastupljenije. Spektar životnih oblika ukazuje na dominaciju hemikriptofita (43,14 %) i fanerofita (27,45 %). Rezultati horološke analize ukazuju na

dominaciju euroazijskog flornog elementa (27,45 %) iza kojeg slijedi visoki udio široko rasprostranjenih (22,35 %) te kultiviranih i adventivnih biljaka (18,04 %). Zabilježena je samo jedna ugrožena, tri strogo zaštićene i čak 12 invazivnih svojti. Usporedba flore Jelenovca s drugim sličnim urbanim i suburbanim područjima zagrebačke konglomeracije ukazala je na određene razlike, ali ipak odražava zajedničku pripadnost istom biogeografskom području i utjecaj umjerene klime te ukazuje na razmjerno visok antropogeni utjecaj.

Ključne riječi: bioraznolikost, florni elementi, urbana flora, životni oblici

Introduction

Jelenovac Forest Park is situated on the southern slopes of Mt Medvednica at an elevation ranging from 150 to 260 m a. s. l. (Anonymous 2020a). It is situated in the eastern part of the Zagreb city centre, only about ten minutes walk from the Zagreb main street Ilica (Fig. 1). It owes its name, which it shares with the associated forest stream, to the old village of the city serfs of the Vrhovec *folnegia*. The forest park includes a children's playground and numerous pathways running within and around the area, providing a large recreational space. The total area of the Park-forest is 54.5 ha, with the major part, 48.9 ha in area, covered with forests dominated by climazonal hornbeam and sessile oak forest (Ass. *Epimedio-Carpinetum betuli* (Horvat 1938) Bohridi 1963), while several grasslands and meadows are situated on higher altitudes in the northern part of the area (Anonymous 2020b).

According to Köppen's climatic types, the climate of the area of the city of Zagreb is temperate (Cfb) without a dry season and with a warm summer. The coldest month of the year is January with temperatures above -3°C, while the summers are fresh with the average temperature of the hottest month below 22°C (Šegota & Filipčić 2003).

With the expansion of cities and population growth, the amount of urban areas is increasing. Urban areas are, unlike natural habitats, more affected by human activities that alter habitats, increase disturbance and the concentration of nitrogen in the soil and affect other biotic and abiotic factors, making them suitable for the growth of weeds, ruderal and invasive plants (Pyšek et al. 2010). Floristic studies of urban areas contribute to the understanding of the effects of urbanisation on flora composition and at the same time help preserve the biodiversity of such ecosystems. However, the plant diversity of urban areas in Croatia is considerably less studied than that of natural ecosystems. Comprehensive floristic data exist only for few Dalmatian cities: Šibenik and its surroundings (Milović 2002), Split (Ruščić 2003), Omiš (Tafra et al. 2012) and Zadar (Milović and Mitić 2012). As for the wider Zagreb area, first floristic studies were conducted in the second half of the 19th century by Schlosser and Vukotinović (1857, 1869), Klinggräff (1861-1862) and Neilreich (1869). More numerous studies followed during the 20th century (Gjurašin 1923, Horvatić 1931, Gospodarić 1958, Marković 1970, 1973, 1975, 1978, Randić et al. 1981, Lukač 1988, Ilijanić et al. 1989, Smital et al. 1998) and so far, only a few in the 21st century (Mitić et al. 2007, Nikolić et al. 2007, Hudina et al. 2012, Alegro et al. 2013, Vuković et al. 2013 and Budisavljević et al. 2017). Jelenovac Forest Park was, before our study, a botanically rather unexplored area with only 31 records of vascular plant taxa, 22 of which originate from Herbarium Croaticum collection (ZA) (Rešetnik & Šegota 2020). Only one herbarium specimen dates back to 1993, while all other specimens are from 1955 or even earlier. The data on the remaining five records of vascular taxa originate from literature: Hirc (1903, 1912), Bevilacqua (1957), Ilijanić et al. (1994) and Pandža et al. (2001), most of them being secondary references.

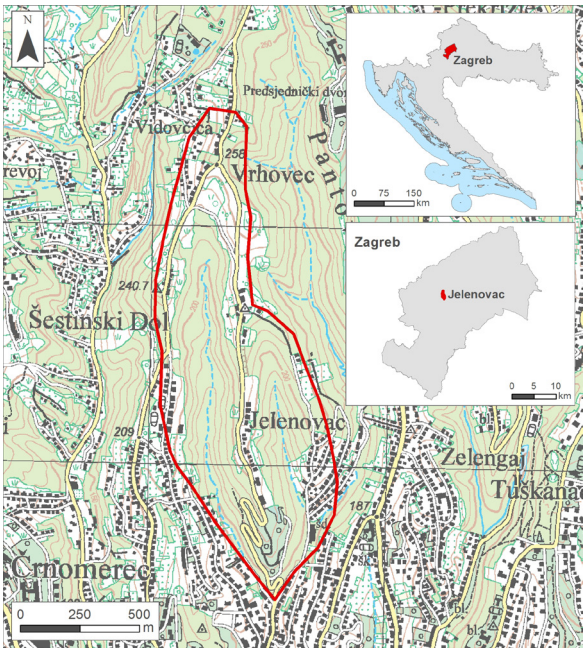

Figure 1. Geographical position of Jelenovac Forest Park.

The aim of this research was to study the vascular plant taxa of the Jelenovac Forest Park; to perform an analysis of the recorded flora according to: taxonomic preferences, chorological types, life-forms, IUCN category, protection status, endemism and invasiveness and to compare the results with those of floristic analyses of other urban and suburban areas.

Materials and methods

Jelenovac was floristically surveyed during the vegetation season of 2019., from March to June, as a part of a student field project in the practical course "Croatian flora" given at the Faculty of Science, University of Zagreb. The area was searched with the intention of exploring all the habitats. Plants were mostly identified directly in the field, however, some were collected, pressed and dried in order to be identified or additionally confirmed. For this purpose, standard and specialized identification keys and iconographies were used: Horvatić (1954), Jávorka & Csapody (1991), Tutin et al. (1993), Domac (1994), Alegro et al. (2003), Delforge (2006), Eggenberg & Mohl (2007), Rothmaler & Jäger (2007) and Nikolić (2019). All collected plant material was stored in the ZA herbarium collection at the Division of Botany of the Department of Biology, Faculty of Science, University of Zagreb and is publicly available via Flora Croatica Database (Nikolić 2020) and ZA & ZAHO Virtual Herbarium (Rešetnik & Šegota 2020).

Rare and protected specimens were not collected but photographed only. Nomenclature was mainly given according to Flora Croatica Database (Nikolić 2020), with the exception of some cultivated and adventitious taxa and varieties (*Hosta plantaginea, Pinus peuce, Populus nigra* var. *italica* and *Salix* × *salamonii*) where The Plant List (2020) was used as a nomenclature reference. Taxa were presented in alphabetical order of families, genera and species.

Life-form and chorological type were attributed to each taxon of the checklist. Data from Šegulja (1977), Pignatti (1982) and Ellenberg et al. (1991) were used in the preparation of the life-form spectrum, with the following abbreviations: Ch – chamaephytes, G – geophytes, H – hemicryptophytes, Hy – hydrophytes, P – phanerophytes and T – therophytes. Chorological analysis was based on Horvatić (1963) and Horvatić et al. (1968) using the following abbreviations: 1 – Mediterranean floral element, 2 – Illyrian-Balkan floral element, 3 – South-European floral element, 4 – Atlantic floral element, 5 – East-European-Pontic floral element, 6 – Southeast-European floral element, 7 – Central-European floral element, 8 – European floral element, 9 – Eurasian floral element, 10 – Circum-holarctic floral element, 11 – widespread plants and 12 – cultivated and adventitious plants.

Spectra of families, life-forms and chorological types were compared with similar urban and suburban areas of Zagreb and surrounding areas such as Stupnik (Mitić et al. 2007), Piškorovo and Konopljenka (Hudina et al. 2012), seminatural marshland Savica (Alegro et al. 2013), Jarun (Vuković et al. 2013) and Dotrščina Forest Park (Budisavljević et al. 2017).

Data on threat level according to IUCN criteria were taken from the Red Book of the Vascular Flora of Croatia (Nikolić & Topić 2005) with corresponding abbreviations showing the degree of threat for each taxon as follows: CR – Critically Endangered, EN – Endangered, VU – Vulnerable, NT – Near Threatened, LC – Least Concern and DD – Data Deficient. The legal protection status in Croatia is in accordance with the Ordinance on strictly protected species (Anonymous 2016), while data on endemic, as well as invasive, taxa are obtained from the Flora Croatica Database (Nikolić 2020).

Results and discussion

Altogether 255 taxa (one identified only to the genus level, 248 species and six subspecies) have been recorded in the flora of Jelenovac Forest Park, belonging to 186 genera and 75 plant families (Appendix 1). The most abundant family is *Compositae* (*Asteraceae* and *Cichoriaceae*) (12.55%), followed by *Rosaceae* (7.06%) and *Poaceae* (6.67%), while all other families account for less than 4% each (Tab. 1). The order of families with the highest number of taxa mostly differs from other surveyed localities in Zagreb and its surroundings (Tab. 2) with the exception of *Compositae* which is the most abundant family in all the surveys. The large share of *Rosaceae* in the Jelenovac flora is due to the presence of five cultivated trees, one cultivated shrub and one invasive taxon. A similar situation was found in another Zagreb forest park, Dotrščina (Budisavljević et al. 2017). Jelenovac and Dotrščina are dominantly forest areas, whereas the other areas (Stupnik, Piškorovo and Konopljenika, Savica and Jarun) have much more open habitats, the larger share of *Poaceae* in those floras being thus comprehensible.

Regarding life-form spectrum, almost half of the recorded taxa (43.14%) are hemicryptophytes, followed by phanerophytes (27.45%), geophytes (14.12%) and therophytes (13.33%) (Fig. 2). In comparison with other floras of Zagreb and its surrounding areas, hemicryptophytes are always dominant, while phanerophytes and therophytes share the second place, depending on the particular area (Tab. 3). Domination of hemicryptophytes and a small percentage of chamaephytes in all compared floras is in accordance with the expected composition of temperate zone life-forms, reflecting the temperate climate of the studied area (Horvat 1942). The share of the next most common life-form, phanerophytes, most closely coincides with the flora of Dotrščina. This correlation is expected given that Jelenovac and Dotrščina are covered primarily by forest vegetation. Another, more important, factor contributing to the considerable share of phanerophytes in the flora of Jelenovac is human intervention as many trees are cultivated and planted for decorative purposes only.

Table 1. Families with the highest number of taxa in the flora of Jelenovac.

Family	No. of taxa	% of total flora
Compositae	32	12.55
Rosaceae	18	7.06
Poaceae	17	6.67
Lamiaceae	9	3.53
Brassicaceae	8	3.14
Caryophyllaceae	8	3.14
Fabaceae	8	3.14
Polygonaceae	7	2.75
Apiaceae	6	2.35
Boraginaceae	6	2.35
Ranunculaceae	6	2.35
Salicaceae	6	2.35
Scrophulariaceae	6	2.35
other families (62)	118	46.27

Table 2. Comparison of families (in percentages) for Jelenovac and similar urban and suburban areas in Zagreb and its surroundings.

Families	Jelenovac	Stupnik	Piškorovo and Konopljenika	Savica	Jarun	Dotrščina
Compositae	12.6	11.5	12.2	12.5	13.7	8.0
Rosaceae	7.1	4.7	5.4	4.8	4.0	6.4
Poaceae	6.7	8.4	11.4	11.8	11.8	5.9
Lamiaceae	3.5	5.8	5.7	5.9	6.8	3.5
Fabaceae	3.1	6.0	7.4	5.2	6.8	5.9
Brassicaceae	3.1	4.4	3.7	3.5	4.0	2.5
Caryophyllaceae	3.1	3.6	2.3	2.4	2.8	2.5

Compared to most other floras, that of Jelenovac has a relatively small share of therophytes, although greater than the one recorded in Dotrščina Forest Park. Given the forest cover of the studied area, a small share of therophytes was to be expected, as they mostly fail to grow in the shade of trees. However, due to the research area location in the urban area surrounded by private gardens and open areas, it is not surprising that the share of therophytes is greater than in the Dotrščina Forest Park. Unlike therophytes, geophytes tend to grow in the shade of trees and therefore occur to a lesser extent in the floras of open areas such as Stupnik, Piškorovo and Konopljenika and Savica.

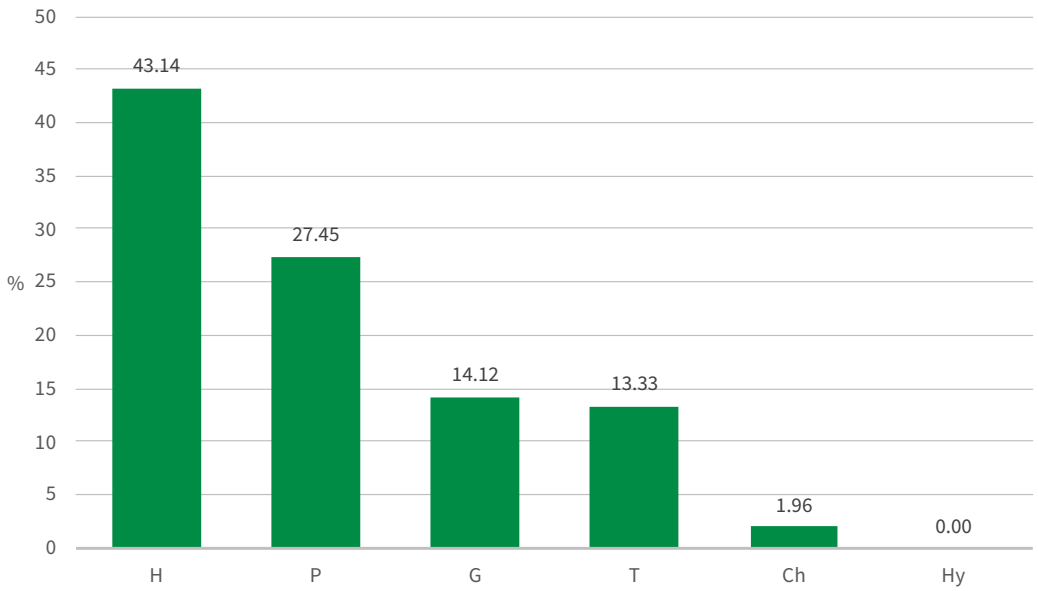

Figure 2. Life-form spectrum for the flora of Jelenovac (H – hemicryptophytes, P – phanerophytes, G – geophytes, T – therophytes, Ch – chamaephytes, Hy – hydrophytes).

Table 3. Comparison of life-form ratios (in percentages) for Jelenovac and similar urban and suburban areas in Zagreb and its surroundings.

Life-forms	Jelenovac	Stupnik	Piškorovo and Konopljenika	Savica	Jarun	Dotrščina
Hemicryptophytes	43.1	49.6	48.1	47.9	42.4	47.4
Phanerophytes	27.5	10.9	14.5	14.2	13.0	20.9
Geophytes	14.1	10.0	10.8	10.1	16.1	17.5
Therophytes	13.3	24.0	22.2	19.1	24.8	9.5
Chamaephytes	2.0	3.1	3.1	1.4	1.9	4.7
Hydrophytes	0.0	2.4	1.1	5.9	1.9	0.0

The recorded taxa belong to a total of ten floral elements (Fig. 3), with the domination of Eurasian floral element (27.45%), followed by widespread plants (22.35%), cultivated and adventitious plants (18.04%) and South-European floral element (8.34%), while other life forms account for less than 4% each. Even though the Eurasian floral element always dominates in the floras compared and the shares of some floral elements do correlate, orders of dominance generally do not coincide with the order of dominance of the flora of Jelenovac (Tab. 4). High share of widespread plants and comparatively lower shares of other chorological types in our survey as well as in the floras of Stupnik and Piškorovo and Konopljenika can be largely explained by the use of different approaches in detection of chorological types. In determining the chorological types of Stupnik, Piškorovo and Konopljenika and Jelenovac, Horvatić (1963) and Horvatić et al. (1968) were primarily used, while in Savica, Jarun and Dotrščina, Landolt et al. (2010) was used, either completely or for revision purposes. In spectra made according to Landolt et. al. (2010) a significantly lower share of widespread plants was recorded because since the work of Horvatić et al. (1968) the distribution of many species has become better understood. The higher percentage of cultivated plants than in other related floras is explained by the partially ornamental purpose of the studied area.

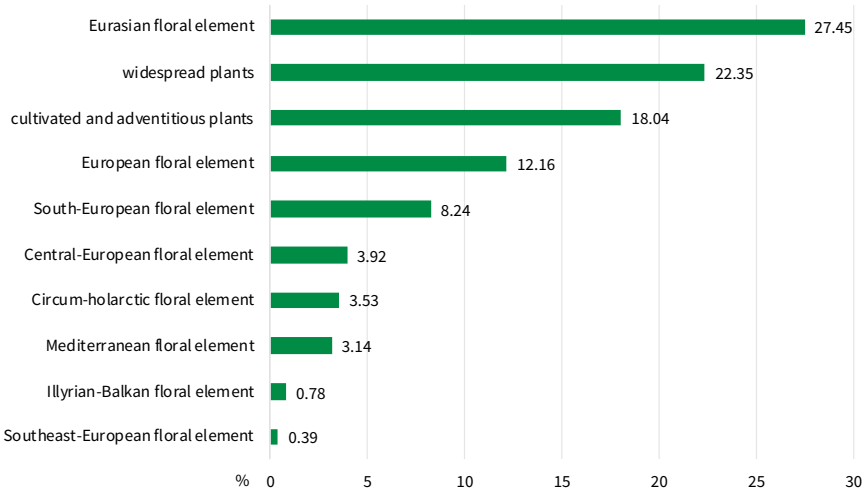

Figure 3. Chorological spectrum for the flora of Jelenovac.

Table. 4. Comparison of chorotype ratios (in percentages) for Jelenovac and similar urban and suburban areas in Zagreb and its surroundings.

Chorological type	Jelenovac	Stupnik	Piškorovo and Konopljenika	Savica	Jarun	Dotrščina
Eurasian floral element	27.5	32.5	30.1	48.3	44.1	44.1
widespread plants	22.4	27.7	27.0	3.1	8.4	2.5
cultivated and adventitious plants	18.0	3.7	10.2	13.2	9.9	5.9
European floral element	12.2	11.5	11.1	3.8	7.8	4.0
South-European floral element	8.2	9.0	9.1	3.1	7.8	5.4
Central-European floral element	3.9	4.2	3.1	6.3	5.9	17.8
Circum-holarctic floral element	3.5	7.3	6.3	8.7	5.3	4.5
Mediterranean floral element	3.1	2.0	1.4	9.7	9.6	10.4
Illyrian-Balkan floral element	0.8	0.2	0.0	0.7	0.3	2.5
Southeast-European floral element	0.4	0.4	0.6	1.0	0.0	1.0
East-European-Pontic floral element	0.0	0.9	1.1	2.1	0.9	1.5
Atlantic floral element	0.0	0.4	0.0	0.0	0.0	0.5

Seven recorded taxa are classified into one of the IUCN categories, but only one (*Taxus baccata*) belongs to one of the threatened categories and is classified as Vulnerable (VU), while other taxa belong either to Near Threatened (NT) (*Cephalanthera damasonium, Cyclamen purpurascens* and *Daphne laureola*) or Least Concern (LC) (*Hordeum murinum* ssp. *murinum*, *Poa annua* and *Ruscus aculeatus*) category. In total, three taxa (*Taxus baccata, Cephalanthera damasonium* and *Neottia nidus-avis)* are classified as strictly protected in Croatia and none as endemic.

In the study area, 12 invasive taxa (*Acer negundo, Ailanthus altissima, Artemisia verlotiorum, Chamomilla suaveolens, Datura stramonium, Duchesnea indica, Erigeron annuus, Reynoutria* x *bohemica, Robinia pseudoacacia, Solidago canadensis, Solidago gigantea* and *Veronica persica*) were recorded, accounting for 4.71% of the total flora of Jelenovac. Among them, as expected, as many as five taxa belong to the family *Compositae,* the family with the biggest number of invasive taxa in Croatia and Europe. None of the existing invasive taxa covered a considerable area and were, as expected, mainly recorded along the edge of the forest in disturbed areas along pathways, streets and near households. Proximity to the city leads to nitrogen accumulation in the living systems while many surrounding private houses with their gardens allow alien and potentially invasive plants to thrive, consequently putting open areas and forest edges, under a certain anthropogenic pressure. Therefore, given the location of the studied area, the number of 12 recorded invasive taxa was to be expected. Although there are not large areas

covered by invasive plants and they have not yet progressed into the forest, monitoring should be established and habitat degradation, such as logging and construction, should be prevented in order to conserve the forest in its original form and disable the future spread of existing invaders.

Jelenovac Forest Park, with its 255 recorded taxa, is floristically relatively rich forest area of Zagreb when compared with similar, but larger Dotrščina Forest Park, with 202 taxa recorded. The floral composition reflects the character of the studied area as an anthropogenically influenced, managed and maintained forest with a partly ornamental purpose, daily visited and used by people for recreational activity and socializing. Therefore, given the anthropogenic pressure present in the area, the larger share of adventitious taxa compared to similar urban and suburban areas was as expected. Nevertheless, its original floristic composition is still well preserved and generally resembles other, similar, suburban areas in Zagreb and its surroundings, making it a valuable source of plant diversity in the very centre of the city of Zagreb. Therefore, the results of this research represent a relevant addition to the knowledge of the urban flora of Zagreb and Croatian flora in general and can further serve as the basis for monitoring changes in the following period.

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Appendix 1. The list of vascular plant taxa recorded in Jelenovac Forest Park.

Family	Taxon	Chorotype	Life-form	IUCN category	Strictly protected	Invasive status
MONILOPHYTA (PTERIDOPHYTA)						
Dryopteridaceae	*Dryopteris filix-mas* (L.) Schott	11	G			
Equisetaceae	*Equisetum arvense* L.	10	G			
Hypolepidaceae	*Pteridium aquilinum* (L.) Kuhn	11	G			
SPERMATOPHYTA - GYMNOSPERMAE						
Cupressaceae	*Thuja orientalis* L.	12	P			
Ginkgoaceae	*Ginkgo biloba* L.	12	P			
	Abies alba Mill.	3	P			
	Picea abies (L.) H. Karst.	12	P			
Pinaceae	*Pinus peuce* Griseb.	12	P			
	Pinus nigra J. F. Arnold	3	P			
	Tsuga canadensis (L.) Carriere	12	P			
Taxaceae	*Taxus baccata* L.	9	P	VU	+	
SPERMATOPHYTA - ANGIOSPERMAE						
MAGNOLIANAE						
Aristolochiaceae	*Asarum europaeum* L.	9	H			
LILIANAE						
Agavaceae	*Yucca filamentosa* L.	12	P			
	Allium schoenoprasum L.	10	G			
Amaryllidaceae	*Allium ursinum* L.	9	G			
	Narcissus pseudonarcissus L.	12	G			
Araceae	*Arum maculatum* L.	8	G			
	Hosta plantaginea (Lam.) Asch.	12	G			
	Muscari neglectum Guss. ex Ten.	1	G			
Asparagaceae	*Polygonatum multiflorum* (L.) All.	10	G			
	Polygonatum odoratum (Mill.) Druce	10	G			
	Ruscus aculeatus L.	1	G	LC		
	Carex divulsa Stokes	11	H			
	Carex hirta L.	9	G			
Cyperaceae	*Carex sylvatica* Huds.	8	H			
	Carex vulpina L.	8	H			
Dioscoreaceae	*Tamus communis* L.	3	G			
Iridaceae	*Crocus vernus* (L.) Hill	6	G			

Family	Taxon	Chorotype	Life-form	IUCN category	Strictly protected	Invasive status
Juncaceae	*Juncus effusus* L.	11	H			
	Luzula campestris (L.) DC.	11	H			
	Luzula forsteri (Sm.) DC.	3	H			
	Luzula pilosa (L.) Willd.	10	H			
Liliaceae	*Erythronium dens-canis* L.	3	G			
	Gagea lutea (L.) Ker Gawl.	9	G			
Orchidaceae	*Cephalanthera damasonium* (Mill.) Druce	3	G	NT	+	
	Neottia nidus-avis (L.) Rich.	9	G		+	
Poaceae	*Alopecurus pratensis* L.	9	H			
	Anthoxanthum odoratum L.	9	H			
	Arrhenatherum elatius (L.) J. Presl et C. Presl	8	H			
	Brachypodium sylvaticum (Huds.) P. Beauv.	9	H			
	Briza media L.	9	T			
	Bromus sterilis L.	11	T			
	Dactylis glomerata L.	9	H			
	Elymus repens (L.) Gould	11	G			
	Festuca drymeja Mert. Koch	3	H			
	Holcus lanatus L.	9	H			
	Hordeum murinum L. ssp. *murinum*	11	T	LC		
	Lolium perenne L.	8	H			
	Melica nutans L.	8	H			
	Poa annua L.	11	T	LC		
	Poa pratensis L.	11	H			
	Poa trivialis L.	9	H			
	Setaria viridis (L.) P. Beauv.	9	T			
EUDICOTYLEDONAE						
Aceraceae	*Acer campestre* L.	8	P			
	Acer negundo L.	12	P			+
	Acer platanoides L.	8	P			
	Acer pseudoplatanus L.	8	P			
Adoxaceae	*Adoxa moschatellina* L.	10	G			
Anacardiaceae	*Rhus typhina* L.	12	P			
Apiaceae	*Aegopodium podagraria* L.	9	H			
	Anthriscus cerefolium (L.) Hoffm.	8	H			
	Anthriscus sylvestris (L.) Hoffm.	9	H			
	Daucus carota L.	9	H			
	Heracleum sphondylium L.	9	H			
	Sanicula europaea L.	11	H			

Family	Taxon	Chorotype	Life-form	IUCN category	Strictly protected	Invasive status
Apocynaceae	*Vinca major* L.	12	Ch			
	Vinca minor L.	8	Ch			
Araliaceae	*Hedera helix* L.	8	P			
Berberidaceae	*Berberis vulgaris* L.	9	P			
	Epimedium alpinum L.	9	H			
	Mahonia aquifolium (Pursh.) Nutt.	12	P			
Betulaceae	*Betula pendula* Roth	9	P			
Bignoniaceae	*Campsis radicans* (L.) Seen.	12	P			
	Catalpa bignonioides Walter	12	P			
Boraginaceae	*Borago officinalis* L.	1	T			
	Myosotis ramosissima Rochel	9	T			
	Myosotis sparsiflora Pohl	9	T			
	Omphalodes verna Moench	7	H			
	Pulmonaria officinalis L.	8	H			
	Symphytum tuberosum L.	7	G			
Brassicaceae	*Alliaria petiolata* (M. Bieb.) Cavara et Grande	9	H			
	Armoracia rusticana P. Gaertn. , B. Mey. et Scherb.	11	G			
	Capsella bursa-pastoris (L.) Medik.	11	H			
	Cardamine bulbifera (L.) Crantz	8	G			
	Cardamine hirsuta L.	11	T			
	Cardaria draba (L.) Desv.	11	H			
	Rorippa sylvestris (L.) Besser	9	H			
	Sisymbrium officinale (L.) Scop.	11	T			
Cannabaceae	*Humulus lupulus* L.	9	P			
Caprifoliaceae	*Lonicera caprifolium* L.	3	P			
	Lonicera pileata Oliv.	12	P			
	Sambucus nigra L.	8	P			
	Symphoricarpos orbiculatus Moench	12	P			
Caryophyllaceae	*Cerastium glomeratum* Thuill.	11	T			
	Cerastium pumilum Curtis ssp. *glutinosum* (Fr.) Jalas	11	T			
	Lychnis flos-cuculi L.	9	H			
	Silene italica (L.) Pers. ssp. *nemoralis* (Waldst. et Kit.) Nyman	3	H			
	Stellaria graminea L.	9	H			
	Stellaria holostea L.	9	Ch			
	Stellaria media (L.) Vill.	11	T			
	Stellaria nemorum L.	8	H			

Family	Taxon	Chorotype	Life-form	IUCN category	Strictly protected	Invasive status
Celastraceae	*Euonymus europaeus* L.	9	P			
Clusiaceae	*Hypericum perforatum* L.	11	H			
Compositae	*Achillea millefolium* L.	11	H			
	Aposeris foetida (L.) Less.	3	H			
	Arctium lappa L.	9	H			
	Arctium nemorosum Lej.	9	H			
	Artemisia verlotiorum Lamotte	12	H			+
	Artemisia vulgaris L.	11	H			
	Bellis perennis L.	7	H			
	Calendula officinalis L.	12	T			
	Centaurea jacea L.	9	H			
	Chamomilla suaveolens (Pursh) Rydb.	11	T			+
	Cichorium intybus L.	11	H			
	Cirsium arvense (L.) Scop.	9	T			
	Cirsium vulgare (Savi) Ten.	9	H			
	Crepis vesicaria L. ssp. *taraxacifolia* (Thuill.) Thell.	1	T			
	Doronicum austriacum Jacq.	3	H			
	Erigeron annuus (L.) Pers.	12	H			+
	Eupatorium cannabinum L.	9	H			
	Hieracium murorum L.	9	H			
	Lactuca serriola L.	11	T			
	Lapsana communis L.	9	T			
	Leucanthemum vulgare Lam.	9	H			
	Prenanthes purpurea L.	7	H			
	Senecio vulgaris L.	11	T			
	Solidago canadensis L.	12	H			+
	Solidago gigantea Aiton	12	H			+
	Sonchus asper (L.) Hill	9	T			
	Sonchus oleraceus L.	11	T			
	Tanacetum corymbosum (L.) Sch. Bip.	7	H			
	Tanacetum vulgare L.	9	H			
	Taraxacum officinale Weber	11	H			
	Tragopogon pratensis L. ssp. *orientalis* (L.) Čelak.	9	H			
	Tussilago farfara L.	9	G			

Family	Taxon	Chorotype	Life-form	IUCN category	Strictly protected	Invasive status
Cornaceae	*Cornus mas* L.	3	P			
	Cornus sanguinea L.	8	P			
Corylaceae	*Carpinus betulus* L.	7	P			
	Corylus avellana L.	8	P			
Crassulaceae	*Sedum ochroleucum* Chaix	3	Ch			
	Sedum sarmentosum Bunge	12	Ch			
Dipsacaceae	*Dipsacus fullonum* L.	11	H			
	Knautia arvensis (L.) Coult.	9	H			
	Knautia drymeia Heuff.	3	H			
Euphorbiaceae	*Euphorbia cyparissias* L.	9	H			
	Euphorbia dulcis L.	7	G			
	Euphorbia peplus L.	11	T			
	Euphorbia virgata Waldst. et Kit.	9	H			
Fabaceae	*Lathyrus niger* (L.) Bernhardt	8	G			
	Lathyrus vernus (L.) Bernhardt	8	G			
	Lotus corniculatus L.	11	H			
	Robinia pseudoacacia L.	12	P			+
	Trifolium pratense L.	9	H			
	Trifolium repens L.	11	H			
	Vicia cracca L.	9	H			
	Vicia oroboides Wulfen	2	H			
Fagaceae	*Fagus sylvatica* L.	8	P			
	Quercus petraea (Matt.) Liebl.	8	P			
Fumariaceae	*Corydalis bulbosa* (L.) DC.	9	G			
Geraniaceae	*Geranium pusillum* Burm. f.	8	T			
	Geranium robertianum L.	11	T			
Grossulariaceae	*Ribes rubrum* L.	12	P			
Hidrangeaceae	*Deutzia scabra* Thunb.	12	P			
Lamiaceae	*Ajuga reptans* L.	9	H			
	Glechoma hederacea L.	10	H			
	Lamium galeobdolon (L.) L.	9	H			
	Lamium maculatum (L.) L.	9	H			
	Lamium orvala L.	2	H			
	Lamium purpureum L.	9	T			
	Melissa officinalis L.	1	H			
	Prunella vulgaris L.	11	H			
	Stachys sylvatica L.	9	H			

Family	Taxon	Chorotype	Life-form	IUCN category	Strictly protected	Invasive status
Loranthaceae	*Loranthus europaeus* Jacq.	9	P			
Malvaceae	*Hibiscus syriacus* L.	12	P			
	Malva sylvestris L.	11	H			
Moraceae	*Ficus carica* L.	1	P			
	Morus alba L.	12	P			
Oleaceae	*Forsythia* sp.	12	P			
	Fraxinus ornus L.	3	P			
	Ligustrum vulgare L.	7	P			
	Syringa vulgaris L.	12	P			
Onagraceae	*Circaea lutetiana* L.	11	H			
Oxalidaceae	*Oxalis acetosella* L.	11	H			
Papaveraceae	*Chelidonium majus* L.	11	H			
Plantaginaceae	*Plantago lanceolata* L.	11	H			
	Plantago major L.	11	H			
	Plantago media L.	9	H			
Platanaceae	*Platanus orientalis* L.	12	P			
Polygonaceae	*Fallopia baldschuanica* (Regel) Holub	12	P			
	Fallopia convolvulus (L.) Á. Löve	11	T			
	Polygonum aviculare L.	11	T			
	Reynoutria x *bohemica* Chrtek et Chrtková	12	G			+
	Rumex acetosa L.	11	H			
	Rumex crispus L.	11	H			
	Rumex obtusifolius L.	11	H			
Primulaceae	*Cyclamen purpurascens* Mill.	3	G	NT		
	Lysimachia nummularia L.	8	H			
	Primula vulgaris Huds.	3	H			
Ranunculaceae	*Anemone nemorosa* L.	11	G			
	Aquilegia vulgaris L.	9	H			
	Clematis vitalba L.	8	P			
	Ranunculus acris L.	11	H			
	Ranunculus ficaria L.	8	G			
	Ranunculus lanuginosus L.	7	H			

Family	Taxon	Chorotype	Life-form	IUCN category	Strictly protected	Invasive status
Rosaceae	*Chaenomeles japonica* (Thunb.) Spach	12	P			
	Crataegus laevigata (Poir.) DC.	8	P			
	Duchesnea indica (Andrews) Focke	12	H			+
	Fragaria moschata Weston	7	H			
	Fragaria vesca L.	11	H			
	Geum urbanum L.	11	H			
	Kerria japonica (L.) DC.	12	P			
	Potentilla micrantha DC.	3	H			
	Potentilla reptans L.	1	H			
	Prunus armeniaca L.	12	P			
	Prunus avium (L.) L.	9	P			
	Prunus domestica L.	12	P			
	Prunus domestica L. ssp. *insititia* (L.) Bonnier et Layens	12	P			
	Prunus laurocerasus L.	12	P			
	Prunus padus L.	9	P			
	Rosa canina L.	11	P			
	Rubus saxatilis L.	10	H			
	Sorbus torminalis (L.) Crantz	9	P			
Rubiaceae	*Galium aparine* L.	11	T			
	Galium mollugo L.	9	H			
	Galium odoratum (L.) Scop.	9	G			
	Galium sylvaticum L.	8	G			
Salicaceae	*Populus alba* L.	9	P			
	Populus x *canadensis* Moench	12	P			
	Populus nigra var. *italica* Münchh.	12	P			
	Salix alba L.	9	P			
	Salix caprea L.	9	P			
	Salix × *salamonii* (Carrière) Carrière	12	P			
Saxifragaceae	*Saxifraga tridactylites* L.	11	T			
Scrophulariaceae	*Lathraea squamaria* L.	9	G			
	Veronica chamaedrys L.	9	H			
	Veronica hederifolia L.	9	T			
	Veronica officinalis L.	10	H			
	Veronica persica Poir.	11	T			+
	Veronica serpyllifolia L.	11	H			

Family	Taxon	Chorotype	Life-form	IUCN category	Strictly protected	Invasive status
Simaroubaceae	*Ailanthus altissima* (Mill.) Swingle	12	P			+
Solanaceae	*Datura stramonium* L.	11	T			+
Taxodiaceae	*Cryptomeria japonica* (L. f.) D. Don	12	P			
Thymelaeaceae	*Daphne laureola* L.	3	P	NT		
Tiliaceae	*Tilia cordata* Mill.	8	P			
Ulmaceae	*Ulmus glabra* Huds.	11	P			
Urticaceae	*Parietaria officinalis* L.	3	H			
	Urtica dioica L.	11	H			
Valerianaceae	*Valeriana officinalis* L.	9	H			
	Valerianella locusta (L.) Laterr.	1	T			
Violaceae	*Viola alba* Besser	3	H			
	Viola odorata L.	8	H			
	Viola reichenbachiana Jord. ex Boreau	9	H			
	Viola riviniana Rchb.	8	H			
Vitaceae	*Parthenocissus quinquefolia* (L.) Planchon	12	P			
	Vitis vinifera L.	12	P			