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VASCULAR FLORA OF KRALJEVEC FOREST PARK (ZAGREB, CROATIA)

NIKA GRADIŠČAJ[1], SARA ESSERT[2] & DARIO HRUŠEVAR[2]*

[1] Osnovna škola Odra, Đačka ulica 5, 10000 Odra, Hrvatska

[2] Sveučilište u Zagrebu, Prirodoslovno-matematički fakultet, Biološki odsjek, Horvatovac 102a 10000 Zagreb, Hrvatska

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The studied Kraljevec Forest Park represents an urban forest complex located in the immediate vicinity of the very center of the city of Zagreb. It is situated in a colline belt zone and floristically belongs to the *Epimedio-Carpinetum betuli* community. The survey of vascular flora was conducted during the 2023 vegetation season, recording a total of 262 vascular plant taxa, classified into 78 families and 188 genera. The dominant life forms are hemicryptophytes (40.13 %) and geophytes (17.39 %), while the prevailing floristic elements are Eurasian (47.08 %) and European (17.51 %). Alien species constitute 24.05 % of the flora. Moreover, urbanization indices reveal that the proportion of moderately to strongly urbanophobic taxa (35.29 %) is more than twice as high as that of moderately to strongly urbanophilic taxa (14.9 %). Thirteen invasive species were recorded (*Juncus tenuis, Acer negundo, Bidens frondosa, Galinsoga ciliata, Solidago gigantea, Impatiens balfourii, Robinia pseudoacacia, Phytolacca americana, Reynoutria japonica, Duchesnea indica, Veronica persica, Ailanthus altissima,* and *Parthenocissus quinquefolia*), along with two potentially naturalised species with invasive potential (*Glyceria striata* and *Rosa multiflora*). Seven species are listed under IUCN threat categories: two as Vulnerable (*Taxus baccata* and *Ilex aquifolium*) both of which are also strictly protected in Croatia, three as Least Concern (*Galanthus nivalis, Poa annua,* and *Serratula tinctoria*), one as Near Threatened (*Cyclamen purpurascens*), and one as Data Deficient (*Aira caryophyllea*). The results of this study contribute to the knowledge of the urban flora of Zagreb and support the recommendation for the official designation of Kraljevec Forest Park as a protected area**.**

Key words: biodiversity, chronoelement, ecological indicators values, floral elements, indices of urbanity and anthropogenic changes, life forms, urban flora

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Istraživana Park šuma Kraljevec predstavlja dio urbanih šuma centra grada Zagreba, a nalazi se u brežuljkastom pojasu i vegetacijski pripada zajednici *Epimedio-Carpinetum betuli*. Istraživanje vaskularne flore Park šume Kraljevec provedeno je tijekom vegetacijske sezone 2023. godine kada su zabilježene ukupno 262 svojte vaskularnih biljaka, svrstanih u 78 porodica i 188 rodova. Dominantni životni oblici su hemikriptofiti (40.13 %) i geofiti (17,39 %), a prevladavajući florni elementi su euroazijski (47,08 %) i europski (17,51%). Udio alohtonih svojti iznosi 24.05 %, a indeksi urbanizacije pokazuju da je udio umjereno do izrazito urbanofobnih svojti više nego dvostruko veći (35,29 %) od umjereno do izrazito urbanofobnih (14,9 %). Zabilježeno je 13 invazivnih vrsta (*Juncus tenuis, Acer negundo, Bidens frondosa, Galinsoga ciliata, Solidago gigantea, Impatiens balfourii, Robinia pseudoacacia, Phytolacca americana, Reynoutria japonica, Duchesnea indica, Veronica persica, Ailanthus altissima* i *Parthenocissus quinquefolia*) i dvije potencijalno naturalizirane vrste s potencijalom da postanu invazivne (*Glyceria striata* i *Rosa multiflora*). Sedam je vrsta s IUCN kategorijama ugroženosti; dvije su osjetljive i zakonom strogo zaštićene vrste u Hrvatskoj (*Taxus baccata* i *Ilex aquifolium*), tri imaju najmanji stupanj zabrinutosti (*Galanthus nivalis, Poa annua* i

*corresponding author: dario.hrusevar@biol.pmf.unizg.hr

Serratula tinctoria), jedna je vrsta blizu ugroženosti (*Cyclamen purpurascens*), a za jednu ne postoji dovoljno podataka (*Aira caryophyllea*). Rezultati ovog istraživanja doprinose poznavanju urbane flore Zagreba i podržavaju preporuku za službeno proglašenje Park šume Kraljevec zaštićenim područjem.
Ključne riječi: bioraznolikost, ekološki indeksi, florni elementi, indeksi urbanizacije i antropogenizacije, kronoelementi, urbana flora, životni oblici

INTRODUCTION

The City of Zagreb is the capital of the Republic of Croatia, covering an area of 641.32 km² and inhabited by 767,131 people according to the most recent census conducted in 2021 (ODJEL ZA STATISTIČKE I ANALITIČKE POSLOVE, 2022). Zagreb is home to 22 Forest Parks extending approximately 20 kilometers in an east–west direction and about nine kilometers north–south. These green islands are separated by city districts, although some are spatially more connected, forming larger green complexes. These small forested oases are of high economic, social, scientific, and ecological value (MATIĆ, 2010). Due to their significance and sensitivity, some of Zagreb's Forest Parks are protected under the General Urban Plan of the City of Zagreb (ANONYMOUS, 2019). For others, such as the Kraljevec Forest Park examined in this study, it is recommended that they be officially reclassified into the park forest category, which confers the status of a protected area at the county level. This recommendation is based on various characteristics that make these areas worthy of protection, including biological, ecological, aesthetic, stylistic, artistic, and cultural-historical features (ANONYMOUS, 2019).

Over the past decade, the urban flora of the City of Zagreb has been studied only sporadically (HUDINA *et al*., 2012; ALEGRO *et al*., 2013; VUKOVIĆ *et al*., 2013; BUDISAVLJEVIĆ *et al.*, 2017; JUSTIĆ *et al*., 2020; ESSERT *et al.*, 2023). To date, floristic studies have been conducted in only three Forest Parks—Dotršćina (BUDISAVLJEVIĆ *et al.*, 2017), Jelenovac (JUSTIĆ *et al*., 2020), and Tuškanac (ESSERT *et al*., 2023)—all of which, including the Kraljevec Forest Park studied herein, are situated along the southern slopes of Mount Medvednica.

MATERIALS AND METHODS

Study area

The Kraljevec Forest Park is located just 2.5 km from the city's main square and forms part of the central forest complex within the central part od Zagreb (Fig. 1). The total area of the Kraljevec Forest Park is 48 hectares, situated in a hilly zone at an elevation ranging from 180 to 238 meters above sea level. Of the total area, 66.28 % is publicly owned, while as much as 33.72 % remains under private ownership (MIHETEC, 2022).

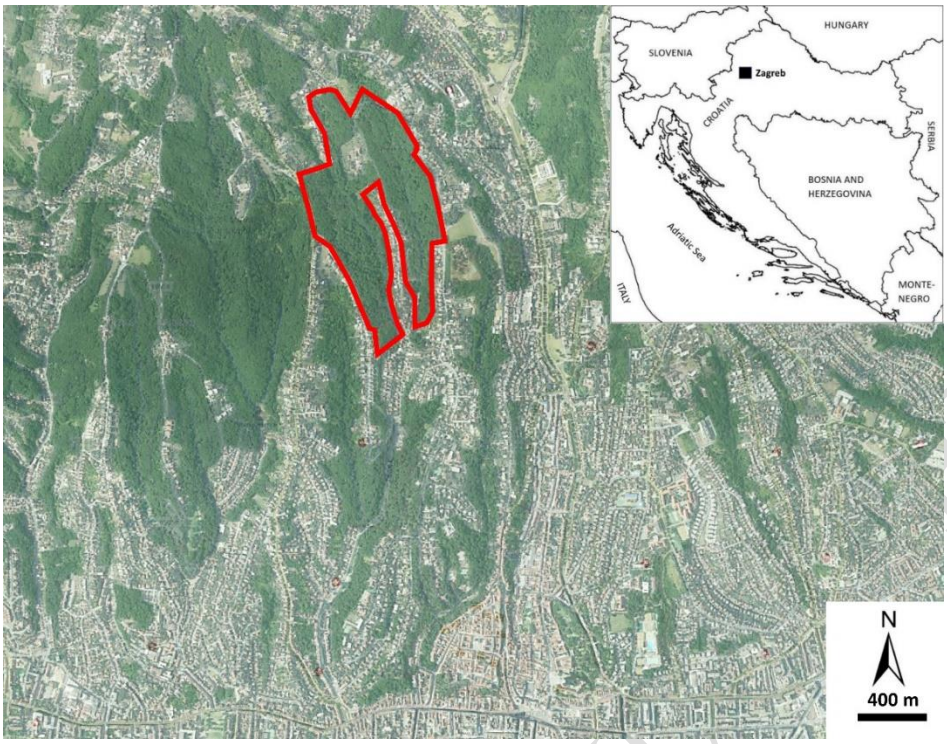

Fig. 1. Position of Kraljevec Forest Park, red line marked the position of Kraljevec forest park.

According to Köppen's geographical classification of climate types, both the City of Zagreb and the Kraljevec Forest Park belong tothe Cfb climate category, which denotes a temperate oceanic climate with warm summers. This climate type is characterized by an average January temperature above −3 °C and an average temperature of the warmest month below 22 °C (ŠEGOTA & FILIPČIĆ, 2003). According to data from the Croatian Meteorological and Hydrological Service, the highest average monthly precipitation recorded at the Zagreb Grič station occurs in June (95.2 mm), while the lowest is observed in February (46.5 mm) (DRŽAVNI HIDROMETEROLOŠKI ZAVOD, 2024). Annual precipitation amounts range from 520.8 mm (in 2011) to 1,387.4 mm (in 1937), with an average value of 886.7 mm (BONACCI & ROJE-BONACCI, 2019). These values are based on long-term data covering the period from 1862 to 2017.

The Kraljevec Forest Park area belongs to the Euro-Siberian–North American vegetation region and, in terms of climate-zonal vegetation, is classified within the colline belt of sessile oak forests. It is particularly associated with the most prominent community of this belt: the Illyrian sessile oak and common hornbeam forest [*Epimedio-Carpinetum betuli* (Horvat 1938) Borhidi 1963] (FRANJIĆ & ŠKVORC, 2010), prevailing forest vegetation for the colline belt of Central Croatia from the later High Middle Ages until nowadays (HRUŠEVAR *et al*., 2020).

Flora Research

The flora of the Kraljevec Forest Park was surveyed during several field visits conducted throughout the 2023 vegetation season. Floristic investigations included both the forest interior and its edge zone, extending from the outermost woody species to the adjacent roads delimiting the Forest Park (within a width of approximately 1–3 meters).

For species identification and taxonomic analysis, the following references were used: JAVORKA & CSAPODY (1991), DOMAC (1994), ROTHMALER (2017) and NIKOLIĆ (2020). Taxonomic nomenclature and classification were aligned with NIKOLIĆ (2023).

To classify life forms, we applied RAUNKIAER's (1934) classification system, with determinations based on LANDOLT *et al.* (2010). In the referenced literature, hemicryptophytes are divided into short-lived and long-lived types; however, for the reason of easier comparison with other urban flora studies, we merged them into a single category in this study.

Chorological classification (geoelements, geographical floristic elements) follows LANDOLT *et al.* (2010), and is adjusted according to HORVATIĆ (1963) i HORVATIĆ *et al.* (1967-1968).

Chronoelements (i.e. chronological floristic elements) were determined using MEDVECKÁ *et al.* (2012), with taxa classified into four categories: Spontanophytes (sp) – native species with no tendency to colonize transformed anthropogenic areas; Archaeophytes (ar) – non-native species naturalized before the year 1500; Kenophytes (kn) – non-native species naturalized after 1500; Diaphytes (df) – occasional alien species recorded after 1500, occurring sporadically.

Geographic origin of alien species were identified based on MEDVECKÁ *et al.* (2012).

We also analyzed ecological indicator values, divided into climate indices and soil indices. The climatic indices determined for each taxon were: temperature (T), continentality (K), and light (L); while the soil-related indices included: moisture (F), moisture variability (W), soil reaction (pH) (R), and nutrient availability (N). All ecological indicator values were obtained from LANDOLT *et al.* (2010).

Human impact on habitat conditions was assessed using LANDOLT *et al*. (2010). Taxa were categorized into five groups: strongly urbanophobic (species found exclusively in natural habitats), moderately urbanophobic (species occurring in natural habitats and sites with low human impact), urbanoneutral (species present in both natural and anthropogenically influenced habitats), moderately urbanophilic (species predominantly found in habitats heavily altered by

human activity) and strongly urbanophilic (species occurring exclusively in highly anthropogenically transformed habitats).

Anthropogenic impact indices were determined according to JACKOWIAK (1990, 2006), and the formulas used for index calculation are presented in Tab. 1.

Tab. 1. Formulas for calculating values of anthropogenization indices (JACKOWIAK, 1990; 2006).
(Ar – archaeophytes, Kn – kenophytes, Df – diaphytes, Sp – spontanophytes, An – number of alien species, Mt – number of metaphytes, IAnt – index of total anthropogenization, IAnp – index of permanent anthropogenization, IAr_t – index of total archaeophytization, IAr_p – index of permanent archaeophytization, IKn_t – index of total kenophytization, IKn_p – index of permanent kenophytization, IM – modernization index, IF – fluctuation change index)

Index	Description	Formula
1.1. IAn_t	Proportion of alien species in the total flora	$IAn_t = (An/(Sp + An))\times100$
1.2. IAn_p	Proportion of naturalized alien species in the total flora excluding diaphytes	$IAn_p=(Mt/(Sp+Mt))\times100$
2.1. IAr_t	Proportion of archaeophytes in the total flora	$IAr_t=(Ar/(Sp+An))\times100$
2.2. IAr_p	Proportion of archaeophytes in the total flora excluding diaphytes	$IAr_p=(Ar/(Sp+Mt))\times100$
3.1. IKn_t	Proportion of kenophytes in the total flora	$IKn_t=(Kn/(Sp+An))\times100$
3.2. IKn_p	Proportion of kenophytes in the total flora excluding diaphytes	$IKn_p=(Kn/(Sp+Mt))\times 100$
4. IM	Proportion of kenophytes within the naturalized alien flora	$IM=(Kn/Mt)\times100$
5. IF	Proportion of diaphytes in the total flora	$IF=(Df/(Sp+An))\times100$
An	number of alien species	An=Ar+Kn+Df
Mt	number of alien species permanently present at a given site	Mt=Ar+Kn

Invasive species were identified according to BORŠIĆ *et al.* (2008).

Categories of threat were determined using data from the Red Book of Vascular Flora of Croatia (NIKOLIĆ & TOPIĆ, 2005).

Protected species were identified based on the Regulation on Strictly Protected Species (ANONYMOUS, 2016), while endemic species were determined according to the Flora Croatica Database (NIKOLIĆ, 2023).

If a species lacked relevant data in the listed sources for a given analysis, that species was excluded from the respective analysis.

RESULTS AND DISCUSSION

The floristic survey of the Kraljevec Forest Park documented a total of 262 taxa, belonging to 78 families and 188 genera. The majority of taxa are Angiosperms (96.18 %), whereas Gymnosperms and Pteridophytes are equally represented (1.91 %) (App. 1). Compared to other studied park forests in Zagreb, a lower number of species has been recorded: Tuškanac – 173 taxa (ESSERT *et al.*, 2023), Dotrščina – 202 taxa (BUDISAVLJEVIĆ *et al.*, 2017), and Jelenovac – 255 taxa (JUSTIĆ *et al.*, 2020). The slightly higher number of species recorded in

this study may be attributed to the inclusion of species occurring along the forest edge, as well as the presence of degraded habitats within the forest caused by anthropogenic activities and/or the impact of storm Teodor in 2013.

Among the Angiosperms, dicotyledons constitute the majority (83.73 %), with 211 species across 60 families, followed by monocotyledons (16.26 %), comprising 41 species in 12 families. The most species-rich families are Rosaceae, Asteraceae and Poaceae (Fig. 2). In the nearby Tuškanac Park Forest (ESSERT *et al.*, 2023), the most represented families follow the same order: Rosaceae (8.1 %), Asteraceae (7.5 %), Poaceae (6.4 %), and Lamiaceae (5.2 %). In contrast, in Dotrščina Park Forest (BUDISAVLJEVIĆ *et al.*, 2017), following the most dominant family Rosaceae (6.4 %), the next most represented families are Fabaceae (5.9 %), Poaceae (5.9 %), and Cyperaceae (5.4 %).

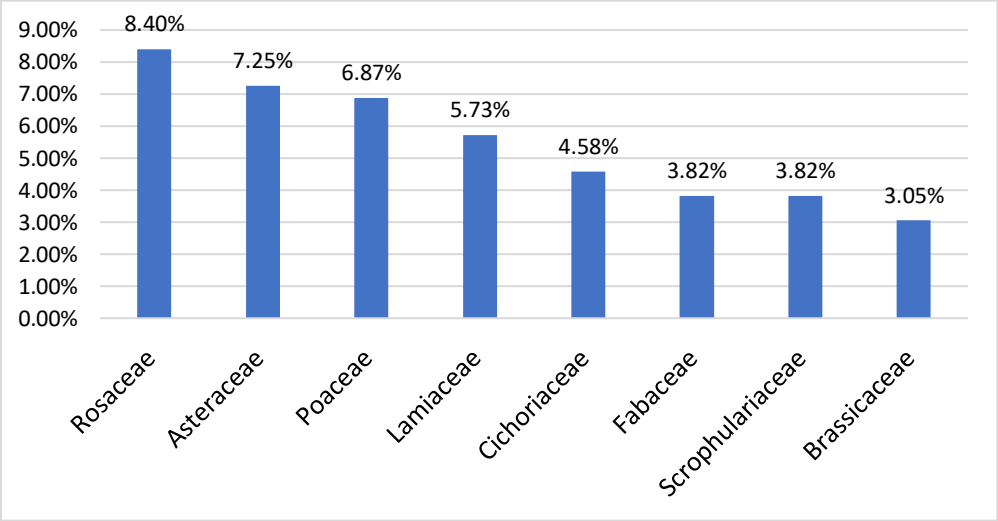

Fig. 2. Representation of the most common families in the Kraljevec Forest Park.

The analysis of life forms in the Kraljevec park forest shows that the largest number are hemicryptophytes, geophytes, and therophytes (Fig. 3). The highest proportion of hemicryptophytes (40.13 %) was expected for the temperate climate characterizing the Kraljevec Forest Park area. Geophytes (17.39 %), which include numerous spring ephemerals recorded in the study area, rank second in terms of abundance, which is also expected given their survival strategy under unfavorable conditions, matching the climatic conditions of their habitat (BUDISAVLJEVIĆ *et al.*, 2017). The proportion of therophytes at 14,72 % and their third-place ranking indicate a low to moderate anthropogenic influence on the flora (HRUŠEVAR *et al.*, 2018). The representation of phanerophytes at as much as 14.38 % corresponds to the fact that the study area belongs to a forest community (MATIĆ & ANIĆ, 2010).

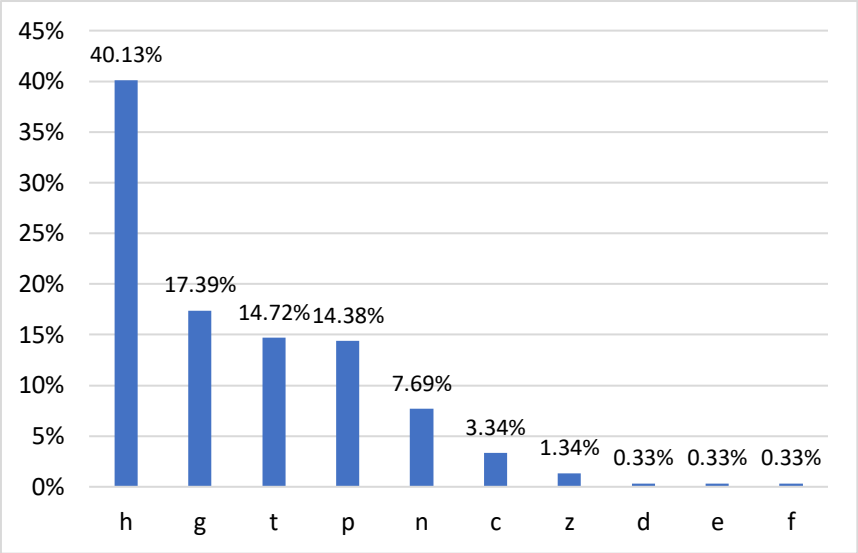

Fig. 3. Representation of life forms in the vascular flora of Kraljevec Forest Park.
(c–herbaceous chamaephytes, d–nanophanerophyte-hemicryptophytes, e–epiphytes, f–chamaephyte-hemicryptophytes, g–geophytes, h–hemicryptophytes, n–nanophanerophytes, p–phanerophytes, t–therophytes, z–woody chamaephytes)

Chorological analysis (Fig. 4, App. 1) revealed that the majority of taxa belong to the Eurasian floral element (47.08 %), as is also the case in Tuškanac Forest Park (37.16 %) (ESSERT *et al.*, 2023), Jelenovac (27.45 %) (JUSTIĆ *et al.*, 2020), and Dotrščina (44.1 %) (BUDISAVLJEVIĆ *et al.*, 2017). This was expected given the geographical location of the city of Zagreb. The next most represented are plants of the European floral element (17.51 %), followed by cultivated and adventive plants (12.45 %), whose representation is similar to that in Tuškanac Forest Park (14.86 %), somewhat lower than in Jelenovac Forest Park (18.04 %), and significantly higher than in Dotrščina Forest Park (5.9 %). The higher percentage of cultivated and adventive plants is a result of the proximity to urban areas and, consequently, the cultivation of various plant species in home gardens, included in our species list. Additionally, Kraljevec Forest Park has been degraded in several places due to human influence, as well as natural disasters (such as the Teodor storm in 2013), making certain areas suitable habitats for the establishment of various neophytes, which do not belong to the natural and expected forest vegetation of the studied area.

Analysis of chronoelements (Fig. 5, App. 1) revealed that spontaneous species (75.95 %) dominate among the recorded taxa in Kraljevec Forest Park, meaning that native species comprise the largest proportion of the total flora. A similarly high percentage of spontaneous species was recorded in Tuškanac Forest Park (84.4 %) (ESSERT *et al.*, 2023). Alien species (diaphytes, archaeophytes, and kenophytes) account for 24.05 %, which is higher than the

results obtained for Tuškanac Forest Park (15.6 %). This can be explained by the fact that this study included the forest edge flora where allochthonous species, which colonize degraded and less stable habitats, are more common.

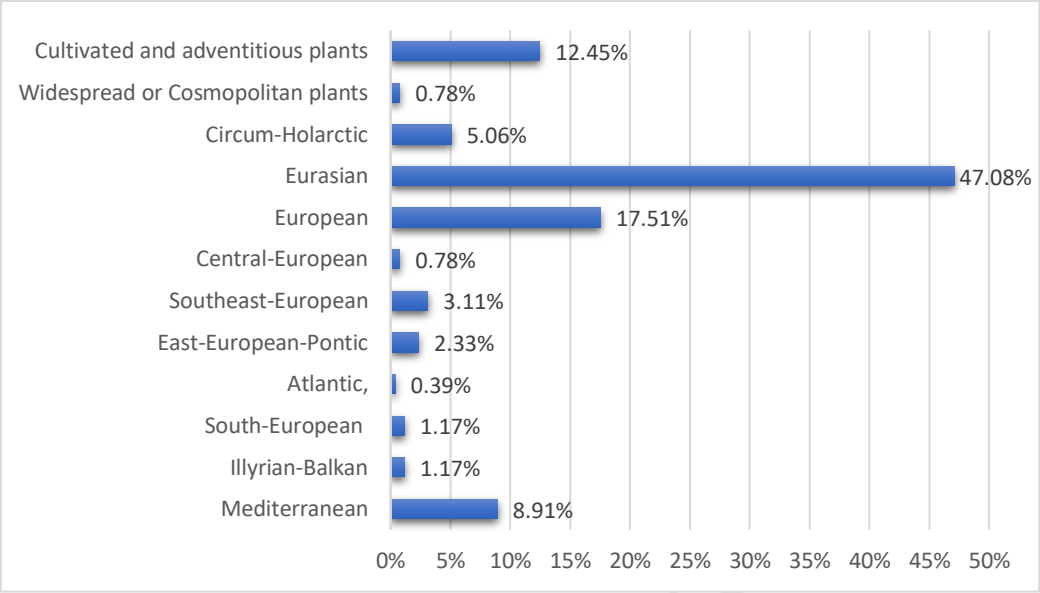

Fig. 4. Chorological spectrum of the flora of Kraljevec Forest Park.

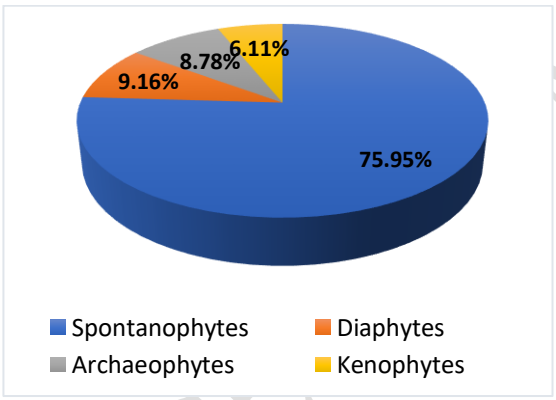

Fig. 5. Representation of chronoelements in the vascular flora of Kraljevec Forest Park.

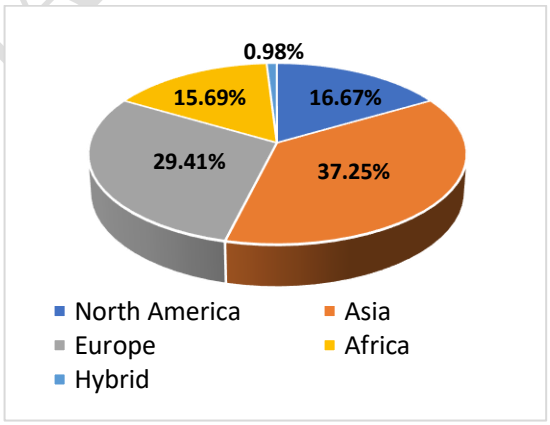

Fig. 6. Geographical origin of vascular flora in Kraljevec Forest Park.

The analysis of geographical origin for alien species shows that most non-native species originate from Asia and Europe (Fig. 6, App. 1).

Calculation of average ecological indicator values (App. 1) revealed that the most prevalent plant species in Kraljevec Forest Park are those adapted to submontane belt temperatures (T=3.74). This is unsurprising, as the study area belongs to the submontane vegetation zone (MATIĆ & ANIĆ, 2010). The highest proportion of species with suboceanic to subcontinental distribution (K=2.88) aligns with local conditions - moderate winter temperatures, moderate air humidity, and moderate diurnal/seasonal temperature fluctuations

(LANDOLT *et al.*, 2010). This is further supported by the dominance of species thriving in moderately moist soils (F=3.03) with intermediate moisture variability (W=1.67). The prevalence of semi-shade plants (L=3.02) reflects the forest community flora (App. 1). Most species occur in slightly acidic to neutral soils (R=3.38) with moderately low to moderately high fertility (N=3.35). No species adapted to alpine/nival zone temperatures or flooded areas were recorded. Similarly, species requiring highly acidic soils (pH = 2.5–5.5) are absent in Kraljevec Forest Park.

Urbanoneutral species dominate in Kraljevec Forest Park, while strongly urbanophilic species are rare (1.57 %) (Fig. 7, App. 1). These results indicate a predominance of species typical of natural habitats or areas with minimal anthropogenic influence. Comparable findings were reported for Tuškanac Forest Park, where urbanoneutral species accounted for 45.9 % and strongly urbanophilic species only 1.7 % (ESSERT *et al.*, 2023). The mean urbanity value for Kraljevec Forest Park is 2.69 (App. 1), placing it between moderate urbanophobicity and urbanoneutrality.

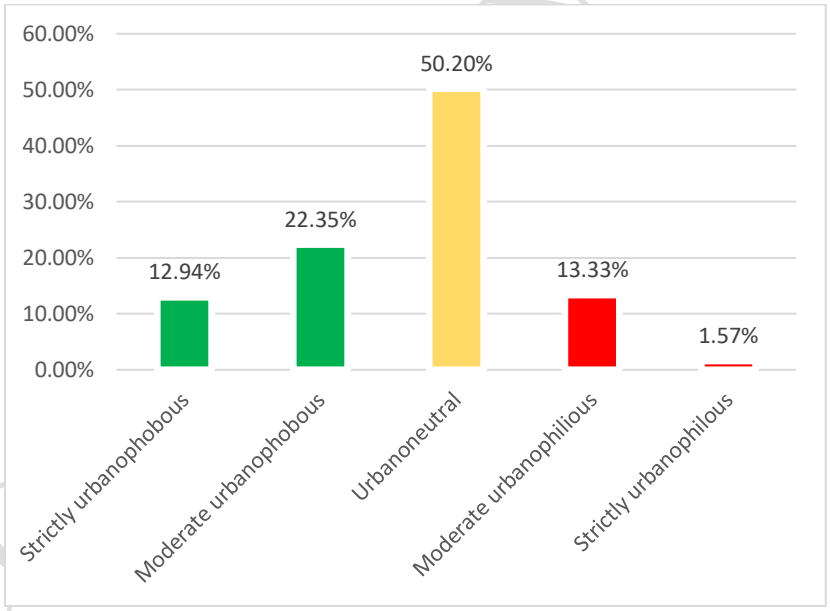

Fig 7. Levels of urbanity of the flora of Tuškanac Forest Park.

Anthropization indices are presented in Tab. 2. The relatively large difference between the calculated total indices (IAn_t) and permanent values of anthropization, archeophytization, and kenophytization for Kraljevec Forest Park (Tab. 2) suggests that in addition to permanent populations, sporadic populations are also present. This is further supported by the high fluctuation change index (9.16), which indicates the proportion of diaphytes in the total population. The modernization index value of 41.03 represents the proportion of kenophytes in the alien flora, showing that kenophytes are less numerous than archaeophytes (HRUŠEVAR *et*

al., 2018). A comparison of anthropization indices calculated for Tuškanac Forest Park (ESSERT *et al.*, 2023) and Kraljevec (Tab. 2) reveals that all index values are lower for Tuškanac. We conclude that the higher proportion of native taxa (spontaneous species) in Tuškanac results from both the inclusion of an extensive forest edge zone along roadways in this study area and the more pronounced storm damage from the 2013 Teodor event in Kraljevec, which created intermittent canopy openings that are less evident in Tuškanac.

Tab. 2. Anthropization index values calculated for Kraljevec Forest Park and comparative values from adjacent Tuškanac Forest Park (ESSERT *et al.*, 2023).

Anthropization index values	Kraljevec	Tuškanac
IAn$_t$ - Total Anthropization Index	24.05	15.6
IAn$_p$ - Permanent Anthropization Index	16.38	12.6
IAr$_t$ - Total Archeophytization Index	8.77	8.1
IAr$_p$ - Permanent Archeophytization Index	9.66	8.4
IKn$_t$ - Total Kenophytization Index	6.11	4.0
IKn$_p$ - Permanent Kenophytization Index	6.72	4.2
IM - Modernization Index	41.03	33.3
IF - Fluctuation Change Index	9.16	3.5

The study area recorded 13 invasive species, accounting for 4.98 % of the total flora. The invasive species in Kraljevec Forest Park include: *Juncus tenuis*, *Acer negundo*, *Bidens frondosa*, *Galinsoga ciliata*, *Solidago gigantea*, *Impatiens balfourii*, *Robinia pseudoacacia*, *Phytolacca americana*, *Reynoutria japonica*, *Duchesnea indica*, *Veronica persica*, *Ailanthus altissima*, and *Parthenocissus quinquefolia* (App. 1). The percentage of invasive species is very similar in Tuškanac Forest Park and Dotrščina (4 %), while two other surveyed urban locations in Zagreb show approximately double the values: Jarun – 7.74 % (VUKOVIĆ *et al.*, 2013) and Savica – 8.68 % (ALEGRO *et al.*, 2013). Those areas have more open habitats and artifical water bodies and have undergone significant human-induced vegetation changes, making them more susceptible to invasive species compared to climate-zonal forest systems.

Two potentially invasive species were also observed: *Glyceria striata* and *Rosa multiflora*, the both already having invasive status in neighboring Slovenia (STRGULC-KRAJŠEK *et al.*, 2016). The discovery of *G. striata* marks its first record in the continental biogeographical region, though it had been previously observed in the alpine region of Gorski Kotar in 2015 (ŠEGOTA *et al.*, 2016). *Rosa multiflora* was first documented in the Savica and Maksimir Park of the Zagreb area in 2020 (HRUŠEVAR *et al.*, 2021), representing its first record in Croatia. While their naturalization and invasiveness in Croatia remain uncertain, their presence in Kraljevec Forest Park, combined with their invasive status in Slovenia, highlights the need for

population monitoring to prevent potential threats to biodiversity. Endemic taxa were not recorded.

Seven species with IUCN threat categories were identified: two Vulnerable and strictly protected species in Croatia (*Taxus baccata* and *Ilex aquifolium*), one Near Threatened (*Cyclamen purpurascens*), three Least Concern species (*Galanthus nivalis*, *Poa annua*, and *Serratula tinctoria*), and one Data Deficient (*Aira caryophyllea*) (App. 1). These findings support the proposal to designate Kraljevec Forest Park as a protected area (ANONYMOUS, 2019).

Despite their ecological and recreational importance, Zagreb's Forest Parks, including Kraljevec, show signs of degradation. Storm damage, particularly from the 2013 Teodor storm and subsequent summer storms, has left noticeable clearings. Maintenance appears inconsistent, with publicly owned areas in better condition than private plots (MIHETEC, 2022). Given their immense ecological, social, and educational value, these Forest Parks require regular, ecologically sound management (MATIĆ, 2010). Proper upkeep would not only preserve biodiversity but also enhance recreational and educational use - this forest's accessibility makes it particularly suitable for educational school field trips. With climate change increasing storm frequency, proactive management is essential to safeguard these vital green spaces.

CONCLUSION

The investigation of the vascular flora of the Kraljevec Forest Park has revealed considerable floristic diversity, with a total of 262 recorded taxa. The dominance of hemicryptophytes and the Eurasian floristic element is consistent with the region's geographical position and climate. A notable proportion of urbanophilous and alien species, including 13 invasive (*Juncus tenuis, Acer negundo, Bidens frondosa, Galinsoga ciliata, Solidago gigantea, Impatiens balfourii, Robinia pseudoacacia, Phytolacca americana, Reynoutria japonica, Duchesnea indica, Veronica persica, Ailanthus altissima,* and *Parthenocissus quinquefolia*), and two potentially invasive taxa (*Glyceria striata* and *Rosa multiflora*), indicate a significant anthropogenic influence and raise concerns about potential threats to native vegetation and the degradation of the local floristic composition. Furthermore, the presence of two species strictly protected (*Taxus baccata* and *Ilex aquifolium*) in Croatia as well as seven species listed under some IUCN threat categories highlights the ecological value of this area.

The results of this comprehensive floristic survey underscore the importance of Kraljevec Forest Park as an important component of Zagreb's urban green infrastructure and

provide additional justification for its formal designation as a protected area. Continued monitoring of the flora, particularly in the context of climate change and anthropogenic pressures, will be essential for preserving its biodiversity and ecological function.

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Appendix 1. Inventory of vascular flora in Kraljevec Forest Park with specified threat and protection statuses, life forms, chorotypes, urbanity levels, ecological indices (temperature, continentality, light availability, moisture, moisture variability, soil pH, and nutrient content indices), geographical origin for alien species, invasiveness and chronoelements.

IUCN status: VU – Vulnerable, NT – Near Threatened, LC – Least Concern, DD – Data Deficient

Protection status: * - strictly protected

Life forms: c – herbaceous chamaephytes, d – nanophanerophyte-hemicryptophytes, e – epiphytes, f – chamaephyte-hemicryptophytes, g – geophytes, h – hemicryptophytes, n – nanophanerophytes, p – phanerophytes, t – therophytes, z – woody chamaephytes)

Chorological elements: 1 – Mediterranean, 2 – Illyrian-Balkan, 3 – Southern European, 4 – Atlantic, 5 – Eastern European-Pontic, 6 – Southeastern European, 7 – Central European, 8 – European, 9 – Eurasian, 10 – Circumboreal, 11 – Cosmopolitan, 12 – Cultivated/Adventive

Levels of urbanity: 1 – strongly urbanophobic to 5 – strongly urbanophilic

Ecological indicators: temperature zones (2 – subalpine to 5 – very warm colline), continentality (1 – oceanic to 5 – continental), light availability (1 – deep shade to 5 – full light), soil moisture (1 – very dry to 4.5 – wet), moisture variability (1 – low to 3 – high fluctuation), soil pH (2 – acidic to 5 – basic), and nutrient availability (1 – very poor to 5 – very rich)

Geographical origin: E - Europe, Af - Africa, As - Asia, N Am - North America, H - hybrid.

Invasiveness: I

Chronoelements: ar - archaeophytes, kn - kenophytes, df - diaphytes, sp – spontaneophytes

Family	Species	**IUCN and protection status**	**Life forms**	**Chorotype**	**Levels of urbanity**	**Temperture zones (T)**	**Continentality (K)**	**Light avaiability (L)**	**Soil moisture (F)**	**Moisture variability (W)**	**Soil pH (R)**	**Nutrient availability (N)**	**Geographical origin**	**Invasiveness**	**Chronoelement**
MONILOPHYTA (PTERIDOPHYTA)															
Dryopteridaceae	*Dryopteris filix-mas* (L.) Schott		h	10	3	3	3	2	3.5	2	3	3			sp
	Polystichum aculeatum (L.) Roth		h	9	1	3	2	3	3.5	1	3	3			sp
Equisetaceae	*Equisetum telmateia* Ehrh.		g	10	2	3.5	2	3	4.5	3	4	3			sp
Hypolepidaceae	*Pteridium aquilinum* (L.) Kuhn		g	11	2	3	2	3	3	3	2	2			sp

Woodsiaceae	*Athyrium filix-femina* (L.) Roth		h	9	1	3	2	2	3	1	2	3			sp
SPERAMTOPHYTA – GYMNOSPERMAE															
Pinaceae	*Picea abies* (L.) H. Karst.		p	8	2	2.5	3	1	3	1		3			sp
	Picea pungens Engelm.		p	12									N Am		df
	Pinus nigra J. F. Arnold		p	2	2	4.5	4	4	2	2	4	2			sp
	Pinus wallichiana A. B. Jacks.		p	12									As		df
Taxaceae	*Taxus baccata* L.	VU*	p	9	3	3.5	2	2	2.5	3	4	2			sp
SPERAMTOPHYTA – ANGIOSPERMAE															
MAGNOLIANAE															
Aristolochiaceae	*Asarum europaeum* L.		g	9	1	3.5	2	2	3.5	1	4	3			sp
LILIANAE															
Amaryllidaceae	*Allium ursinum* L.		g	9	2	3.5	2	2	4	2	4	3			sp
	Galanthus nivalis L.	LC	g	3	3	4	4	3	3	1	4	3			sp
	Leucojum vernum L.		g	8	2	3.5	2	3	3.5	2	3	4			sp
Araceae	*Arum maculatum* L.		g	8	2	4	2	2	3	3	4	3			sp
Asparagaceae	*Asparagus officinalis* L.		g	1	4	4.5	4	4	2	1	4	3			sp
	Convallaria majalis L.		g	8	3	3.5	3	3	2.5	2	3	2			sp
	Polygonatum multiflorum (L.) All.		g	9	1	3.5	3	2	3	1	4	3			sp
Commelinaceae	*Commelina communis* L.		c-t	12	4	5	2	3	3	1	3	3	As		df
Cyperaceae	*Carex divulsa* Stokes		h	1	3	4.5	2	3	2.5	2	3	3			sp
	Carex hirta L.		g-h	8	3	3.5	3	3	3.5	3	3	4			sp
	Carex pendula Huds.		h	9	2	3.5	2	2	4	3	3	4			sp
	Carex spicata Huds.		h	9	3	3.5	3	4	3	3	3	4			sp
	Carex sylvatica Huds.		h	9	3	3.5	3	2	3.5	2	3	3			sp
Dioscoreaceae	*Tamus communis* L.		g	1	1	4.5	2	3	3.5	1	4	3			sp
Iridaceae	*Crocus heuffelianus* Herb.		g	8											sp
	Crocus purpureus Weston		g	8											sp
	Crocus vernus (L.) Hill		g	3	2	3.5	3	2	2.5	2	4	3			sp
Juncaceae	*Juncus effusus* L.		h	10	3	3.5	3	3	4	3	2	4			sp
	Juncus tenuis Willd.		h	12	3	3.5	3	4	3.5	3	2	4	N Am	I	kn

	Luzula luzuloides (Lam.) Dandy et Wilmott		h	8	1	3.5	3	3	2.5	1	2	2			sp
Liliaceae	*Erythronium dens-canis* L.		g	9	1	5	2	2	3	1	4	3			sp
Orchidaceae	*Epipactis helleborine* (L.) Crantz		g	9	1	3	4	3	2	3	4	3			sp
Poaceae	*Aira caryophyllea* L.	DD	t	1	3	4.5	2	5	1	1	2	1			sp
	Brachypodium sylvaticum (Huds.) P. Beauv.		h	9	3	3.5	3	3	3.5	2	3	3			sp
	Bromus sterilis L.		t	9	4	4	4	3	2	1	3	4	E, As		ar
	Calamagrostis epigejos (L.) Roth		g-h	9	3	3.5	3	3	3	2	4	3			sp
	Dactylis glomerata L.		h	9	3	4	3	4	3	1	3	4			sp
	Elymus repens (L.) Gould		g	10	3	3.5	3	4	3	3	4	4			sp
	Festuca altissima All.		h	9	1	2.5	2	2	3.5	2	2	3			sp
	Festuca gigantea (L.) Vill.		h	9	2	3.5	3	2	4	3	3	3			sp
	Glyceria striata(Lam.) Hitchc.		g	12	2	3.5	2	3	4.5	3	2	4	N Am		kn
	Holcus lanatus L.		h	8	3	3.5	3	4	3	2	3	3			sp
	Hordeum murinum L.		t	1	4	4	4	4	2	1	3	4	E, As		ar
	Lolium perenne L.		h	9	3	3.5	3	4	3	3	3	4			sp
	Melica nutans L.		h	9	2	3.5	4	2	2.5	2	4	3			sp
	Melica uniflora Retz.		g	9	1	4	2	2	2.5	2	2	3			sp
	Milium effusum L.		g	10	1	3.5	2	2	3	1	2	3			sp
	Poa annua L.	LC	h-t	9	3	3.5	3	4	3	2	3	4			sp
	Poa pratensis L.		h	10	3	3	3	4	3.5	1	3	4			sp
	Poa trivialis L.		h	10	3	3	3	3	3.5	3	4	4			sp
EUDICOTYLEDONAE															
Aceraceae	*Acer campestre* L.		p	9	1	4	3	3	2.5	1	3	3			sp
	Acer negundo L.		p	12	4	4.5	2	3	3.5	3	3	4	N Am	I	kn
	Acer platanoides L.		p	8	3	4	3	2	3	1	4	3			sp
	Acer pseudoplatanus L.		p	8	3	3	2	2	3.5	3	3	3			sp
Adoxaceae	*Adoxa moschatellina* L.		g	10	2	3	3	2	3.5	2	4	3			sp
Anacardiaceae	*Rhus typhina* L.		n-p	12	4	4.5	2	4	2	1	3	3	N Am		df
Apiaceae	*Aegopodium podagraria* L.		g-h	9	3	3.5	3	2	3.5	1	3	4			sp
	Chaerophyllum temulum L.		t	8	3	4.5	2	3	3	1	3	5			sp

	Daucus carota L.		k-t	1	3	4	3	4	2.5	1	4	2			sp
	Hacquetia epipactis (Scop.) DC.		h	6	1	3.5	3	2	2.5	1	4	3			sp
	Heracleum sphondylium L.		h	8	3	3	3	3	3	1	3	4			sp
	Pastinaca sativa L.		k-t	9	5	4	4	4	2.5	2	4	4			sp
	Sanicula europaea L.		h	9	1	3.5	2	2	3	1	4	3			sp
Apocynaceae	*Vinca major* L.		z	1	3	5	3	3	3	1	3	4	E, As		df
	Vinca minor L.		z	9	3	3.5	3	2	3	1	4	3			sp
Aquifoliaceae	*Ilex aquifolium* L.	VU*	n-p	9	3	3.5	2	2	2.5	1	3	3	E, As, Af		sp
Araliaceae	*Hedera helix* L.		c-p	8	3	4	2	2	3	1	3	3			sp
Asteraceae	*Achillea millefolium* L.		c-h	9	3	3	3	4	2	1	3	3			sp
	Arctium lappa L.		k	9	3	3.5	4	3	2.5	2	4	5	E, As		ar
	Arctium minus (Hill) Bernh.		k	9	3	3	4	3	2.5	2	4	5			sp
	Artemisia vulgaris L.		g-h	9	4	4	4	4	2.5	2	3	4			sp
	Bellis perennis L.		h	9	3	3.5	3	4	3	1	4	3			sp
	Bidens frondosa L.		t	12	3	4.5	2	3	4.5	3	3	4	N Am	I	kn
	Carpesium abrotanoides L.		h		3	4	3	3	3.5	2	3	3			sp
	Centaurea jacea L.		h	8	3	3	3	4	2.5	1	3	3			sp
	Centaurea nigrescens Willd.		h	5	3	3	4	4	3	1	3	3			sp
	Cirsium arvense (L.) Scop.		g	9	3	3.5	3	3	3	3	3	4			sp
	Doronicum austriacum Jacq.		g	8	1	2.5	3	3	4	2	4	4			sp
	Erigeron annuus (L.) Desf.		k-t	12	3	4	3	4	2.5	2	3	4	N Am		kn
	Eupatorium cannabinum L.		h	9	2	3.5	3	3	4	3	4	4		I	kn
	Galinsoga ciliata (Raf.) S. F. Blake		t	12	4	4	2	4	3	2	3	4		I	kn
	Senecio vulgaris L.		t	1	4	3.5	3	4	3	1	4	4	E, As		ar
	Serratula tinctoria L.	LC	h	9	2	3.5	4	4	3.5	3	4	2			sp
	Solidago gigantea Aiton		h	12	3	3.5	2	3	3.5	3	3	4	N Am	I	kn
	Taraxacum officinale F. H. Wigg.		h	9	3	3	3	4	3	1	3	4			sp
	Tussilago farfara L.		g	9	3	3	3	4	3.5	1	4	3			sp
Balsaminaceae	*Impatiens balfourii* Hook. f.		t	12	2	5	2	3	3.5	3	4	4	As	I	kn
Berberidaceae	*Epimedium alpinum* L.		g	6	3	4.5	2	2	3	1	2	3			sp

	Mahonia aquifolium (Pursh.) Nutt.		n	12	3	4.5	2	2	2.5	1	3	3	N Am		df
Betulaceae	*Alnus glutinosa* (L.) Gaertn.		p	9	1	4	3	3	4.5	3	3	4			sp
Boraginaceae	*Brunnera macrophylla* (Adams) I.M.Johnst.		g	12	3	4	2	2	3	1	3	3	E, As		df
	Pulmonaria obscura Dumort.		h	5	1	3.5	4	2	3.5	1	4	3			sp
	Pulmonaria officinalis L.		h	2	1	4.5	4	2	3.5	1	4	3			sp
	Symphytum officinale L.		h	9	3	3.5	2	3	3.5	3	3	4			sp
	Symphytum tuberosum L.		g	4	2	4	1	2	3.5	2	4	3			sp
Brassicaceae	*Alliaria petiolata* (M. Bieb.) Cavara et Grande		h-t	9	3	4	3	2	3.5	1	4	5			ar
	Capsella bursa-pastoris (L.) Medik.		k-t	9	3	3	3	4	2	1	3	4			sp
	Cardamine bulbifera (L.) Crantz		g	8	2	3.5	3	2	3.5	1	3	4			ar
	Cardamine hirsuta L.		t	9	4	3.5	3	4	3	1	3	4			sp
	Cardamine impatiens L.		t	9	2	3.5	3	3	3.5	2	3	4			sp
	Cardamine parviflora L.		t	9	3	4.5	3	4	4.5	3	4	3			sp
	Cardaria draba (L.) Desv.		h	1	4	4	4	3	2	1	4	4	E, As, Af		ar
	Diplotaxis muralis (L.) DC.		t	1	4	4.5	3	4	2.5	1	4	4	E, As, Af		ar
Campanulaceae	*Campanula glomerata* L.		h	9	2	4	4	4	2	2	4	2			sp
	Campanula patula L.		k	8	3	3.5	3	4	3.5	2	3	3			sp
	Campanula persicifolia L.		h	8	3	4	4	3	2	1	4	2			sp
Cannabaceae	*Humulus lupulus* L.		h	9	3	4	4	3	4	3	3	4			sp
Caprifoliaceae	*Lonicera caprifolium* L.		n	6	2	4.5	3	3	3	1	4	3			sp
	Lonicera nitida E. H. Wilson		n	12	4	4.5	2	3	3	1	3	3	As		df
	Sambucus nigra L.		n-p	8	3	3.5	3	3	3.5	2	4	4			sp
	Symphoricarpos albus (L.) S. F. Blake		n	12	3	3.5	2	3	3.5	2	3	4	N Am		df
	Symphoricarpos orbicularis Moench												N Am		df
Caryophyllaceae	*Cerastium glomeratum* Thuill.		t	9	5	4	4	4	2.5	1	3	4			sp
	Myosoton aquaticum (L.) Moench		h	9	3	3.5	3	3	4	3	3	4			sp
	Silene vulgaris (Moench) Garcke		h	8	3	3	4	4	2.5	1	3	2			sp
	Stellaria holostea L.		c	9	1	4.5	3	2	3	1	2	3			sp
	Stellaria media (L.) Vill.		t	9	4	3	3	3	3	1	3	4			sp
Celastraceae	*Euonymus europaeus* L.		n	9	2	3.5	3	3	3.5	3	4	3			sp

	Euonymus fortunei (Turcz.) Hand.-Mazz.		p	12	4	5	2	3	3	1	3	3	As		df
Cichoriaceae	*Aposeris foetida* (L.) Less.		h	6	2	2.5	2	3	3.5	1	4	3			sp
	Cichorium intybus L.		h	9	3	4	3	4	2.5	2	4	3	E, As, Af		ar
	Crepis biennis L.		k	8	3	3.5	3	4	3	1	3	4			sp
	Hieracium murorum L.		h	9	3	3	3	2	2	1	3	3			sp
	Hieracium sabaudum L.		h	8	3	4	3	3	2.5	2	2	3			sp
	Lactuca serriola L.		k-t	9	4	4.5	4	4	2	1	4	4	E, As, Af		ar
	Lapsana communis L.		h-t	9	3	3.5	3	3	3.5	1	3	4			sp
	Leontodon hispidus L.		h	8	3	3	3	4	2.5	2	4	3			sp
	Mycelis muralis (L.) Dumort.		h	9	3	3.5	3	2	3.5	1	4	4			sp
	Prenanthes purpurea L.		h	8	1	3	3	2	3	1	3	3			sp
	Sonchus asper (L.) Hill		t	9	3	3.5	3	4	3.5	1	3	4			sp
	Sonchus oleraceus L.		t	9	4	3.5	3	4	3	1	4	4	E, As, Af		ar
Clusiaceae	*Hypericum hirsutum* L.		h	9	2	4	3	3	3.5	2	4	3	E, As, Af		ar
	Hypericum montanum L.		h	8	2	3.5	3	3	2.5	2	4	2			sp
	Hypericum perforatum L.		h	9	3	4	3	3	3	2	3	3			sp
	Hypericum tetrapterum Fr.		h	8	2	4	2	3	4	3	3	3			sp
Convolvulaceae	*Calystegia sepium* (L.) R. Br.		g	9	3	3.5	2	3	3.5	2	4	4			sp
	Convolvulus arvensis L.		g	9	4	4	4	4	2.5	2	4	4	E, As, Af		ar
Cornaceae	*Cornus sanguinea* L.		n	8	4	3.5	3	3	3	1	4	3			sp
Corylaceae	*Carpinus betulus* L.		p	9	2	4	3	2	3	2	3	3			sp
	Corylus avellana L.		n-p	8	3	3	3	3	3	2	3	3			sp
Crassulaceae	*Sedum palmeri* S. Watson												N Am		df
Dipsacaceae	*Dipsacus fullonum* L.		k-t	9	4	4.5	3	4	3.5	2	4	4			sp
	Knautia drymeia Heuff.		h	6	2	3.5	3	3	3	1	4	3			sp
Euphorbiaceae	*Euphorbia cyparissias* L.		h	9	2	3	4	3	2	1	4	2			sp
	Euphorbia dulcis L.		g	5	1	3.5	4	2	3	1	4	3			sp
	Mercurialis perennis L.		g	9	1	3.5	2	1	3.5	1	4	3			sp
Fabaceae	*Chamaecytisus supinus* (L.) Link		z	9	2	4.5	4	3	1.5	1	4	2			sp
	Galega officinalis L.		h	1	4	4.5	2	3	3.5	2	4	4			sp

	Genista tinctoria L.		z	9	2	4.5	3	4	2.5	2	2	2			sp
	Lathyrus niger (L.) Bernh.		g	9	1	4.5	4	3	2	1	3	2			sp
	Lathyrus vernus (L.) Bernh.		g	9	1	3.5	4	3	2.5	2	4	2			sp
	Medicago lupulina L.		h-t	9	3	4	3	3	2	1	4	3			sp
	Robinia pseudoacacia L.		p	12	3	4.5	3	3	2.5	1	3	4	N Am	I	kn
	Trifolium pratense L.		h-t	9	3	3.5	3	4	3	1	3	3			sp
	Trifolium repens L.		c-h	9	4	3	3	4	3	2	3	4			sp
	Vicia sativa L.		t	1	4	4.5	3	4	3	1	4	3	E, As, Af		ar
Fagaceae	*Fagus sylvatica* L.		p	8	1	3.5	2	1	3	1	3	3			sp
	Quercus petraea (Matt.) Liebl.		p	8	1	4	3	3	2	2	3	2			sp
Fumariaceae	*Corydalis bulbosa* (L.) DC.		g	8	3	3.5	2	3	3.5	1	4	4			sp
Garryaceae	*Aucuba japonica* Thunb *variegata*		n	12	3	5	2	3	3	1	3	3	As		df
Geraniaceae	*Geranium phaeum* L.		h	8	2	3	4	3	3.5	1	4	4			sp
	Geranium robertianum L.		t	10	3	3.5	3	3	3	1	3	4			sp
	Geranium rotundifolium L.		t	1	5	4.5	4	4	2	1	4	3			sp
Hippocastanaceae	*Aesculus hippocastanum* L.		p	12	3	4	2	3	3.5	2	4	3			df
Hydrangeaceae	*Philadelphus coronarius* L.		n	6	4	4.5	3	3	3.5	2	4	3	N Am		df
Juglandaceae	*Juglans regia* L.		p	1	2	4	2	3	2.5	1	4	4	E As		df
Lamiaceae	*Ajuga reptans* L.		h	9	3	3.5	3	3	3	1	3	3			sp
	Ballota nigra L.		g	1	3	4.5	5	4	2.5	1	3	5	E, As, Af		ar
	Clinopodium vulgare L.		g	9	2	4	3	3	2.5	1	4	2			sp
	Galeopsis speciosa Mill.		t	5	3	3	4	3	3	1	3	5			sp
	Glechoma hederacea L.		h	9	3	3.5	3	3	3.5	2	4	3			sp
	Glechoma hirsuta Waldst. et Kit.		h	6	3	4	5	3	3.5	2	4	3			sp
	Lamium galeobdolon (L.) Crantz		c	5	2	3.5	4	1	3	1	4	3			sp
	Lamium maculatum L.		h	8	3	3.5	2	3	3.5	1	3	5			sp
	Lamium orvala L.		h	2	1	4.5	3	2	4	1	3	4			sp
	Lamium purpureum L.		k-t	1	4	3	3	4	3	1	4	4	E, As, Af		ar
	Lycopus europaeus L.		g	9	2	3.5	3	3	4.5	3	3	3			sp
	Melissa officinalis L.		g-h	1	3	4.5	2	3	3	1	4	4	E, As, Af		sp

	Mentha aquatica L.		g-h	9	2	3.5	3	3	4.5	3	3	3			sp
	Prunella vulgaris L.		h	10	3	3	3	4	3.5	1	3	3			sp
	Stachys sylvatica L.		h	9	3	3.5	3	3	3.5	1	3	4			sp
Loranthaceae	*Loranthus europaeus* Jacq.		e	9	3	5	4	4							sp
Malvaceae	*Malva sylvestris* L.		k-t	9	3	4	4	4	2.5	2	4	4	E, As, Af		ar
Moraceae	*Ficus carica* L.		p	1	3	5	2	3	2	2	3	3	As		df
Oleaceae	*Fraxinus ornus* L.		p	9	2	4.5	3	3	2	1	4	2			sp
	Ligustrum vulgare L.		n	9	2	4	3	3	2.5	3	4	3			sp
	Syringa vulgaris L.		n	1	3	4.5	4	3	3	1	4	3			df
Onagraceae	*Circaea lutetiana* L.		g	9	3	3.5	2	2	3.5	2	4	4			sp
	Epilobium parviflorum Schreb.		h	8	3	3.5	3	3	4	3	4	4			sp
Oxalidaceae	*Oxalis acetosella* L.		c-g	9	1	3	3	1	3	1	2	2			sp
	Oxalis fontana Bunge		h	12	3	4	2	3	3	2	3	4	N Am		kn
Papaveraceae	*Chelidonium majus* L.		h-k	9	3	3.5	3	3	3	1	4	4	E, As		ar
Phytolaccaceae	*Phytolacca americana* L.		h	12	3	4.5	1	3	3	1	3	4	N Am	I	kn
Plantaginaceae	*Plantago lanceolata* L.		h	9	3	3	3	4	2.5	2	3	3			sp
	Plantago major L.		h	9	3	3	3	4	3	3	3	4			sp
Polygonaceae	*Polygonum aviculare* L.		t	9	3	4	2	4	3.5	1	3	4			sp
	Polygonum mite Schrank		t	8	2	4	2	3	4	3	4	4			sp
	Polygonum persicaria L.		t	11	3	3.5	3	4	3	2	3	4			sp
	Reynoutria japonica Houtt.		g	12	3	4	2	3	3.5	3	3	4		I	kn
	Rumex crispus L.		h-k	9	4	3.5	3	4	3.5	3	3	4			sp
	Rumex patienta L.		h	1	4	4.5	4	4	3	1	3	4			sp
	Rumex sanguineus L.		h	9	2	3.5	2	3	4	3	4	4			sp
Primulaceae	*Anagallis arvensis* L.		t	1	4	4	3	4	3	1	3	3	E, As, Af		ar
	Cyclamen purpurascens Mill.	NT	g	6	2	4	4	2	3	1	4	3			sp
	Lysimachia punctata L.		h	5	3	4.5	4	3	3.5	2	3	4			sp
	Primula vulgaris Huds.		h	9	3	4.5	2	3	3	1	4	3			sp
Ranunculaceae	*Anemone nemorosa* L.		g	8	2	3.5	3	2	3	1		3			sp
	Clematis vitalba L.		p	8	2	3.5	3	3	3	1	4	3			sp

	Ranunculus bulbosus L.		h	9	3	3	4	4	2	1	4	2			sp
	Ranunculus ficaria L.		g	8	2	3.5	2	2	3.5	3	4	4			sp
	Ranunculus lanuginosus L.		h	8	1	2.5	2	2	3.5	2	3	4			sp
	Ranunculus repens L.		h	9	3	3	3	3	3.5	3	3	4			sp
Rosaceae	*Aruncus dioicus* (Walter) Fernald		h	10	2	3.5	2	2	3.5	1	3	4			sp
	Crataegus laevigata (Poir.) DC.		n-p	8	3	3.5	2	3	3.5	2	3	3			sp
	Crataegus monogyna Jacq.		n-p	9	2	4	4	4	3	2	4	3			sp
	Duchesnea indica (Andrews) Focke		h	12	3	4.5	2	3	3	1	3	4		I	kn
	Fragaria vesca L.		h	9	3	3	3	3	3	1	3	3			sp
	Fragaria x ananassa Duchesne		h	12	4	5	2	3	3	1	4	3	H		df
	Geum urbanum L.		h	9	3	3.5	3	2	3.5	1	3	4			sp
	Potentilla hirta L.		h	1	4	5	3	4	1.5	1	5	2			sp
	Potentilla micrantha DC.		h	9	3	4.5	4	3	2	1	3	3			sp
	Potentilla reptans L.		h	9	3	3.5	3	4	3	3	4	4			sp
	Prunus avium (L.) L.		p	9	3	4	3	3	3.5	1	3	3			sp
	Prunus cerasifera Ehrh.		p	9	3	4.5	3	3	2.5	1	3	3	E As		df
	Prunus laurocerasus L.		n-p	12	3	4.5	2	2	2.5	1	3	3	E As		df
	Prunus padus L.		n-p	9	1	4	2	2	3.5	3	3	3			sp
	Prunus spinosa L.		n	9	2	3.5	3	4	2.5	1	3	3			sp
	Rosa canina L.		n	9	2	2	3	3	2.5	1	4	3			sp
	Rosa multiflora Thunb.		p	12	3	4.5	2	3	2	1	3	3	As		df
	Rubus caesius L.		f	9	2	3.5	3	3	3.5	3	4	4			sp
	Rubus idaeus L.		d	9	3	3	3	3	3	2	3	4			sp
	Sorbus aucuparia L.		n-p	9	3	3	3	3	3	1	3	3			sp
	Sorbus torminalis (L.) Crantz		p	9	1	4	4	3	2	2	4	2			sp
	Spiraea japonica L.f.		n	12	3	5	2	3	3	1	3	3	As		df
Rubiaceae	*Galium aparine* L.		t	9	3	3.5	3	3	3	2	3	5			sp
	Galium sylvaticum L.		g	8	1	3.5	2	2	2.5	1	3	3			sp
Salicaceae	*Populus alba* L.		p	9	3	4.5	3	4	3.5	3	4	4			sp
	Salix alba L.		p	9	3	4	3	3	4.5	3	4	4			sp

	Salix caprea L.		n-p	9	3	3	3	3	3	3	3	3			sp
Saxifragaceae	*Chrysosplenium alternifolium* L.		h	9	2	3	3	2	4.5	3	4	3			sp
Scrophulariaceae	*Cymbalaria muralis* P. Gaertn.. B. Mey. et Scherb.		c-h	3	4	4.5	2	4	3.5	2	4	3			sp
	Lathraea squamaria L.		g	9	1	4	3	1	3.5	2	4	3			sp
	Paulownia tomentosa (Thunb.) Siebold et Zucc.		p	12	3	5	2	3	3	1	3	3	As		df
	Scrophularia nodosa L.		h	10	2	3	3	2	3.5	2	3	4			sp
	Veronica arvensis L.		t	9	3	3.5	3	3	2.5	1	4	3	E, As, Af		ar
	Veronica chamaedrys L.		c-h	9	3	3	3	3	2.5	1	4	3			sp
	Veronica hederifolia L.		t	9	3	4	3	3	3	1	3	4			sp
	Veronica officinalis L.		c	8	2	3	3	3	2	1	2	2			sp
	Veronica persica Poir.		t	12	4	3.5	3	4	3	1	4	4	As	I	kn
	Veronica serpyllifolia L.		h	9	3	3.5	3	4	3	1	3	4			sp
Simaroubaceae	*Ailanthus altissima* (Mill.) Swingle		p	12	5	4.5	3	4	2	1	4	4	As	I	kn
Solanaceae	*Solanum nigrum* L.		t	10	4	3.5	3	4	3	1	4	4			ar
Tiliaceae	*Tilia platyphyllos* Scop.		p	8	2	4	2	2	3	1	4	3			sp
Ulmaceae	*Ulmus glabra* Huds.		p	8	2	3.5	2	2	3.5	3	3	4			sp
	Ulmus minor Mill.		p	1	2	4.5	3	3	3.5	3	4	3			sp
Urticaceae	*Urtica dioica* L.		h	9	3	3	3	3	3.5	3	3	5			sp
Verbenaceae	*Verbena officinalis* L.		k-t	9	4	3.5	3	4	3	2	3	4	E, As, Af		ar
Violaceae	*Viola hirta* L.		h	9	3	3.5	3	3	2.5	1	4	2			sp
	Viola reichenbachiana Jord. ex Boreau		h	8	3	3	2	2	3	1	3	3			sp
	Viola riviniana Rchb.		h	8	2	3	4	3	2.5	3	2	3			sp
Vitaceae	*Parthenocissus quinquefolia* (L.) Planchon		p	12	3	5	2	3	2.5	1	3	3	N Am	I	kn
Average					**2.69**	**3.74**	**2.88**	**3.02**	**3.03**	**1.67**	**3.38**	**3.35**			