VAROVANJE NEKATERIH IZBRANIH NATURA 2000 RASTLINSKIH VRST (LIFE SEEDFORCE PROJEKT)

PROTECTION OF SELECTED NATURA 2000 PLANT SPECIES (LIFE SEEDFORCE PROJECT)

HORTUS BOTANICUS UNIVERSITATIS LABACENSIS, SLOVENIA
INDEX SEMINUM

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PROTECTION OF SELECTED NATURA 2000 PLANT SPECIES (LIFE SEEDFORCE PROJECT)

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KAZALO / INDEX

300 LETNICA ROJSTVA JANEZA ANTONA SCOPOLIJA IN 250 LETNICA DRUGE IZDAJE *FLORA CARNIOLICA*

Nada Praprotnik, Blanka Ravnjak, Jože Bavcon

V letošnjem letu je pred nami 300 letnica rojstva Johannesa Antoniusa Scopolija - Giovannija Antonija Scopolija - Janeza Antona Scopolija. V letu 2022 pa je minilo 250 let od njegove druge izdaje obsežnega dela *Flora Carniolica*. V Botaničnem vrtu Univerze v Ljubljani mu bomo v letu 2023 posvetili več pozornosti. V tem uvodnem in kratkem povzetku je samo kratek utrip iz njegovega življenja.

Rodil se je 3. junija 1723 (po nekaterih podatkih pa 13. junija) v mestecu Cavalese na južnem Tirolskem. Medicino je študiral v Innsbrucku, leta 1743 je postal doktor medicine. Kot zdravnik je deloval v Cavaleseju, v Trentu in Benetkah. Na Dunaju je leta 1753 opravil izpit iz vsega zdravilstva. V teoretičnem delu je za temo temo obdelal Linnejev botanični sistem proti zastarelemu Tournefortovem sistemu. To razpravo je potem še v istem letu objavil kot *Methodus plantarum enumerandis stirpibus ab eo hucusque repertis destinata* (Soban 2004). Leta 1754 je kot rudniški zdravnik prišel v Idrijo (Petkovšek 1977).

Kljub vsem težavam, ki jih navaja v mnogih delih, pa je bilo njegovo delovanje v Idriji najbolj uspešno in ustvarjalno obdobje v njegovem znanstvenem in publicističnem življenju. Pod vplivom sodobnika švedskega botanika Carla Linnéja se je lotil težavnega raziskovalnega dela s tolikšnim znanjem, vztrajnostjo in uspehom, da lahko imenujemo leto njegovega prihoda v Idrijo kot prelomnico v znanstvenem delovanju na slovenskih tleh. V letih od 1755 do 1766 je prepotoval velik del Kranjske. Preučeval je bolezni in socialno stanje idrijskih rudarjev in opisal tudi oblike njihovih poklicnih bolezni. Spoznal je pomen higiene pri delu in njene preventive, se zavzemal za socialne ukrepe in tako postal začetnik socialne medicine v Avstriji (Petkovšek 1977, Praprotnik 2018a, b). Prav v Idriji je ustvaril največja dela: *Flora Carniolica* (1760), *Entomologia carniolica* (1763) in drugo izdajo dela *Flora Carniolica* (1772).

Leta 1769 je odšel v Bansko Štiavnico na Slovaško, leta 1777 pa je v Pavii postal profesor kemije in botanike. Vodil je tudi botanični vrt v Pavii. Umrl je v Pavii 8. maja 1788.

Scopolijevo botanično delovanje na Kranjskem (1754-1769)

Scopoli je leta 1754 prišel v Idrijo kot rudniški zdravnik. Prvi vtis ni bil najbolj vzpodbuden, saj je v uvodu dela *Flora Carniolica* (Scopoli 1760) zapisal:

»Ko sem jo od daleč zagledal, so mi kot v slutnji stopile pred oči vse težave in neprijetnosti, ki sem jih v tej ječi moral prenašati skoraj šestnajst let.«

V predgovoru knjige *Entomologia carniolica* (Scopoli 1763) je povedal, zakaj se je sploh začel ukvarjati z naravoslovjem:

»V življenje narave se nisem poglabljal zaradi poklica, temveč me je srce vleklo, da sem si olajšal stiske prežalostnega življenja.«

V avtobiografiji *Vitae meae vices* (Scopoli 1788) pa je potožil:

»Na teh potovanjih, ki sem jih opravljal na lastne stroške, je naravnost neverjetno, kakšne napore sem moral prenašati in kakšne težave premagovati. Sam, spremljan le po enem človeku, sem blodil po planinah, spal v mrzlih nočeh pod milim nebom in živel dneve in dneve samo ob mleku ali samo ob kruhu, prišel nad Trstom celo roparjem v roke in nekoč s Storžiča grede prebil tri polne ure v smrtni nevarnosti ...«

V idrijskem obdobju je prepotoval velik del tedanje avstrijske dežele Kranjske in nekaj sosednjih dežel. V svojih delih našteva naslednje kraje in gorovja: Idrijo in okolico, Ljubljansko barje, Nanos, Storžič, pogorje do Kokre, Dolenjsko med Ribnico in Ljubljano, Grintovec, Kočno, Greben, Planino, Cerkniško jezero, Senožeče, Vremščico, Kras nad Trstom, Gorenjsko in Bohinjske Alpe (južna pobočja Triglava), okolico Gorice in Devina, okolico Vrhnike in Ljubljane, okolico Polhovega Gradca, Škofje Loke in Kranja, Otalež, Porezen, Tolminske Alpe, Karavanke, Ljubelj, Jezersko, Bled (grad), Bohinj, Ribnico, okolico Novega mesta, Čepovan, Vojsko, Hrušico, Col, Ajdovščino, Vipavo, okolico Trsta, Lipico ... Kot prvi naravoslovec je bil leta 1758 na Storžiču in leta 1759 na Grintovcu v Kamniško-Savinjskih Alpah (Petkovšek 1977, Praprotnik 2018a, b).

Na svojih izletih je nabiral rastline tudi za herbarij, ki pa se na žalost ni ohranil. V nekaterih herbarijskih zbirkah hranijo le posamezne pole. Voss (1884, 2008) je za botanične zbirke zapisal:

»O tem, kam so prišle … njegove botanične zbirke … žal nisem uspel nič dognati.«

Flora Carniolica (1760)

Leta 1760 je izšla njegova *Kranjska flora* (*Flora Carniolica*). V tem delu še ni upošteval Linnéjevega sistema in pravil dvojnega poimenovanja, ne zajema pa tudi nekaterih območij Kranjske. Opisal je 756 vrst semenk in 256 vrst nesemenk. Pri 127 vrstah je zapisal tudi slovenska ljudska rastlinska imena. V Uvodu je poudaril, da je skrbno beležil nahajališča rastlin in dodal tudi zdravilne moči mnogih rastlin, ki jih je sam opazoval in z vztrajnimi poskusi ugotovil njihovo zdravilnost. Zapisal je:

»Na ta način botanika ni samo prijetna, ampak tudi koristna.«

Tedaj je bila botanika pomemben del medicinskih študij, ker so bile zdravilne rastline glavni vir lekarniških pripravkov.

Flora Carniolica (1772)

Druga izdaja dela *Flora Carniolica* je izšla leta 1772 v dveh delih. V njej je Scopoli naštel 1252 semenk in 384 vrst nesemenk. Upošteval je že dvojno poimenovanje rastlin, ki ga je leta 1853 uvedel Carl Linné (1707-1778), in navedel natančne podatke o nahajališčih. Manjkajo pa slovenska imena in podatki o zdravilnosti.

Kljub temu, da se *Flora Carniolica* druga izdaja običjano vedno citira z letnico 1772, obstojijo tudi izvodi z letnico 1771. V Botaničnem vrtu univerze v Ljubljani hranimimo tri izvode in vsi imajo letnico 1772. Zato se nekateri avtorji sprašujejo ali je *Flora Carniolica* druga izdaja že 1771 ali šele 1772 (Wraber 1986). Že Paulin je našel izvod prvega zvezka z letnico 1771, Ernest Mayer je pregledal okrog 45 izvodov *Kranjske flore*, vendar v nobenem ni zasledil letnice 1771. Wraber navaja več prvih zvezkov z

letnico 1771 in samo en izvod drugega zvezka z letnico 1771. Italijanski botanik Adriano Soldano (1988) pa piše o pismu, ki ga je nemški botanik Christian Ludwig Willich (1718-1773) pisal Scopoliju 2. januarja 1772 in se mu zahvalil za poslano *Floro*. Soldano je menil, da je to dovolj velik razlog, da je dosledno pri citiranju *Flore* zapisoval letnico 1771. Kljub temu da obstojata obe letnici, pa je večji del izvodov, kot je razvidno iz povedanega, naveden z letnico 1772.

Čeprav se zdi da Botanični vrt Univerze v Ljubljani ni neposredno povezan s Scopolijem je ta povezava še kako pomembna. Franc Hladnik ustanovitelj Vrta domovinske flore leta 1810 (Lazar 1960, Strgar 1973, Bavcon 2000, 2010) je bil po rodu Idrijčan. Za svojega botaničnega mentorja je imel jezuita Franca Ksaverja Wulfena, ki je zelo intenzivno sodeloval s Scopolijem, mu pošiljal rastline (Praprotnik 2016). Tudi prenekatera rastlinska vrsta bi lahko bila opisana z njegovim podpisom. Še posebej to velja za rdečo reliko (*Chamaecytisus purpureus* Scop.), kjer je originalni opis Wulfenov, a je to vrsto za svojo prevzel Scopoli (Wraber 1990). Wulfenovo sodelovanje s Scoplijem je bilo zelo plodno in prav zato je Hladnik lahko dobil praktično Scopolijevo znanje posredno preko Wulfena (Bavcon s sod. 2021). To védenje je bilo za kasnejše Hladnikovo delo v vrtu Domovinske flore (današnjem Botaničnem vrtu Univerze v Ljubljani) in pri njegovem predvanju botanike, zelo pomembno. Prav podlaga, ki so jo ustvarjale povezave med Scopolijem in Linnejem (Soban 1995, 2004) ter stalni stiki z Wulfenom (Praprotnik 2015), so izredno močno vplivali na nadaljnji razvoj botanike v tedanji deželi Kranjski. Enako pomembno pa so vplivale tudi na razvoj samega Botaničnega vrta (Praprotnik 2015, Bavcon 2010, Bavcon s sod. 2021). Scopoli je v letih 1756 in 1758 veliko raziskoval tudi v Ljubljani z okolico, kar je kasneje

lahko uporabil Hladnik, ki je za svoj vrt v letu 1810 najprej nabral rastline iz okolice Ljubljane.

Slika / Figure 1 Janez Anton Scopoli (https://sl.wikipedia.org/wiki/Giovanni_Antonio_Scopoli#/media/Slika:Portret_Giovannija_Antonija_Scopoli.jpg)

300TH ANNIVERSARY OF THE BIRTH OF JOHANNES ANTONIUS SCOPOLI AND 250TH ANNIVERSARY OF THE SECOND EDITION OF *FLORA CARNIOLICA*

Nada Praprotnik, Blanka Ravnjak, Jože Bavcon

This year is the 300th anniversary of the birth of Johannes Antonius Scopoli – Giovanni Antonio Scopoli – Janez Anton Scopoli. In 2022, the year of the seed collection, 250 years have passed since the second edition of his extensive work *Flora Carniolica*. This year, we will dedicate special attention to Johannes Antonius Scopoli in the Botanic Gardens. This introductory and short summary will present a brief overview of his life.

Johannes Antonius Scopoli was born on 3 June 1723 (according to some sources, on 13 June) in the town of Cavalese in South Tyrol. He studied medicine in Innsbruck and became a doctor of medicine in 1743. He worked as a physician in Cavalese, Trento and Venice. In 1753, we passed the state physician's examination in Vienna. In the theoretical section, he examined the Linnaean botanical system against the outdated

Tournefort's system of classification. He published the discussion that same year under the title *Methodus plantarum enumerandis stirpibus ab eo husque repertis destinata* (Soban 2004). In 1754, he came to Idrija as a physician of the mercury mines (Petkovšek 1977).

Despite all the problems he mentions in many of his publications, his work in Idrija was the most successful and creative period of his scientific and publishing life. Under the influence of the contemporary Swedish botanist Carl Linnaeus, he undertook difficult research work with such knowledge, perseverance and success that the year of his arrival in Idrija can be called a turning point in scientific activity on Slovenian soil. From 1755 to 1766, he travelled across much of Carniola. He studied the diseases and social condition of miners in Idrija and also described the forms of their occupational diseases. He realised the importance of hygiene at work and prevention, advocated for social measures, and thus became the pioneer of social medicine in Austria (Petkovšek 1977, Praprotnik 2018 a, b). It was here that he created his greatest works: *Flora Carniolica* (1760), *Entomologia Carniolica* (1763) and *Flora Carniolica* (1772).

In 1769, he moved to Banská Štiavnica in Slovakia, and in 1777 became a professor of chemistry and botany in Pavia. He also managed the Botanic Garden. He died in Pavia on 8 May 1788.

Scopoli's botanical work in Carniola (1754–1769)

Scopoli moved to Idrija in 1754 as a physician of the mercury mines. His first impression was not the most

encouraging, as he wrote in the introduction to *Flora Carniolica* (Scopoli 1760):

"When I saw it from afar, all the problems and troubles that I would have to endure in this prison for almost sixteen years appeared before my eyes, as if in a premonition."

In the preface to *Entomologia Carniolica* (Scopoli 1763), he explained why he began pursuing natural science in the first place:

"I didn't delve into the life of nature for the sake of my profession, but my heart drew me towards this field to ease the hardships of a life that was too sad."

In his autobiography *Vitae meae vices* (Scopoli 1788), he complained:

"On these travels, which I made at my own expense, it is absolutely incredible what efforts I had to endure and what difficulties I had to overcome. Alone, accompanied by only one person, I wandered the mountains, slept in the cold nights under the open sky and lived for days and days only on milk or only on bread, was even caught by robbers above Trieste, and was once in mortal danger three full hours coming down from Storžič..."

During his time in Idrija, he travelled through a large part of the then Austrian land of Carniola and some neighbouring lands. In his works, he lists the following places and mountains: Idrija and its surroundings, the Ljubljana Marshes, Nanos, Storžič, the foothills to Kokra, Dolenjska between Ribnica and Ljubljana, Grintovec, Kočna, Greben, Planina, Lake Cerknica, Senožeče, Vremščica, Karst above Trieste, Gorenjska and Bohinjska Alps (southern slopes of Triglav), surrounding are of Gorica and Devin, surroundings of Vrhnika and Ljubljana, surroundings of Polhov Gradec, Škofja Loka and Kranj, Otalež, Porezen, Tolmin Alps, Karavanks, Ljubelj, Jezersko, Bled (castle), Bohinj, Ribnica, surroundings of Novo mesto, Čepovan,

Vojska, Hrušica, Col, Ajdovščina, Vipava, surroundings of Trieste, Lipica... As the first naturalist, he climbed Storžič in 1758 and Grintovec in the Kamnik–Savinja Alps in 1759 (Petkovšek 1977, Praprotnik 2018 a, b).

On his travels, he also collected plants for his herbarium, which, unfortunately, had not been preserved to this day. Some herbarium collections keep only individual sheets. Voss (1884, 2008) wrote about Scopoli's botanical collections:

"Unfortunately, I have not been able to find out anything about where his botanical collections ended up."

Flora Carniolica (1760)

In 1760, Scopoli published *Flora of Carniola* (*Flora Carniolica*). In this publication, he did not yet use the Linnaean system and the rules of binomial nomenclature, and it also does not cover some areas of Carniola. He described 756 spermatophyte species and 256 non-spermatophyte species. He also recorded Slovenian folk plant names for 127 species. In his introduction, he emphasised that he carefully recorded the locations of plants and also added the healing powers of many plants that he himself observed and determined their medicinal properties through persistent experiments. He wrote:

"In this way, botany is not only pleasant, but also useful."

At that time, botany was an important part of medical studies because medicinal plants were the main source of pharmaceutical preparations.

Slika / Figure 2 *Flora Carniolica*, druga izdaja 1772. / *Flora Carniolica*, second edition. (Foto / Photo: J. Bavcon)

Flora Carniolica (1772)

The second edition of *Flora Carniolica* in two parts was published in 1772. In this second edition, Scopoli described 1252 spermatophyte species and 384 non-spermatophyte species. He already used the binomial nomenclature of plants, which was introduced in 1753 by Carl Linnaeus (1707–1778), and provided precise data on their locations. However, Slovenian names and data on medicinal properties are missing.

Even though the second edition of *Flora Carniolica* is usually always cited with the year 1772, there are also copies that were published in 1771. The University Botanic Gardens

Ljubljana keep three copies, and they are all dated from 1772. Therefore, some authors question whether the second edition of *Flora Carniolica* was already published in 1771 or only in 1772 (Wraber 1986). Paulin had already found a copy of the first volume from 1771, while Ernest Mayer examined approximately 45 copies of *Flora Carniolica*, but did not find any from 1771. Wraber lists several first volumes dated 1771 and only one copy of the second volume dated 1771. The Italian botanist Adriano Soldano (1988) writes about the letter that the German botanist Christian Ludwig Willich (1718–1773) wrote to Scopoli on 2 January 1772, thanking him for the sent *Flora Carniolica*. Soldano considered this to be a big enough reason to consistently write the year 1771 when citing *Flora Carniolica*. Despite the fact that both years are mentioned, the majority of the copies, as can be seen from above, is listed under the year 1772.

Although it seems that the University Botanic Gardens Ljubljana are not directly connected to Scopoli, this connection is nonetheless important. Franc Hladnik, the founder of the *Native Flora Garden* in 1810 (Lazar 1960, Strgar 1973, Bavcon 2000, 2010), was born in Idrija. His botanical mentor was the Jesuit Franz Xaver Wulfen, who collaborated intensively with Scopoli, also sending him plants (Praprotnik 2016), and many plant species could have been described or at least co-signed with his signature. This is particularly true of the purple broom (*Chamaecytisus purpureus* Scop.), which was originally described by Wulfen, although it was adopted by Scopoli as his own (Wraber 1990). Wulfen's collaboration with Scopoli was very fruitful, and that is why Hladnik was an indirect recipient of Scopoli's knowledge through Wulfen (Bavcon et al. 2021). This knowledge was very important for Hladnik's later work: he was the first assistant professor of botany at the high school level and

the founder of the Native Flora Garden, today the University Botanic Gardens Ljubljana. It was the basis created by Scopoli, who also corresponded with Linnaeus (Soban 1995, 2004), and, of course, constant contacts with Wulfen (Praprotnik 2015) that had an extremely strong influence on later development of botany in the Carniola at that time, as well as on the development of the botanic gardens themselves (Praprotnik 2015, Bavcon 2010, Bavcon et al. 2021). In 1756 and 1758, Scopoli also conducted a lot of research in Ljubljana and its surroundings, which was later used by Hladnik, who first collected plants from the surroundings of Ljubljana for his garden in 1810.

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Jože Bavcon, Blanka Ravnjak

ABSTRAKT

Različni človeški posegi v okolje spreminjajo življenjska okolja tako živali kot rastlin. Nekatera so se spremenila do te mere, da so se populacije rastlinskih in živalskih vrst zelo zmanjšale ali celo izginile. V kolikor še pravi čas načrtno naberemo semena rastlinskih vrst in jih shranimo v semenskih bankah, lahko le-te predstavljajo pomemben del pri reintrodukciji rastlinskih vrst nazaj na naravna rastišča ali vsaj pri povečanju njihovih populacij. Vsekakor je ob tem pomembno preučiti dejavnike, ki so privedli do zmanjšanja ali izginotja rastlinskih vrst in dejavnike nato seveda odstraniti. Primer ojačitve populacij in reintrodukcije nekaterih Natura 2000 rastlinskih vrst je tudi projekt LIFE Seedforce. V njem bo 15 partnerskih institucij z nabiranjem semen, njihovim shranjevanjem v semenskih bankah in vzgojo rastlin iz semen ojačalo ali ponovno naselilo populacije 29 Natura 2000 rastlinskih vrst v 26 SAC Natura 2000 območija.

Ključne besede: LIFE Seedforce, Natura 2000 vrste, ponovna naselitev, ohranjanje rastlinskih vrst, semenske banke

UVOD

V letu 2020 smo na pobudo kolegov botanikov iz Museo delle scienze (MUSE) iz Trenta pristopili k LIFE prijavi projekta katerega cilj je ohraniti ali ponovno naseliti (reintroducirati) nekatere izmed ogroženih in zavarovanih Natura 2000 rastlinskih vrst v izbranih Natura 2000 območjih s pomočjo semenskih bank. Projekt je bil uspešno sprejet in tako smo jeseni 1.10. 2021 že začeli s prvimi aktivnostmi projekta. Projekt z naslovom LIFE Seedforce bo trajal do 12.12.2026 in vključuje 15 partnerjev iz Italije, Francije, Malte in Slovenije. Vodilni partner je kot že rečeno MUSE iz Trenta. Ostali sodelujoči partnerji poleg Botaničnega vrta Univerze v Ljubljani pa so še Universitá degli Studi di Roma la Sapienza, Conservatoire Botanique National Méditrranéen de Porquerolles, Parco Monte Baro, Legambiente Nazionale, Ente Parco Nazionale della Maiella, Univerzita 'ta' Malta, Universitá degli Studi di Cagliari, Universitá degli Studi di Catania, Universitá degli Studi di Genova, Universitá degli Studi di Palermo, Universitá degli Studi di Padova, Universitá degli Studi di Tuscia, Universitá degli Studi di Udine. V okviru projekta smo za ojačanje populacij oz. za ponovno naselitev izbrali 28 Natura 2000 rastlinskih vrst: *Astragalus verrucosus, Bassia saxicola, Campanula sabatia, Cytisus aeolicus, Galium litorale, Limonium strictissimum, Linum muelleri, Ribes sardoum, Silene hicesiae, Adenophora liliifolia, Botrychium simplex, Centranthus amazonum, Crepis pusilla, Dracocephalum austriacum, Elatine gussonei, Eleocharis carniolica, Eryngium alpinum, Gentiana ligustica, Gladiolus palustris, Himantoglossum adriaticum, Kosteletzkya pentacarpos, Leucojum nicaeense, Linaria flava, Liparis loeselii, Marsilea quadrifolia, Primula palinuri, Saxifraga tombeanensis, Woodwardia radicans* pri čemer so bile vrste izbrane tako, da se areal posamezne izbrane vrste razširja vsaj preko dveh

partnerskih držav. Za območje Slovenije smo izbrali vrste: navadno obročnico (*Adenophora liliifolia*), kranjsko sito (*Eleocharis carniolica*), alpsko možino (*Eryngium alpinum*), močvirski meček (*Gladiolus palustris*) in štiriperesno marzilko (*Marsilea quadrifolia*).

V začetnih fazah projekta smo za vse izbrane vrste ocenili kakšno je dejansko stanje njihovih populacij v naravi na izbranih 26 SAC Natura 2000 območjih (skupno območja vseh partnerjev projekta). Populacije rastlinskih vrst smo številčno ocenili. Na vsaki izmed lokacij smo nato odvzeli tudi vzorce listov osebkov posamezne vrste za genetske analize. V okviru projekta namreč želimo izvedeti tudi ali so si med seboj ločene populacije posamezne rastlinske vrste genetsko podobne ali različne. Od tega je namreč odvisno katera populacija lahko nato predstavlja donorsko populacijo za ponovno naselitev na lokacije, kjer je določena rastlinska vrsta že izginila. Poleg ocene stanja populacij bomo izvedli analizo dosedanjega poznavanja razširjenosti posamezne vrste z vidika zgodovinskih podatkov o vrsti, njenem pojavljanju in njeni ogroženosti zaradi spreminjanja okolja. Za vsako izmed vrst smo že ob ocenitvi njihovih populacij opisali tudi značilnosti okolja, v katerem vrsta raste in opredelili dejavnike ogrožanja. Na tistih Natura 2000 območjih kjer je vrsta izginila, pa smo zabeležili morebitne dejavnike, ki so razlog izginotja. Hkrati smo izbrali nahajališča za reintrodukcijo in predvideli ukrepe, ki jih bomo morali na območju izvesti za uspešno reintrodukcijo. V letu 2022 smo pričeli tudi z zbiranjem semen izbranih rastlinskih vrst. Nabrana semena bodo osnova za vzgojo osebkov izbranih rastlinskih vrst s katerimi bomo ojačali majhne populacije na Natura 2000 območjih, oziroma bomo izvedli reintrodukcijo na mesta kjer je posamezna rastlinska vrsta že izginila. Skupno je pri vseh partnerjih predvidena vzgoja cca

50000 osebkov v kulturi in od tega translokacija cca 21000 osebkov nazaj v naravo. Ostali osebki bodo ostali v kulturi kot rezerva in za potrebe promocije projekta. Velik del projektnih aktivnosti in hkrati tudi njihov najzahtevnejši del bo predstavljal prenos in zasajanje osebkov izbranih vrst na naravna rastišča v izbrana Natura 2000 območja. Zaradi težke dostopnosti do posameznih lokacij bo delo logistično zahtevno. Prav tako bo sam uspeh saditve ter uspešne rasti osebkov v veliki meri odvisen od okoljskih dejavnikov in nadaljnje skrbi za posamezno rastišče in širše območje. Zaradi tega je pomembno, da bomo že ob sajenju osebkov določili kakšni bodo ukrepi za nadaljnje predvideno upravljanje z območjem zasaditve. Glede na to, da gre za ojačanje populacij oz. reintrodukcijo izbranih vrst na naravna rastišča, ki so tako ali drugače dostopna širši javnosti ali širša javnost oz. lokalna skupnost upravlja z območji na katerih bodo reintroducirane rastlinske vrste, bomo del projektnih akcij usmerili v seznanjanje širše javnosti s projektom. Izvedli bomo javna predavanja kjer bomo predstavljali aktivnosti projekta in napredek pri posameznih aktivnostih. Lastnike zemljišč na katerih se nahajajo izbrane Natura 2000 vrste bomo sproti obveščali o posegih v zvezi z reintrodukcijo osebkov in povečanjem populacij. Prav tako pa bomo skupaj z njimi poiskali dolgoročne ukrepe za upravljanje z njihovimi zemljišči in lokacijami reintroduciranih rastlinskih vrst. Izvajali naj bi jih namreč tudi po zaključku projekta in s tem zagotovili obstoj populacij izbranih rastlinski vrst.

PREDSTAVITEV POSAMEZNIH VRST IZ SLOVENIJE VKLJUČENIH V PROJEKT LIFE SEEDFORCE

Eleocharis carniolica W. D. J. Koch - kranjska sita

Opis vrste: Je od 5-30 cm visoka trajnica. Raste v šopih. Ima kratko koreniko in je brez pritlik. Njena stebla so zelo tanka (0,5 mm debela) in drobno žlebasta. Klaski so mnogocvetni, dolgi od 3 do 13 mm, vretenasti, koničasti ali jajčasti. Pleve cvetov so koničaste, rdeče rjave in imajo na sredini zeleno progo. Plodovi so dvostransko izbočeni, narobe jajčaste do lečaste tope oblike in dolgi od 1 do 1,5 mm. Površina je gladka in bleščeča, olivno do rumeno rjave barve (Vreš 2004 a).

Slika / Figure 3 *Eleocharis carniolica* (Foto / Photo: B. Ravnjak)

Razširjenost: Je izrazito kolinska vrsta in redkeje montanska. Kljub imenu kranjska sita, saj je bila na Kranjskem prvič odkrita, je njen areal širši. Pojavlja se na severu Švice, Avstrije, Madžarske, do severa osrednje Rusije, na južnem delu pa do severne Italije, preko Slovenije do lokalno sredine Balkanskega polotoka in centralne Romunije (Schultze-Motel 1967).

Kranjsko sito je našel Jurij Dolliner pri Postojni, prvi pa jo je opisal Koch leta 1844 in jo poimenoval po deželi Kranjski

Heleocharis carniolica (Praprotnik 2015). Kranjska sita ima torej klasično nahajališče pri Postojni. Že Cilenšek (1892) nato v knjigi naše škodljive rastline piše o sitah: močvirski in jajčasti. Pod vrsto jajčaste site je najverjetneje uvrstil tudi kranjsko sito. Zanjo pravi, da ima drobne klaske, ki so okrogli ali jajčasti. Glede na zapis o času njenega cvetenja (julij, avgust), se ujema s cvetenjem kranjske site. Tudi Alfonz Paulin je kranjsko sito za svojo posušeno zbirko rastlin Kranjske (*Flora exicata carniolica*) nabral v okolici Postojne. S številko 1463 se v zbirki nahaja pod imenom *Heleocharis carniolica* Koch. Navaja da raste: »Na močvirnih mestih Mali Otok pri Postojni, 530m -VII. *Locus clasicus*«. Dolšak (1936) je ob Paulinovih primerkih na poli zapisal, da se na teh primerkih opaža zelo zanimiva mutacija. Pojavljajo se namreč še sekundarni klaski, katerih spodnji cvetovi so spremenjeni v brstiče. Paulin je pod to številko nabral še primerke iz Šenturške gore v Kamniških planinah. Primerki so rastli na višini 600 m, na mokrih ilovnatih mestih blizu vasi Sidrož. Na tretji poli pa se nahajajo primerki iz Kosez v Ljubljani, kjer so rastline rasle zopet na vlažnih ilovnatih mestih.
Poznavanje razširjenosti kranjske site pri nas se je povečalo predvsem v zadnjih dveh desetletjih, po njeni vključitvi med kvalifikacijske vrste Natura 2000 (Vreš 2004 a) in je bilo raztreseno po Sloveniji najdenih več novih nahajališč (Kocjan s sod. 2013, Kocjan s sod. 2019)

Kranjska sita je ena izmed na videz manj opaznih rastlin, ker se nahaja v občasno poplavljenih habitatih, ki pa lahko v sušnejšem obdobju povsem presahnejo in se osušijo. S tem običajno tam izgine tudi sita. Zato je njeno pojavljanje zelo omejeno na vlažno obdobje leta, torej zgodnjo pomlad in do začetka poletja. V vmesnem času do jeseni pa je njeno pojavljanje zopet odvisno od obilnejših padavin. Najbolje uspeva na zamočvirjenih tleh, kjer

voda zastaja in se tla ne izsušijo povsem vsaj da tudi tekom poletja. Tam je sita stalno prisotna. Na mestih kjer se podlaga v poletju povsem presuši, pa sita v tistem času izgine. V kolikor je pred izsušitvijo tvorila dovolj semen, le-ta dozorijo in v naslednji ugodni sezoni ponovno vzkalijo. Cvetenje kranjske site se je sedaj zaradi zelo toplih pomladi premaknilo, saj na mnogih rastiščih kjer danes raste, je julija že preveč suho, včasih že celo v drugi polovici junija. Gre za sekundarna rastišča, ki so nastala kot posledica človeškega delovanja. Tako kranjska sita pogosto raste v globokih traktorskih kolesnicah, ki so bistveno širše in globoke kot pa so bile nekoč kolesnice vozov. Zaradi globine se zastajanje vode po padavinah podaljša in s tem pomeni primerno življenjsko okolje za poseljevanje kranjske site. Vendar se tudi ta sekundarna rastišča preko sušnega poletja popolnoma izsušijo. V zadnjih letih je takšnih sušnih poletij vedno več. Kranjska sita je očitno še vedno dovolj dobro prilagojena na spremenljive razmere, saj se v kolesnicah bolj ali manj stalno pojavlja. Zanjo je tu in tam značilna tudi živorodnost.

Gladiolus palustris (L.) Bess. - močvirski meček

Opis vrste: Je do 50 cm visoka trajnica s pokončnim, tankim in okroglim steblom. Na njem je enostransko socvetje z do 6 cvetovi. Vsak cvet obdajata dva enako dolga suličasta ovršna lista. Sta zelene barve z vijoličastim nadihom in sta komaj tako dolga kot polovica perigona. Enojno cvetno odevalo je rožnato rdeče, 3 cm dolgo in z zakrivljeno cevjo. Spodnji trije listi perigona imajo na notranji strani podolgovato belkasto liso. Prašnice so krajše kot prašnične niti. Plodna glavica je narobe jajčaste oblike z zaokroženim vrhom. Semena so široko krilata. Listi so suličasti in kratko priostreni. V zemlji je jajčast gomolj s

premerom do 2 cm in izrazito mrežastim ovojem (Pospichal 1897, Seliškar 2004).

Razširjenost: Vrsta je naravno prisotna v osrednji in jugovzhodni Evropi do Apeninov, ter na Balkanu. V Sloveniji je razširjena v Alpah in bližnji okolici, prisotna naj bi bila še v Ljubljanski kotlini, na dinarskem območju (npr. Cerkniško jezero), v okolici Cerknega (Seliškar 2004).

Slika / Figure 4 *Gladiolus palustris* (Foto / Photo: J. Bavcon)

O rodu *Gladiolus* na slovenskem ozemlju je prvi pisal Johanes Antonius Scopoli (1772). V svojem delu *Flora Carniolica* omenja vrsto *Gladiolus communis* znotraj katere sta sicer združeni *G. palustris* in *G. illyricus*. Pri njeni navedbi je zapisano, da vrsta raste na travnikih, pri čemer ni navedb natančnih lokacij. O vrsti *G. communis* so pisali tudi Host (1827-1831), Wulfen (1858) in Fleischmann (1844). Eduard Pospichal pa v svojem

delu *Flora des Oesterreichischen Küstenlandes* (1897) že govori o dveh vrstah *G. palustris* in *G. illyricus* ob katerih je dodal še opis obeh vrst in njunih razlikovalnih znakov. Za *G. palustris* je kot rastišča navedel hribovske travnike Kokoške, Slavnika, Lipnika, Planik, Čuak, Merče, Ravnice pri Trnovem, Berzovice, Odolina, Obrova, Sušice in Suhorice.

Starejši izmed avtorjev pa se je z vrsto *G. palustris* prvič spoznal pri svojem diplomskem delu. Vrsta je bila namreč takrat prisotna tudi na Cerkljanskem (Bavcon 1986, 2013, Bavcon s sod 2018). Zanimivo je, da so vrsto kar dobro poznali že domačini in jo imenovali divje gladijole (Bavcon s sod. 2019). Tudi nadaljnje raziskave rastlinstva Cerkljanskega (Bavcon s sod. 2000) so pripeljale do še enega, tedaj dokaj bogatega nahajališča na drugem koncu Cerkljanske, kjer se že stikata subalpski in dinarski svet. Kasnejše raziskave pojavljanja močvirskega mečka v Sloveniji pa so večinoma pokazale na prisotnost *G. illyricus* (Bavcon 2013, 2014, Bavcon s sod. 2019). Obe vrsti sta si med seboj zelo podobni in ju je možno razlikovati le po ovoju gomolja in po navedbah Pospichala (1897-1898) tudi po obliki semenske kapsule, ki je pri *G. illyricus* na vrhu rahlo vtisnjena, pri *G. palustris* pa lepo okrogla. Območja razširjenosti *G. palustris* je za Natura 2000 obdelal Seliškar (2004). Za zavarovanje je predlagal območja v Kamniško Savinjskih Alpah. Po tem obdobju je sledilo daljše zatišje pri raziskovanju močvirskega mečka v Sloveniji. Šele novejši članki prejšnjih raziskav kažejo na nova pojavljanja te vrste na Banjščicah, Koradi (Dakskobler s sod. 2021 a, b).

Eryngium alpinum L. – kraljica gora, alpska možina

Opis vrste: Vrsta je trajnica in zraste do 80 cm. Spada med kobulnice, njeno socvetje je oblikovano v podolgovat glavičast kobul. Sestavljajo ga drobni cvetovi s petimi resastimi čašnimi listi in belimi venčnimi. Ogrinjalni listi so pernato nacepljeni, ščetinasti, bodeče nazobčani in presegajo cvetove. Socvetje je modrikasto obarvano. Pritlični listi so jajčasti do srčasti, neenakomerno nazobčani ter dolgopecljati. Stebelni listi so sedeči in dlanasto peterno nacepljeni (Dakskobler 2004).

Razširjenost: Vrsta je vezana na Alpska območja in je tako poleg Slovenije naravno prisotna v Franciji, Italiji, Švici, preko Dinaridov pa njen areal sega še do Bosne in Črne gore.

Eryngium alpinum je vrsta, ki je značilna za alpski svet. V Sloveniji raste v Julijskih Alpah in na Poreznu v predalpskem območju. Podatki obstajajo tudi za Karavanke, kjer je bila nekoč pogosta, ter Storžič in Krn, vendar pa ta nahajališča v novejšem času niso bila potrjena. Vrsta je bila omenjena že v delu *Flora Carniolica*, kjer je Scopoli zapisal (1772), da se pojavlja v Tolminskih Alpah. Host (1827-1831) je za njena rastišča navedel Hrvaško, Kranjsko in Furlanijo Julijsko krajino, Wulfen v svoji *Flora Norica Phanerogama* (1858) pa dolino Julijskih Alp. Fleischmann že omenja natančnejšo lokacijo – Črno prst (1844).

Največja sedanja rastišča so na Črni prsti (Dakskobler 2004) v njenem severnem prigorju, Gora Lisec (1633 m n. m.) in še niže nad planino Osredki na nadmorski višini 1500 m. Na vzhodnih pobočjih gore Lisec (1600- 1650) so obsežnejša nahajališča na površini okoli 2h. Drugo večje nahajališče je na Poreznu (Bavcon 2013). Populacije alpske možine so na vseh omenjenih nahajališčih v nevarnosti zaradi zraščanja terena. Nekoč so bile na teh mestih senožeti, ki se jih je redno kosilo ali paslo, dandanes

pa se je njihova raba opustila in zato se območja večinoma zaraščajo.

Slika / Figure 5 Rastišče alpske možine na južnih pobočjih Porezna. / Habitat of Eryngium alpinum on the south slope of Porezen. (Foto / Photo: J. Bavcon)

Nahajališča na Poreznu so površinsko bistveno večja kot tista na Črni prsti. Nekoč so bile doline Porezna povsem modre v času cvetenja alpske možine. Do sedemdesetih let prejšnjega stoletja in še malo kasneje so tu in tam te površine kosili. Leta 1974 je to območje botanično preučil Seljak v svoji diplomski nalogi (Seljak 1974). Takrat je bila populacija alpske možine kljub opuščanju košnje še zelo velika. Tudi kasneje je populacija razmeroma dolgo vztrajala, potem pa se je površina začela zelo zaraščati z visokimi steblikami, zeleno jelšo (*Alnus alnobetula*), posameznimi smrekami, tu in tam z ostrolistnim javorjem (*Acer platanoides*) in na bolj soncu izpostavljenih delih z žarkasto

košeničico (*Genista radiata*). V devetdesetih letih prejšnjega stoletja so na pobočjih Malega Porezna in Porezna ponovno začeli pasti in tedaj je bilo pri mnogih planincih veliko odpora na pašo, ker naj bi kraljica gora zaradi paše od tam izginila. Res je, da so ovce v prvi fazi kraljico gora povsem obžrle in v tistem letu rastline niso cvetele, le tu in tam so imele sekundarne poganjke cvetov. Po terenskem ogledu smo takrat priporočili, da je paša za kraljico gora v teh dolinah nujna, a ne vsako leto na celotnem delu. Ta ukrep se je tedaj izkazal kot zelo koristen, saj se je populacija možine v naslednjih letih močno povečala (Bavcon 2013). Ponekod je populacija postala tako številčna kot v sedemdesetih letih. Žal pa so v tem delu pašo zdaj popolnoma opustili in populacija se zaradi tega ponovno krči. Območje se zopet zarašča predvsem z visokimi steblikami in malinovjem (*Rubus idaeus*), kar vpliva na manjše število osebkov alpske možine.

Slika / Figure 6 Zaraščanje rastišče alpske možine na južnih pobočjih Porezna. / Overgrowing of *Eryngium alpinum* habitat on the south slope of Porezen. (Foto / Photo: J. Bavcon)

Adenophora liliifolia (L.) Bess. – navadna obročnica

Opis vrste: Navadna obročnica spada med zvončičevke in je po lastnostih zelo podobna rodu zvončic. Od rodu zvončic se razlikuje po tem, da je vrat pestiča mnogo daljši od venca zaradi česar štrli daleč ven iz cveta. Je zelnata trajnica visoka od 30 do 100 cm. Listi so enostavni, eliptično suličasti in rahlo nazobčani. Zgornji stebelni listi so sedeči, spodnji pa kratkopecljati. Listi so spiralasto nameščeni (Babij 2004). Cvetovi se nahajajo v rahlem ali razvejanem socvetju, so kratkopecljati, dolgi od 2 cm do 2,5 cm, zvončičaste oblike, večinoma bele barve, lahko tudi svetlomodri do svetlolila. Cveti od avgusta do konca septembra.

Slika / Figure 7 *Adenophora liliifolia* (Foto / Photo: B. Ravnjak)

Razširjenost: Center razširjenosti obročnice predstavlja Zahodna Azija – južna Sibirija, od tam se razširja do Mongolije in zahodne Kitajske na vzhodu, do severozahodne Turčije, preko južne, vzhodne in centralne Evrope do zahodne Evrope (Tacik 1971; Fedorov 1978; Hong et al. 2011; Urgamal 2014). V Evropi so prisotne izolirane populacije v Nemčiji, Avstriji, Švici, Poljski, Slovaški, Madžarski, Italiji, Sloveniji, Hrvaški, Bosni, Črni gori, Srbiji in Romuniji (Vaculná 2022).

Navadna obročnica je v Sloveniji razširjena v dinarskem in predalpskem svetu (Martinčič s sod. 1999, Babij 2004). Mayer (1952) pa jo kot redko navaja tudi za Dolenjsko (Zasavje) in dolino Kolpe, v njegovem herbariju pa sta primerka iz Podkraja pri Hrastniku in Belice iz Zgornje Kolpske doline. V osemdesetih letih prejšnjega stoletja je bila zanesljivo najdena samo v Zasavju

in na Kočevskem (Wraber terenski zapisi 1981-1982, Štimec 1982, Babij s sod. 1996, Accetto 1996, 2001) v zadnjem desetletju pa le v Kolpski dolini (Lavrač s sod. 2018, Lavrač s sod. 2021). Kot naravovarstvena območja so bila predlagana območje med Belico, Taborsko steno in Bezgovico na Kočevskem, pobočje ob Račkem potoku prav tako na Kočevskem ter v Zasavju ob robu gozda na desnem bregu Save med Podkrajem pri Hrastniku in Radečami (Babij 2004). Obročnica je pozno glacialni in zgodnje holocenski gozdno stepski relikt. Ustrezajo ji hladnejša presvetljena grmišča (Bylebyl s sod. 2008; Hensen s sod. 2010) in predeli z višjo zračno vlažnostjo zato je pogosto prisotna ob potokih, vlažnih jarkih ali drugih vlažnejših predelih.

Marsilea quadrifolia L. – štiriperesna marzilka

Opis vrste: Značilnost marzilke so listi, ki so do baze deljeni na štiri trikotno narobe jajčaste oblikovane lističe, kar daje videz štiriperesne deteljice. Listi so goli dolgi do 12 mm. Listi plavajo na vodni gladini, v mraku pa rastlina listne segmente zloži v pokončno lego. Ima tri tipe listov: potopljene, plavajoče in kopenske. Je trajnica visoka do 15 cm, s plazečim, rahlo razraslim steblom. Listni peclji lahko v času, ko je rastlina potopljena dosežejo dolžino tudi do 50 cm. Tako kot ostale praproti se razmnožuje s trosi. Nahajajo se v fižolasto oblikovanih sporokarpih, ki so nameščeni na bazi listnih pecljev (Vreš 2004b).

Slika / Figure 8 *Marsilea quadrifolia* (Foto / Photo: J. Bavcon)

Razširjenost: Je evroazijska vrsta, razširjena v srednji in južni Evropi, vse do zmernih ter tropskih predelov vzhodne Azije (Corli in sod. 2021). Po starejših podatkih naj bi bila prisotna na Krškem polju (Plemel 1862) ter na Dravskem in Ptujskem polju (Hayek 1956), vendar za Krško polje že vsaj 100 let ni potrjenega pojavljanja. V preteklih dvajsetih letih je bila opažena v ribnikih na Pragerskem, Račkih ribnikih in v ribnikih, Grajevniku in v ribnikih pri Podvincih (Vreš 2004b), v zadnjem desetletju pa le v Račkih ribnikih.

Uspeva na vlažnih rastiščih s plitvo vodo, kar pomeni da jo lahko najdemo v vodnih jarkih, ribnikih, opuščenih glinokopih in pogosteje poplavljenih mestih. Tolerira lahko s hranili bogato vodo pri različnih pH vrednostih zaradi česar ima

fitoremediacijske zmožnosti in lahko delno nevtralizira negativne učinke zmernega povečanja količine organskega materiala v vodi (Corli in sod. 2021). Pogosto kot pionirska vrsta zasede mesta, ki jih je s svojim delovanjem ustvaril človek in v njih zastaja voda. V procesu sukcesije in z zaraščanjem območji z višjimi rastlinami pa marzilka lahko počasi izgine. Prav zaradi tega opuščanje skrbi za vodna telesa, osuševanje in njih zaraščanje povzroča njeno izginjanje.

REZULTATI RAZISKAV V LETU 2022

Eleocharis carniolica W. D. J. Koch - kranjska sita

Po podatkih o Natura 2000 vrstah in območjih naj bi kranjska sita bila prisotna v 4 SAC Natura 2000 območjih v Sloveniji, od katerih se dve nahajata v vzhodni Slovenji, eno v osrednji, ter zadnje v gorenjski regiji. Po pregledu vseh štirih SAC območij leta 2022, smo kranjsko sito našli le na območju Češeniških gmajn. Prisotna je bila v traktorskih kolesnicah v gozdu ter v manjšem zamočvirjenem gozdnem delu v bližini večjega ribnika. Populacija v kolesnicah na dolžini 50 m in širini 3 m je v juniju štela cca 100 šopov (osebkov), tista v bližini ribnika pa je na površini 15 x 15 m štela cca 50 osebkov. Slednja se je nahajala na robu zamočvirjene površine in sicer v obsegu 3x3 m. Njeno pojavljanje na robu močvirja je posledica tega, da se osrednji del omenjene površine zarašča z močvirnimi vrstami kot so *Typha latifolia, Peucedanum palustris* in *Lythrum salicaria*. Z rastišča v kolesnicah, kjer je bila populacija večja smo odvzeli nekaj osebkov in jih prenesli v kulturo v Botanični vrt. V mesecu avgustu smo ponovno pregledali obe lokaciji in ugotovili, da je populacija v kolesnicah izginila. Razlog je bila verjetno

dolgotrajna poletna suša, saj so bile kolesnice popolnoma izsušene. Enako so bila izsušena tudi tla gozdna tla. Populacija na drugi močvirni lokaciji pa je ostala enaka kot junija in rastline so tudi uspešno semenile. Razlog je v tem, da omenjena lokacija ostaja dovolj vlažna tudi v sušnih obdobjih, saj je očitno nekje dovod vode iz bližnjega ribnika. S tega vidika navedena je lokacija zelo pomemben refugij za kranjsko sito, pri čemer pa jo v tem primeru ogroža le zaraščanje višjih steblik, na kar bomo morali biti pozorni pri nadaljnjih ukrepih za omenjeno rastišče. Del semen, ki smo jih nabrali smo shranili v trajni semenski banki, dal pa takoj posejali. Posejana semena so tudi uspešno kalila. Semenili pa so tudi tisti osebki v kulturi, ki smo jih prinesli z rastišča v kolesnicah.

Slika / Figure 9 *Eleocharis carniolica* (Foto / Photo: B. Ravnjak)

Gladiolus palustris (L.) Bess. - močvirski meček

V letu 2022 na nahajališču na Cerkljanskem nismo uspeli potrditi prisotnosti vrste. Omenjena senožet se sicer zarašča, vendar se spodnji del še vedno kosi. Morda je le košnja nekoliko zgodnejša. Tudi na Breginjskem stolu, kjer naj bi bila tudi rastišča *G. palustris,* smo vrsto v letu 2022 zaman iskali. Kljub nekaj terenskim ogledom v različnih časovnih obdobjih, nismo našli primerkov te vrste. Glede na videno obstoji možnost, da so se tam v zadnjih letih razmere precej spremenile. Predvsem smo opazili izrazito zaraščanje s kobulnicami, kar bi lahko povzročilo manjšanje ali izginjanje populacije *G. palustris.* Praktične izkušnje z nihanjem številčnosti populacije imamo namreč s populacijo *G. illyricus* (ilirski meček) na travniku v Rojah s katerim Botanični vrt Univerze v Ljubljani upravlja že od leta 2001. Tam je bilo na začetku izvajanj upravljanja, ker travnik veliko let pred tem niso več kosili, le še nekaj primerkov ilirskega mečka. Prisoten je bil samo na obrobju travnika in ob posameznih grmih sredi travnika. S ponovno uvedbo klasičnega tradicionalnega upravljanja s travnikom, pa se je populacija ilirskega mečka izredno povečala (Bavcon 2010, Bavcon in Ravnjak 2016, Bavcon s sod. 2019). Kljub temu, da vsako leto na travniku za semensko banko poberemo znatno količino semen te vrste (Bavcon s sod. 2018), se populacija vsako leto vedno bolj širi.

Opuščanje košnje bi torej lahko bil vzrok zmanjšanja populacij močvirskega mečka (*G. palustris*). Na Breginjskem Stolu kjer so površine zelo strme, zaraščanje z grmičevjem preprečujejo le še plazovi. Paša in košnja sta vsaj v teh strmih delih že dolgo opuščena. Od leta 2014 tudi ni bilo zelo snežnih zim, ko bi sneg

dalje časa obležal in bi potem plazovi na tem območje temeljito polomili večje rastlinje. Zaradi tega prihaja do močnega zaraščanja s kobulnicami. Le-te pa potem zaradi svoje velike pokrovnosti in zaradi šopaste razrasti trav, ki se tudi razvije povsod tam, kjer se površin ne kosi več, preprečujejo uspešno rast močvirskega mečka (Seliškar 2004). Breginjski stol občasno doseže tudi kakšen požar in tedaj se zaraščanje nekoliko upočasni, vendar bi bilo kakršnokoli sprožanje omejenih požarov za varovanje vrste v tem primeru preveč tvegano. Teren je namreč zelo nedostopen in požar se zaradi nepredvidenih vetrov lahko zelo hitro razširi do neobvladljivih razsežnosti. Rešitev bi bila samo paša drobnice in bolj snežne zime, v katerih bi plazovi preprečevali zaraščanje. Glede na trenutne klimatske spremembe pa bolj snežnih zim ni pričakovati.

Slika / Figure 10 Zaraščanje na Breginjskem Stolu. / Overgrowing on Breginj Stol. (Foto / Photo: J. Bavcon)

Prisotnost vrste smo v letu 2022 preverili še na Radenskem polju in Planinskem polju, kjer na bi po podatkih baze Natura 2000 vrsta bila prav tako prisotna. Na Radenskem polju naj bi vrsto opazil Peterlin na območju Srednic. Za obe dve območji je navedeno, da so podatki o pojavljanju vrste neznane kvalitete ali pa imajo pomanjkljivo kvaliteto. Po podatkih poročila iz leta 2020 (Jogan 2020) naj bi pravzaprav šlo na obeh območjih za vrsto *G. illyricus*. Tudi z našim terenskim obiskom v letu 2022 smo potrdili prisotnost le *G. illyricus*, vrste *G. palustris* pa nismo našli. Ni torej popolnoma jasno ali je na obeh območjih vrsta *G. palustris* dejansko bila prisotna in je sedaj izginila, ali pa je v preteklosti prišlo le do njene zamenjave z *G. illyricus*.

Eryngium alpinum L. – kraljica gora, alpska možina

Ob pregledu populacije na Poreznu v letu 2022 smo našteli od 800 do 1000 bolj ali manj cvetočih primerkov. V času pregleda populacije v mesecu avgustu, so bili cvetovi že v semenečem stanju. Tudi celotne rastline so imele že suhe liste. Razlog je v ekstremni in dolgotrajni poletni suši v letu 2022. V letih z običajno porazdeljenimi padavinami tekom rastne sezone, alpska možina na Poreznu cveti šele v drugi polovici avgusta. Opazili smo tudi, da so bila socvetja manjša in je bilo na enoto socvetja razvitih manj semen. Kraljica gora se na preučevani lokaciji na Poreznu pojavlja v šopih in le-ti iz leta v leto postajajo manjši. Bolj vitalni so v zgornjem najbolj strmem delu. Nižje vse do mulatjere pa vrsta zaradi hitrejšega zaraščanja izginja. Za nadaljnje ohranjanje tukajšnje populacije alpske možine je potrebno ponovno vzpostaviti občasno pašo. V analizi 2004 (Dakskobler 2004) je bila namreč paša prepovedana, kar je po toliko letih privedlo do podobne situacije kot je bila v začetku 90

ih let prejšnjega stoletja. Razlika je le v tem, da je v vmesnem obdobju zelena jelša izgubila svojo vitalnost, zaradi glivičnih napadov v 90 letih in se le-ta še ni ponovno obnovila.

Da je paša koristna za ohranjanje populacije alpske možine kaže tudi njena širitev na pašnik nad prej opisanim rastiščem. Tam posamezne primerke sedaj najdemo tudi na levi strani pobočja ob poti, ki s severne strani vodi na vrh Porezna. Vrsta je prisotna na položnejših delih, ki se držijo velike pašne površine, kjer pa se pase goveja živina. Tukaj nekoč kraljice gora ni bilo sedaj pa se je očitno z roba površine s pomočjo živine zanesla naprej ob poti. Podobno širitev s pašo smo opazili tudi pri panonskem svišču (*Gentiana pannonica*), ki se je prav s pašo zanesel nad planinsko kočo pod vrhom Porezna. Tam ga prej ni bilo zdaj pa je tam manjša populacija s preko 26 cvetočimi primerki (naša opažanja v letu 2019). Podobno je sedaj prisoten tudi na sedlu Malega Porezna, kjer je sicer nekoč bil le mestoma opažen, a ga je zdaj že znatno več.

Manjše sekundarno rastišče alpske možine je tudi zadaj za kočo na Poreznu, kjer so kraljico gora že v sedemdesetih letih prejšnjega stoletja poskušali naseliti v vrtiček, a je bilo vedno zaman. Prizadevanja nekaterih planincev iz zadnjih 20 let so sedaj le obrodila sadove. V leseni ogradi namreč alpska možina prav dobro uspeva. To sicer bolj kaže na vpliv večjega števila toplih in sončnih dni, saj je ta lokacija na mestu, ki nima iste južne ekspozicije kot naravna rastišča na strmih pobočjih Porezna. Od leta 1988 pa so se začela topla poletja in so vedno pogostejša, kar verjetno vpliva na uspešno rast rastlin.

Slika / Figure 11 Zaraščanje na južni strani Porezna. / Overgrowing ona the south sloupe of Porezen. (Foto / Photo: J. Bavcon)

Adenophora liliifolia (L.) Bess. – navadna obročnica

Naše terenske raziskave v letu 2021 in 2022 so pokazale, da je vrsta prisotna samo še zelo ozkem območju Belice. Ob Račkem potoku je nismo več našli prav tako tudi ne med Podkrajem in Radečami v Zasavju. Tudi populacija najdena v Belici je zelo majhna, saj gre le za do 35 primerkov vrste. Od tega je bilo cvetočih do 2/3, ostalo so predvsem mladi sterilni primerki. Večji del najdenih rastlin je bil malocveten, le z nekaj cvetovi skupaj na steblu. Slaba tretjina osebkov je bila dokaj polno cvetoča in od tega dobra tretjina res z veliko cvetnimi stebelci. Semena smo nabrali le na do 10 primerkih ostale smo pustili za naravno razmnoževanje. Največ semen je bilo na enem primerku, kjer je bilo skupno število 154 semen. Povsod drugje je bilo v kapsuli največ 50 semen, večinoma manj. Edino torej še dovolj vlažno

rastišče je ozko območje v Belici. Vendar je populacija tudi tukaj omejena le ne prehodni del med bolj suhim in zelo vlažnim delom ter na ozkem območju v že bolj položnem delu. V letu 2022 so obsežne hudourniške poplave v tem območju med 28. septembrom in 2. oktobrom (Arso vode 2022) odnesle večino semenskih kapsul na rastlinah, tako da je bila v semenečem stadiju en sam primerek. To sicer ne pomeni, da so rastline izginile. Brežine vodotoka so namreč še vedno ostale. Vzrok slabega cvetenja in posledično semenenja je bilo verjetno zelo sušno poletno obdobje. Tudi ostale spremljevalne manj ranljive vrste so namreč slabo cvetele. Obročnica cveti običajno v najbolj vročem delu poletja, se torej pozno razvija in ni pričakovati, da bi se v takem poletju populacija kaj dosti povečala, kvečjemu obratno. Čeprav smo pri terenskem delu s strani domačinov dobili nekaj namigov o prisotnosti rastlina še na višje ležečih predelih nad Belico, jih do sedaj tam še nismo našli.

Slika / Figure 12 *Adenophora lilifolia* - plodiči / seed capsule (Foto / Photo: B. Ravnjak)

Glede na naša terenska opažanja v letošnjem letu so se v več kot 40 letih od zadnjega opažanja obročnice v Zasavju razmere na teh rastiščih precej spremenile. Pobočje se je močno zarastlo in s tem se je tudi izsušilo. Vlažnih rastišč je bistveno manj, tam kjer so še, pa so zelo zaraščena z visokim steblikovjem in robidovjem. Razlog zaraščanja je zopet opuščanje nekdanje tradicionalne rabe zemljišč. Prav tako so poletja postala toplejša in tako je za obročnico na razpolago bistveno manj mokrotnih in delno sončno senčnih rastišč. Tam kjer le-ti so, pa so ponekod degradirani, zaradi vpliva človeka. Podobno presuho je postalo območje ob Račkem potoku v dolini Kolpe.

Adenophora liliifolia je verjetno ena izmed zelo ogroženih rastlinskih vrst slovenske in tudi sosednje hrvaške flore, ki ima še vse možnosti za preživetje. A brez posegov človeka je stabilnost njene do zdaj edine še znane populacije pod velikim vprašajem. Gre za zelo omejeno populacijo, ki je v veliki nevarnosti inbridinga in erozije malih populacij (Kliman s sod. 2008, Kosi 2013; Oostermeijer s sod. 1994, 1996, Ooburg s sod. 1991, Rich 1979).

Marsilea quadrifolia L. – štiriperesna marzilka

Štiriperesna marzilka je ena izmed redkih vodnih praproti pri v Sloveniji. Čeprav naj bi bila po nekaterih podatkih nahajališča v severovzhodnem delu Slovenije na videz obsežna je realnost povsem drugačna. Že nekaj let rastline v naravi ne opažamo več, kar so nam ustno pritrdili različni terenski raziskovalci. O tem smo se v letih 2021 in 2022 prepričali tudi sami. Na mnogih lokacijah, kjer so jo nekoč videvali, je na informacijskih panojih še vedno navedena kot velika posebnost. A vendar žal tudi tam te

rastline ni več. Kljub temu obstoji obsežnejša populacija iz teh prvotno naravnih populacij na nadomestnem rastišču v botaničnem vrtu Tal 2000, kjer se je ohranila populacija iz Turnovskih ribnikov.

Glavni vzrok, da je v naravi rastlina praktično izginila, je zaraščanje nekdaj bolj čiščenih ribnikov in manjše število bolj odprtih in plitvejših vodnih površin. Danes so njeni habitati zaraščeni večinoma z vrstami *Phragmites australis, Iris pseudacorus, Typha angustifolia, Nymphaea alba, Nuphar luteum, Nymphoides peltata, Trapa natans*. Vse te vrste tako na vodni gladini kot v delu od obrežja do globine pol metra ali več zasedajo njena rastišča. Štiriperesna marsiljka bi uspevala lahko samo v občasno degradiranih površinah ribnikov, ki niso stalno pod vodo. S tem bi njene druge vodne tekmice izgubile možnost rasti in bi potem marsiljka prevzela vlogo pionirske vrste. Drugi vzrok izginotja je vnos rastlinojedih rib (npr. belega amorja) v ribnike, kar je primer ribnikov pri Pragerskem.

Prav zaradi tega smo iz Botaničnega vrta Tal pridobili posamezne osebke, ki izvirajo iz populacije iz Turnovih ribnikov. Z njimi bomo lahko v prihodnjih letih na prej degradirane površine vrsto ponovno naselili (Botanični vrt TAL 2000 | Botanični vrt, spletna prodaja in urejanje zelenih površin (atropa.si) http://www.atropa.si/botanicni-vrt-tal-20002/).

Slika / Figure 13 *Marsilea quadrifolia* - plodiči / seed capsule (Foto / Photo: B. Ravnjak)

PROTECTION OF SELECTED NATURA 2000 PLANT SPECIES (LIFE SEEDFORCE PROJECT)

Jože Bavcon, Blanka Ravnjak

ABSTRACT

Various human interventions on the environment change the habitats of both animals and plants. Some habitats have been changed to such an extent that the populations of plant and animal species have greatly decreased or even disappeared. If we can collect the seeds of plant species in a planned manner and store them in seed banks, they can represent an important part in the reintroduction of plant species back to their natural habitats or at least in increasing their populations. In any case, it is important to study the factors that led to the reduction or disappearance of plant species and then, of course, remove such factors. An example of increasing populations and reintroducing some Natura 2000 plant species is the LIFE SeedForce project. As part of this project, 15 partner institutions will reinforce populations or reintroduce 29 Natura 2000 plant species in 26 Natura 2000 Special Areas of Conservation (SAC) by collecting seeds, storing them in seed banks, and cultivating plants from these seeds.

Keywords: Life SeedForce, Natura 2000 species, reintroduction, plant conservation, seed banks

INTRODUCTION

In 2020, at the initiative of fellow botanists from the Museo delle scienze (MUSE) from Trento, we joined the LIFE project application whose goal is to preserve or reintroduce some of the endangered and protected Natura 2000 plant species in selected Natura 2000 areas with the help of seed banks. The project was successfully accepted, and so we began with the first project activities in autumn, on 1 October 2021. The LIFE SeedForce project, which includes 15 partners from Italy, France, Malta and Slovenia, will last until 12 December 2026. As already mentioned, the lead partner is MUSE from Trento. In addition to the University Botanic Gardens Ljubljana, the following partners participate in the project: Università degli Studi di Roma "La Sapienza", Conservatoire Botanique National Méditerranéen de Porquerolles, Parco Monte Barro, Legambiente Nazionale, Ente Parco Nazionale della Majella, Università ta' Malta, Università degli Studi di Cagliari, Università degli Studi di Catania, Università degli Studi di Genova, Università degli Studi di Palermo, Università degli Studi di Padova, Università degli Studi della Tuscia, Università degli Studi di Udine. As part of the project for reinforcing or reintroducing populations, we selected the following 28 Natura 2000 plant species: *Astragalus verrucosus*, *Bassia saxicola*, *Campanula sabatia*, *Cytisus aeolicus*, *Galium litorale*, *Limonium strictissimum*, *Linum muelleri*, *Ribes sardoum*, *Silene hicesiae*, *Adenophora liliifolia*, *Botrychium simplex*, *Centranthus amazonum*, *Crepis pusilla*, *Dracocephalum austriacum*, *Elatine gussonei*, *Eleocharis carniolica*, *Eryngium alpinum*, *Gentiana ligustica*, *Gladiolus*

palustris, *Himantoglossum adriaticum*, *Kosteletzkya pentacarpos*, *Leucojum nicaeensis*, *Linaria flava*, *Liparis loeselii*, *Marsilea quadrifolia*, *Primula palinuri*, *Saxifraga tombeanensis* and *Woodwardia radicans*, with species selected so that the area of an individual selected species spans at least two partner countries. For the area of Slovenia, we selected the following species: ladybells (*Adenophora liliifolia*), Carniolan spike-rush (*Eleocharis carniolica*), queen of the Alps (*Eryngium alpinum*), marsh gladiolus (*Gladiolus palustris*) and water clover (*Marsilea quadrifolia*).

In the initial stages of the project, we assessed the actual state of their populations in the wild for all selected species in the 26 selected Natura 2000 Special Areas of Conservation (combines areas of all project partners). Plant species populations were assessed in terms of their numbers. At each location, leaf samples of individual species were also taken for genetic analyses. These analyses will be carried out by the University of Udine (Università degli Studi di Udine). As part of the project, we also want to determine whether separate populations of individual plant species are genetically similar or different. It determines which population can then be used as the donor population for locations where a certain plant species has already disappeared. In addition to assessing the state of populations, we will carry out an analysis of the current knowledge of the distribution of each species from the perspective of historical data for the species, its occurrence, and its endangerment due to environmental changes. When assessing the populations of each species, we also described the characteristics of the environment in which the species grows and identified the risk factors. In Natura 2000 areas where a species has disappeared, we have recorded possible factors that have caused the disappearance of the species. At the

same time, we have selected locations for reintroduction and foreseen measures that will have to be implemented in the area for a successful reintroduction. In 2022, we also began collecting seeds of selected plant species. Collected seeds will be the basis for cultivating specimens of selected plant species, which will be used to reinforce small populations in Natura 2000 areas or to reintroduce the species in locations where individual plant species have already disappeared. In total, all partners are expected to cultivate approximately 50,000 specimens; of these, approximately 21,000 specimens will be relocated. The remaining specimens will stay in culture as a reserve and for the needs of project promotion. A large – and the most demanding – part of project activities will be the transfer and planting of specimens of selected species in natural habitats in selected Natura 2000 areas. Because of difficult access to individual locations, the work will be logistically demanding. Furthermore, the very success of planting and growth of specimens will largely depend on environmental factors and further care for specific habitat and the wider area. It is therefore important that we define the measures to be taken for future planned management of the planting area when planting the specimens. Considering that we are reinforcing populations or reintroducing selected species to natural habitats that are accessible to the general public in one way or another, or areas managed by the general public or local community, part of the project activities will be aimed at raising public awareness of the project. We will hold public lectures where we will present project activities and progress in specific activities. Owners of land where selected Natura 2000 species are located will be informed on an ongoing basis about interventions related to the reintroduction of specimens and the increase of populations. We will also work with land owners to find long-term measures for management of their land and locations of

reintroduced plant species. These measures should be carried out after the completion of the project, thus ensuring continued existence of populations of selected plant species.

PRESENTATION OF INDIVIDUAL SPECIES INCLUDED IN THE LIFE SEEDFORCE PROJECT

Eleocharis carniolica W. D. J. Koch

Description of species: It is a perennial plant, reaching 5 to 10 centimetres in height. It grows in tufts. It has a short rhizome and no runners. Its stems are very thin (0.5 millimetre thick) and finely grooved. Its spikelets hold many flowers, are 3 to 13 millimetre long, spindle-shaped, pointed or ovate. Its flower glumes are blunt or pointed, red-brown, and have a green stripe in the middle. The fruits are convex on both sides, obovate to lenticular, and 1 to 1.5 millimetre long. Their surface is smooth and shiny, olive to yellow-brown in colour (Vreš 2004a).

Distribution: It is a distinctly colline species and, more rarely, a montane species. Despite its name, i.e. Carniolan, as it was first discovered in Carniola, its area of distribution is wider. It grows in the north of Switzerland, Austria, Hungary, to the north of central Russia, and in the south to Northern Italy, through Slovenia to the middle of the Balkan Peninsula in some places and central Romania (Schultze-Motel 1967).

Eleocharis carniolica was found by Jurij Dolliner near Postojna, and it was first described by Koch in 1844 and named after Carniola as *Eleucharis carniolica* (Praprotnik 2015). *Eleocharis carniolica* therefore has a classical location near Postojna. In his book *Naše škodljive rastline* (*Our Harmful Plants*), Cilenšek

(1892) wrote about spikerushes: swamp spikerush and ovoid spikerush. He most likely included *Eleocharis carniolica* under the ovoid spikerush. He described it as having tiny round or ovate spikelets. Looking at its described time of its flowering (July, August), it matches *Eleocharis carniolica.* Alfonz Paulin also collected *Eleocharis carniolica* for his dried collection of Carniolan plants (*Flora exsiccata carniolica*) in the vicinity of Postojna. With the number 1463, it can be found under the name *Heleocharis carniolica* Koch. Paulin states that it grows: "On marshy places, Mali otok near Postojna, 530m – VII. *Locus clasiccus*". Dolšak (1936) noted about Paulin's specimens on the sheet that a very interesting mutation was found on these specimens. Specifically, they have secondary spikelets, the lower flowers of which are transformed into buds. Paulin also collected specimens from Šenturška gora in the foothills of Kamnik–Savinja Alps under this number. The specimens were located at an altitude of 600 metres, in locations with moist clay soil near the village of Sidrož. The third sheet holds specimens from Koseze near Ljubljana, where the plants grew again in locations with moist clay soil.

Eleocharis carniolica is one of the less noticeable plants in terms of appearance, as it is found in occasionally flooded habitats, but which can completely dry up during dry period. This usually causes *Eleocharis carniolica* to disappear from such places as well. Therefore, its occurrence is very limited to wet periods of the year, i.e. early spring and until the beginning of summer. In the interim period until autumn, its appearance again depends on more abundant precipitation. It thrives best on waterlogged soils, where water stagnates and the soil does not dry out completely, not even during the summer. *Eleocharis carniolica* always grows in such places. In places where the soil dries out completely in

summer, *Eleocharis carniolica* disappear during that time. If it formed enough seeds before the soil dried out, they ripen and germinate during the next favourable season. The time of flowering of *Eleocharis carniolica* has now shifted due to very warm springs, as it is already too dry in July in many areas where it grows today, sometimes even in the second half of June. These are secondary habitats that are the result of human activity. Thus, *Eleocharis carniolica* grows in deep tractor wheel tracks. Deep tractor wheel tracks are significantly wider and deeper than wagon wheel tracks in the past. Because of their depth, water stay longer after rainfall, thus forming a suitable environment for colonisation by *Eleocharis carniolica.* However, even these secondary habitats dry out completely during dry summers. In recent years, there have been more and more such dry summers. *Eleocharis carniolica* is apparently still sufficiently well adapted to changing conditions, as it grows more or less constantly in wheel tracks. In some places, *Eleocharis carniolica* is characterised by vivipary.

Gladiolus palustris (L.) Bess. – marsh gladiolus

Description of species: It is a perennial plant up to 50 centimetres tall with an erect, thin and round stem. The stem holds a one-sided inflorescence with up to 6 flowers. Each flower has two equally long lanceolate bracts. They are green with a hint of purple, and are barely half the length of a perigon. The perigon is rose red, 3 centimetre long and with a curved tube. The bottom three leaves of the perigon have an elongated whitish spot on the inside. Its anthers are shorter than its stamens. The seed capsule is obovate with a rounded top. The seeds are widely winged. Its leaves are lanceolate and shortly pointed. In the soil, there is an ovoid corm

with a diameter of up to 2 centimetres and a distinctly reticulate sheath (Pospichal 1897, Seliškar 2004).

Slika / Figure 14 *Gladiolus palustris* (Foto / Photo: J. Bavcon)

Distribution: The species grows in nature in Central and South-East Europe up to the Apennines and in the Balkans. In Slovenia, it grows in the Alps and their surrounding area, it is also said to be present in the Ljubljana Basin, in the Dinaric region (Lake Cerknica), and in the vicinity of Cerkno (Seliškar 2004).

Johannes Antonius Scopoli (1772) was the first to write about the genus *Gladiolus* in the territory of Slovenia. In his *Flora Carniolica*, he mentioned the species *Gladiolus communis*, under which he combined species *G. palustris* and *G. illyricus*. In its description, he wrote that the species grows on meadows. He listed Lake Cerknica, meadows near Vipava, Logatec and Hotedršica. Host (1827–1831), Wulfen (1858) and Fleischmann (1844) wrote only about the species *G. communis*. In his *Flora*

des Oesterreichischen Küstenlandes (1897), Eduard Pospichal already mentioned two species, *G. palustris* and *G. illyricus*, adding a description of both species and their distinguishing features. For *G. palustris*, he listed hill meadows of Kokoška, Slavnik, Lipnik, Planik, Čuk, Merče, Ravnica pri Trnovom, Brezovica, Odolina, Obrova, Sušice and Suhorice as its habitats.

The oldest author first became familiar with the species *G. palustris* at the time of his diploma thesis. The species also grew in Cerkljansko at that time (Bavcon 1986, 2013, Bavcon et al 2018). It is interesting that the species was already well known to the locals and was called "wild gladiolus" (Bavcon et al. 2019). Further studies of the flora of Cerkljansko (Bavcon et al. 2000) also led to another, at that time fairly rich location at the other end of Cerkljanska, where the sub-Alpine and Dinaric regions meet. Later studies on the distribution of marsh gladiolus in Slovenia mostly indicated the presence of *G. illyricus* (Bavcon 2013, 2014, Bavcon et al. 2019). The species are very similar to each other, and can only be distinguished by the tuber sheath and, according to Pospichal (1897–1898), also by the shape of the seed capsule, which is slightly impressed at the top in *G. illyricus*, and nicely round in *G. palustris*. The areas of *G. palustris* were examined for Natura 2000 by Seliškar (2004). He proposed areas in the Kamnik–Savinja Alps to be designated as protected areas. Čušin (2006) mentioned marsh gladiolus on mountain grasslands on the slopes of Stol. However, after this time, there was a long lull in the study of marsh gladiolus in Slovenia. Only recent articles regarding previous studies indicate new areas of distribution in Banjščice, Koradi (Dakskobler et al. 2021 a, b).

Eryngium alpinum L. – queen of the Alps, alpine sea holly, alpine eryngo

Description of species: The species is a perennial that can grow up to 80 centimetres in height. It is an umbellifer, and its inflorescence is shaped into an elongated, umbel head. It consists of tiny flowers with five fringed sepals and white petals. The involucre bracts are pinnately lobed, bristly, prickly-serrated and longer than the flowers. The inflorescence is bluish. The basal leaves are ovoid to cordate, unevenly toothed and with long petioles. The cauline leaves are sessile and palmately five-lobed (Dakskobler 2004).

Distribution: The species grows in Alpine regions and is thus naturally present in France, Italy and Switzerland in addition to Slovenia, and its area extends through the Dinaric Alps to Bosnia and Montenegro.
Eryngium alpinum is a species typical of the Alpine world. In Slovenia, it grows in the Julian Alps and on mount Porezen in the pre-Alpine region. It has also been reported in the Karavanks, where it was once common, as well as Storžič and Krn, but these locations have not been confirmed in recent years. The species was already mentioned in *Flora Carniolica*, where Scopoli noted (1772) that it grows in the Alps around Tolmin. As its habitat, Host (1827–1831) listed Croatia, Carniola and Friuli-Venezia Giulia, while Wulfen listed the valley of the Julian Alps in his *Flora Norica Phanerogama* (1858). Fleischmann already mentioned a more precise location – mount Črna prst (1844).

Slika / Figure 15 *Eryngium alpinum* (Foto / Photo: J. Bavcon)

The largest current habitats are on mount Črna prst (Dakskobler 2004) on its northern foothills, on mount Lisec (1633 m a.s.l.) and even lower above Osredki at an altitude of 1500 m. On the eastern slopes of mount Lisec (1600–1650 m) there are more extensive locations with a surface area of about 2 hectares. Another major location is on mount Porezen (Bavcon 2013). Populations of the queen of the Alps are endangered on all listed locations because the terrain is being overgrown. In the past, these locations were hayfields that were regularly mown or where livestock regularly grazed; nowadays, however, they have been abandoned and are therefore mostly becoming overgrown.

Slika / Figure 16 *Eryngium alpinum* / Rastišče na južni strani Porezna. / Habitat on the south slope of Porezen. (Foto / Photo: J. Bavcon)

The locations on mount Porezen are significantly larger in terms of surface area than those on Črna prst. In the past, the valleys of Porezen were completely blue when queen of the Alps flowered. Until the 1970s and sometime later, these areas were occasionally mowed. In 1974, Seljak conducted botanical studies of this area botanically as part of his diploma thesis. At that time, the queen of the Alps population was still very large even though mowing had been abandoned. The population persisted for a relatively long time even later, but then the area began to become heavily overgrown with tall stemmed plants, green alder (*Alnus alnobetula*), individual spruces, Norway maple (*Acer platanoides*) in some places, and, in parts more exposed to sunlight, with Southern greenweed (*Genista radiata*). In the 1990s, livestock grazing resumed on the slopes of Mali Porezen

and Porezen, and was strong resistance to grazing among many mountaineers at that time, because the queen of the Alps was said to have disappeared from those sites due to grazing. It is true that in the first phase sheep completely ate queen of the Alps plants and that the plants did not flower that year, and had secondary shoots of inflorescences only in some places. After a field visit, we recommended that grazing is necessary for queen of the Alps in these valleys, but not every year throughout the entire area. This measure turned out to be very beneficial at the time, as the population of queen of the Alps increased significantly in the following years (Bavcon 2013). In some places, populations become as numerous as in the 1970s. Unfortunately, grazing has now been completely abandoned in this area, and the population is again shrinking as a result. The area is once again becoming overgrown with tall stemmed plants and red raspberry (*Rubus idaeus*), which is reducing the number of queen of the Alps specimens.

Slika / Figure 17 Zaraščanje na južni strani Porezna. / Overgrowing ona the south sloupe of Porezen. (Foto / Photo: J. Bavcon)

Adenophora liliifolia (L.) Bess. – ladybells

Description of species: Ladybells is part of the bellflower family (Campanulaceae) and are very similar in characteristics to the bellflower genus (*Campanula*). It is distinguished from the bellflower genus by the neck of the pistil, which is much longer than the corolla, causing it to protrude far out of the flower. They are an herbaceous perennial that grows to a height of 30 to 100 centimetres. The leaves are simple, elliptic to lanceolate, and slightly toothed. The upper stem leaves are sessile, while the lower ones have short petioles. The leaves are spirally arranged (Babij 2004). The flowers grow in slight or branched inflorescence, have short peduncles, are 2 to 2.5 centimetres, bell-

shaped, mostly white, but can also be light purple. They flower from August until the end of September.

Distribution: The central point of ladybells distribution is Western Asia – southern Siberia, from there it spreads to Mongolia and western China in the east, to north-western Turkey, through Southern, Eastern and Central Europe to Western Europe (Tacik 1971, Fedorov 1978, Hong et al. 2011, Urgamal 2014). In Europe, isolated populations are in Germany, Austria, Switzerland, Poland, Slovakia, Hungary, Italy, Slovenia, Croatia, Bosnia, Montenegro, Serbia and Romania (Vaculná 2022).

Ladybells grow in Slovenia in the Dinaric and pre-Alpine region (Martinčič et al. 1999, Babij 2004). Mayer (1952) mentioned it as rare also in Dolenjska (Zasavje) and the Kolpa Valley (Lavrač s sod. 2018, Lavrač s sod. 2021). In the 1980s, it could be reliably found only in Zasavje and Kočevsko (Wraber's field records 1981–1982, Štimec 1982, Babij et al.1996, Accetto 1996, 2001). The area between Belica, Taborska stena and Bezgovica in Kočevsko, the slope along Račko potok also in Kočevsko, and in Zasavje along the edge of the forest between Radeče and Podkraj were proposed as nature conservation areas (Babij 2004). *Adenophora liliifolia* is a late glacial and early Holocene forest-steppe relict. It prefers to cooler shrubland with plenty of sunlight (Bylebyl et al. 2008, Hensen et al. 2010) and areas with higher air humidity, so it is often present along streams, moist ditches or other wetter areas.

Marsilea quadrifolia L. – water clover, pepperwort

Description of species: The characteristic feature of water clover are its leaves, which are divided at the base into four triangular

obovoid leaflets, which give it the appearance of a four-leaf clover. Its leaves are glabrous up to 12 millimetre long. The leaves float on water, and in the dark the plant folds its leaf segments into an upright position. It has three types of leaves: submerged, floating and terrestrial. It is a perennial plant up to 15 centimetres tall, with a creeping, slightly branched stem. Leaf petioles can reach a length of up to 50 centimetres when the plant is submerged. Like other ferns, it reproduces via spores. They are located in bean-shaped sporocarps, which are located at the base of petioles (Vreš 2004b).

Distribution: The water clover is a Eurasian species, distributed in Central and Southern Europe, as far as Eurasia and the temperate and tropical regions of eastern Asia (Corli et al. 2021). According to older data, it was present on Krško polje (Plemel 1862), as well as on Dravsko potje and Ptujsko polje (Hayek 1956). However, its distribution on Krško polje has not been confirmed for at least 100 years. In the past twenty years, it has been observed in ponds in Pragersko, Rački ribniki and in ponds near Podvinci (Vreš 2004b).

The species grows in moist habitats with shallow water, which means that it can be found in water ditches, ponds, abandoned clay pits and, more often, flooded areas. It can tolerate nutrient-rich water with different pH values, giving it phytoremediation capabilities and enabling it partially neutralise the negative effects of a moderate increase of organic material in water (Corli et al. 2021). As a pioneer species, it often occupies man-made places with stagnating water. In the process of succession and as areas are becoming overgrown with higher plants, it can slowly disappear. Thus, abandoned maintenance of bodies of water and consequent overgrowing leads to its disappearance.

Slika / Figure 18 *Marsilea quadrifolia* (Foto / Photo: R. Hergan)

RESEARCH RESULTS IN 2022

Eleocharis carniolica W. D. J. Koch

According to Natura 2000 data, *Eleocharis carniolica* is present in 4 Natura 2000 Special Areas of Conservation in Slovenia, two of which are located in eastern Slovenia, one in the central region, and the last one in the Gorenjska region. After surveying all four Special Areas of Conservation in 2022, we found *Eleocharis carniolica* only in the area of Češeniške gmajne. It was present in tractor wheel tracks in the forest and in a small marshy forest area near a large pond. In June, the population in wheel tracks in an area 50 metres long and 3 metres wide numbered approximately 100 specimens, while the population near the pond numbered

approximately 50 specimens in an area of 15 metres by 15 metres. The latter was located on the edge of a marshy area measuring 3 metres by 3 metres. The occurrence of *Eleocharis carniolica* on the edge of this area was caused by the central part being overgrown with wetland species such as *Typha latifolia*, *Peucedanum palustre* and *Lythrum salicaria*. We took some specimens from the wheel track habitat, where the population was larger, and transferred them to culture in the Botanic Gardens. In August, we again surveyed both locations and found that the population in the wheel tracks had disappeared. The reason was probably the prolonged summer drought, as the wheel tracks were completely dried out. The forest ground was also dried out. However, the population at the second location remained the same as in June, and the plants also successfully produced seeds. This is because the latter location remains sufficiently wet even during dry periods, as it obviously gets water from a nearby pond. From this point of view, this location is a very important refuge for *Eleocharis carniolica*; in this case, it is only threatened by overgrowing taller stemmed plants, which will require attention when planning future measures for this habitat. Some of the seeds we collected were stored in a permanent seed bank, and some were sown immediately. Sown seeds germinated successfully. The cultivated specimens that we brought from the wheel track habitat also produced seeds.

Gladiolus palustris (L.) Bess. – marsh gladiolus

In 2022, we were unable to confirm the presence of the species at the location in Cerkljansko. The hayfield is becoming overgrown, but the lower part is still being mowed. Mowing might be slightly earlier. In 2022, we also searched for the species on Breginjski stol, where *G. palustris* habitats are supposed to be, in vain.

Despite several field visits at different times, we did not find specimens of this species. Based on our observations, there is a chance that the circumstances there have changed considerably in recent years. In particular, we observed a pronounced overgrowth with umbellifers, which could lead to a decrease or disappearance of the *G. palustris* population. We have practical experience with population fluctuations with the population of *G. illyricus* (wild gladiolus) in the meadow that the University Botanic Gardens Ljubljana have been managing since 2001. In the beginning, when the meadow had not been mowed for many years, there were only a few specimens of wild gladiolus left. It was present only on the edge of the meadow and next to individual bushes in the middle of the meadow. Once classical traditional meadow management was reintroduced, the population of wild gladiolus increased tremendously (Bavcon 2010, Bavcon & Ravnjak 2016, Bavcon et al. 2019). Although we collect a significant quantity of seeds of this species in the meadow every year for the seed bank (Bavcon et al. 2018), the population is growing every year.

The abandonment of mowing could therefore be the cause of the decrease of *G. palustris* population. On Breginjski stol, where the surfaces are very steep, only avalanches prevent overgrowth by shrubs. Grazing and mowing have long been abandoned, at least in these steep areas. Since 2014, there have also been no winters where snowfall would persist for a long time, followed by avalanches thoroughly destroying any larger vegetation. As a result, there is a strong overgrowth of umbellifers. Umbellifers' thick cover and tufted growth of grasses, which consequently develop in all areas that are no longer mowed, prevent successful growth of marsh gladiolus (Seliškar 2004). An occasional fire does reach Breginjski stol and slightly slows down the overgrowth; however, starting any limited fires to protect this

species would be too risky. The terrain is very inaccessible and the fire can quickly spread to uncontrollable proportions due to unpredictable winds. The only solutions would be grazing of small livestock and winters with more snowfalls, during which avalanches would prevent overgrowing. Given the current climate changes, we cannot expect winters with more snowfall.

Slika / Figure 19 Zaraščanje na Breginjskem Stolu. / Overgrowing on Breginj Stol. (Foto / Photo: J. Bavcon)

In 2022, we checked for the presence of the species in Radensko polje and Planinsko polje, where, according to the Natura 2000 database, the species should also be present. In Radensko polje, the species was reportedly spotted by Peterlin in the area of Srednice. For both areas, it is stated that the data on the occurrence of the species is of unknown or poor quality. According to the report from 2020 (Jogan 2020), it should actually be the species *G. illyricus* in both areas. During our field

trip in 2022, we confirmed the presence of only *G. illyricus*, but did not find the species *G. palustris*. It is therefore not entirely clear whether the species *G. palustris* was actually present in both areas but has now disappeared, or whether it was misidentified as *G. illyricus* in the past.

Eryngium alpinum L. – queen of the Alps, alpine sea holly, alpine eryngo

During the survey of the population on Porezen in 2022, we counted 800 to 1000 more or less flowering specimens. At the time of the population survey in August, the flowers were already in the seed stage. Even entire plants already had dry leaves. The reason for this is the extreme and long-lasting summer drought in 2022. In years with normally distributed rainfall during the growing season, the queen of the Alps on Porezen flowers only in the second half of August. We also observed that the inflorescences were smaller and that fewer seeds were developed per unit of inflorescence. The queen of the Alps appears at the surveyed location on Porezen in tufts, which are becoming smaller every year. More vital tufts grow in the top, steepest section. Lower down to the mountain road, the species disappears due to faster overgrowing. In order to preserve the local population of queen of the Alps in the future, it is necessary to re-establish occasional grazing. Grazing was, in fact, prohibited in the 2004 analysis (Dakskobler 2004), which after so many years led to a situation similar to the one in the early 1990s. The only difference is that in the intervening period the green alder lost its vitality due to the fungal attacks in the 1990s and has not yet recovered.

Slika / Figure 20 *Eryngium alpinum* (Foto / Photo: J. Bavcon)

The fact that grazing is beneficial is also evidenced by the spread of queen of the Alps into the pasture above the described location. There, individual specimens can now also be found on the left side of the slope, next to the path that leads to the top of Porezen from the north. The species is present in flatter sections, which are located next to the large pasture area, where cattle graze. Queen of the Alps did not grow here in the past, but has now apparently spread from the edge of area along the path with the help of livestock. A similar spread with the help of grazing was also observed in the brown gentian (*Gentiana pannonica*), which has spread above the mountain hut under the top of Porezen with the help of grazing. It was not there before, but now there is a small population with over 26 flowering specimens (our observations from 2019). It is now similarly present in the saddle

of Mali Porezen, where it was observed only in a few places in the past, but is now growing in greater numbers.

Slika / Figure 21 *Eryngium alpinum* - nadomestno rastišče / additional habitat. (Foto / Photo: J. Bavcon)

A secondary, smaller location of the queen of the Alps is also behind the mountain hut on Porezen, where attempts were already made in the 1970s to cultivate the queen of the Alps in a small garden, but never successfully. Efforts of some mountaineers from the last 20 years have now finally borne fruit. The queen of the Alps now thrives inside a wooden fence. This indicates a higher number of warm and sunny days, since this location is in a place that does not have the same southern exposure as natural habitats on the steep slopes of Porezen. However, warm summers started in 1988 and are becoming more and more frequent, which obviously affects the successful growth of plants.

Adenophora liliifolia (L.) Bess. – ladybells

Our field studies in 2021 and 2022 showed that the species is present only in a very narrow area of Belica. We no longer found it along Račkov potok, nor between Podkraj and Radeče in Zasavje. The population found in Belica is also very small, with only 35 specimens. Of these, up to two thirds were flowering, whereas the rest were mainly young sterile specimens. Most of the plants found had just a few flowers, with only several flowers together on a stem. A little under a third of the specimens were in fairly full bloom, and a good third of them had many peduncles. We collected seeds from up to 10 specimens. Most seeds were collected from a single specimen, which had a total of 154 seeds. All other specimens had a maximum of 50 seeds in a capsule, mostly less. Therefore, the only sufficiently moist habitat is a narrow area in Belica. However, this population is also restricted to the transitional area between the drier area and the very humid area, and to a narrow area in the already flatter section. In 2022, extensive torrential floods in this area between 28 September and 2 October (Slovenian Environment Agency, Waters 2022) washed away most of the seed capsules on the plants, resulting in only one specimen in the seed stage. This does not mean that the plants have disappeared. The banks of the watercourse still remain. The cause of poor flowering and consequently seeding was probably a very dry year. Other accompanying and less vulnerable species also showed poor flowering. Ladybells flower right in the hottest part of the summer, so it develops late; therefore, the population is not expected to increase much during such summers – in fact, the opposite. Although the locals provided some clues on the presence of the species in higher areas

above Belica during our field work, we have not yet found it there.
However, according to our field observations, in over 40 years of monitoring population stability in Zasavje, the conditions at these locations have changed considerably. The slope became heavily overgrown and therefore dry. There are significantly fewer wet locations; and where they still exist, they are heavily overgrown with tall stemmed plants and brambles. The reason for the overgrowing is, again, the abandonment of the previous traditional land use. The summers have also become warmer, and ladybells thus have significantly fewer wet and partly sunny and shady locations available. Where there are such locations, they are in some places degraded due to human influence. The area along Rački potok in the Kolpa Valley became similarly too dry.

Adenophora liliifolia is probably one of the critically endangered plant species of the Slovenian flora that still has every chance of survival. However, without human intervention, the stability of its sole discovered population is in significant doubt. It is a very limited population that is in great danger of inbreeding and genetic erosion (Kliman et al. 2008, Kosi 2013, Oostermeijer et al. 1994, 1996, Ooburg et al. 1991, Rich et al.1979).

Marsilea quadrifolia L. – water clover, pepperwort

The water clover is one of the few aquatic ferns in Slovenia. Although its locations in the north-eastern part of Slovenia appear to be extensive according to some data, the reality is completely different. We have not observed the plant in the wild for several years, as was verbally confirmed by various field researchers. We confirmed these observations ourselves in 2021 and 2022. In many locations where it was once found, it is still listed as a major

special plant on information boards. Unfortunately, this plant no longer grows in these locations either. Nevertheless, a large population from these originally natural populations exists in an alternative location in the Tal 2000 Botanic Garden, where the population from Turnovski ribniki has been preserved.

Slika / Figure 22 *Marsilea quadrifolia* kultura / Culture (Foto / Photo: B. Ravnjak)

The main reason for its practical disappearance in nature is the overgrowth of previously cleaned ponds and a smaller number of more open and shallower water surfaces. Today, its habitats are overgrown mostly with *Phragmites australis*, *Iris pseudacorus*, *Typha angustifolia*, *Nymphaea alba*, *Nuphar luteum*, *Nymphoides peltata*, *Trapa natans*. All these species occupy its habitats, both on the surface of water and in the part from the shore to a depth of half a metre or more. The water clover could only thrive in occasionally degraded areas of ponds that are not permanently under water. In such conditions, its aquatic competitors would lose the opportunity to grow and the water clover could take over the role of a pioneer species.

It is for this reason that we obtained individual specimens from the Tal 2000 Botanic Garden, which originate in the population from Turnovski ribniki. Using these specimens, we will be able to reintroduce the species to previously degraded areas in the coming years (TAL 2000 Botanic Garden | Botanic garden, on-line store and landscaping services (atropa.si) http://www.atropa.si/botanicni-vrt-tal-20002/).

Slika / Figure 23 *Marsilea quadrifolia* (Foto / Photo: R. Hergan)

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INDEX SEMINUM 2022

Nabiranje semen v sušnem letu 2022

Jože Bavcon, Janja Makše, Blanka Ravnjak

V posameznem letu na nabirko semen močno vplivajo razmere v okolju. Le-te vplivajo na rastline tako v Botaničnem vrtu, kjer rastlinam pomagamo z zalivanjem, kot seveda v naravi, kjer so rastline prepuščene samim sebi. Rastline so izredno dober pokazatelj sušnih let. Še posebej se to pozna na produkciji semen. Kljub morda še vedno obilnem cvetenju, se njih cvetenje potem zelo hitro neha in večinoma se nato rastline zelo zgodaj zasušijo ter ne plodijo (semenijo), ali pa je plodov oz. semen malo.

V zadnjih 20 letih je bilo tovrstnih sušnih let kar nekaj – o čemer smo že večkrat poročali. Zelo sušna in topla leta so bila 2003, 2006, 2012 in še nekatera nadaljnja (Bavcon & Makše 2013). Sušo ob nabiranju semen za *Index seminum* zaznavamo zelo pogosto, včasih vpliva le na posamezne vrste, včasih na celotne habitatne tipe. V nekaterih letih na produkcijo semen vplivajo tudi pozne pozebe, ki se odražajo predvsem na rastlinah v naravi. Pozneje cvetoče rastlinske vrste namreč niso več prilagojene na pozebe in zato je običajno pri teh vrstah zelo viden upad semenjena. V zadnjem desetletju je bilo v Sloveniji več poznih pozeb, kar se je odražalo tudi na nabirkah semen v naravi (ARSO). Pozne pozebe pa seveda niso značilne za vse predele Slovenije in ker semena nabiramo v različnih delih Slovenije, se vpliv poznih pozeb na nabirki semen vseeno manj pozna kot pa sušna leta. Sušna leta so bolj univerzalna in večinoma prizadenejo celotno Slovenijo. Učinki suše so običajno najbolj vidni v

submediteranskem delu Slovenije. Pride do izredno hitrega rjavenja listov in zmanjšanja listne mase predvsem na grmovnih ter drevesnih vrstah.

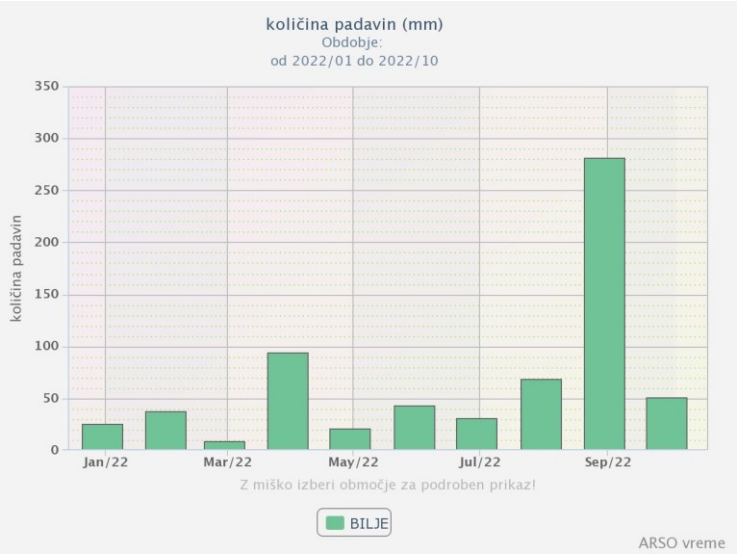
Slika / Figure 24 Nabiranje semen na Kuclju. Seed collecting on Kucelj. (Foto / Photo: J. Bavcon)

Lanskoletna suša je, v primerjavi s sušo 2012 (Bavcon & Makše 2013) in prejšnjimi bila prav v submediteranskem delu Slovenije manj opazna na gozdovih in celo travnatih površinah, kot je bila v različnih drugih delih Slovenije. V ostalih delih Slovenije se je suša namreč na gozdovih poznala že v začetku julija in se potem z močnim rjavenjem listavcev samo še stopnjevala. Tako dolgotrajne suše dejansko v prejšnjih sušnih letih ni bilo, kar smo zaznali tudi z dolgotrajnim cvetenjem zgodnjih pomladank. Zaradi nizkih in sušnih razmer so vztrajale vse do sredine marca,

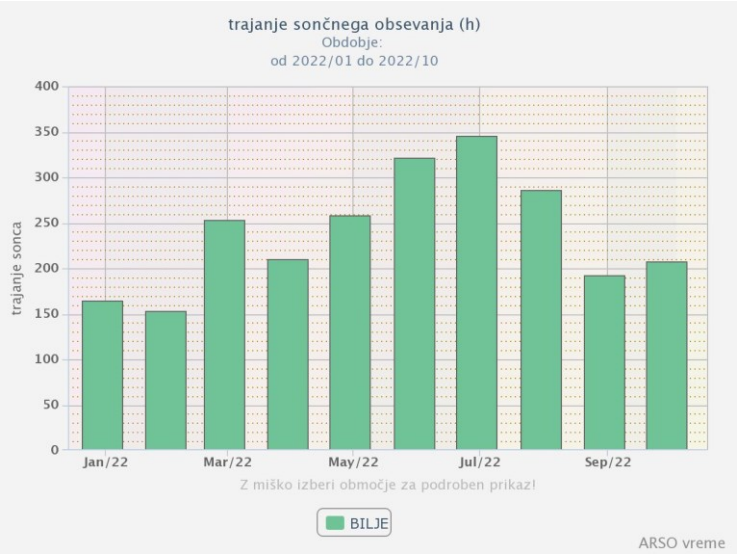
kar je v Ljubljani dokaj nenavadno. Navadno so vmes še snežne padavine, ki pospešijo odcvitanje predvsem vrst kot so *Galanthus nivalis, Crocus vernus* in *Leucojum vernum*. Tudi deževje lahko v tem pozno zimskem času odcvetanje pospeši. Sušni in dokaj hladen del pozne zime je omogočal rast še zimskih čebulnic, manj pa je pospeševal rast trav in ostalih zeliščnih vrst, ki so čakale na obilnejše padavine. A teh tudi kasneje ni bilo na pretek.

Snega v nižinah skoraj ni bilo (ARSO) in tako se je vodna kapaciteta tal z vsakim toplejšim dnem manjšala. Ob otoplitvi je prišlo še do prvih vročinskih udarov, ker je bil prehod iz mrzlih dni na toplejše dokaj hiter. Padavin, vsaj obilnejših, pa ni bilo dovolj (ARSO). Tak klimatski trend se je nato nadaljeval tekom maja in junija. Ponovni močni vročinski udari, pa so bili za večino rastlin že usodni. Ko se je junija razcvetelo največ rastlinskih vrst, so mnoge že kazale znake slabše razrasti, suhi travniki so bili še bolj suhi, trav je bilo zelo malo in tudi zelišča se zaradi pomanjkanja dežja niso dobro razrastla. Gmajne so bile že preveč suhe. Še najbolje so rastline uspevale na globokih tleh, vendar je tam običajno biodiverziteta precej manjša. Na večjem delu Dinarske verige, v Predalpskem in Alpskem svetu smo tu in tam vseeno zaznali normalen začetek cvetenja, potem pa je le-to zaradi suše, izredno visokih temperatur in vročinski udarov, zelo hitro zamrlo. Do razvoja semen zaradi suše prav tako ni prišlo. Večji del poleti cvetočih rastlin, zgodnje poletnih ali kasnejše cvetočih, pa sploh ni semenil. Semen našega rodovnega endemita hladnikije (*Hladnikia pastinacifolia*) praktično sploh ni bilo. Posamezni primerki so sicer cveteli, vendar se njihova semena niso razvila, ali pa so bila le-ta povsem zakrnela. Pri hladnikiji smo to opazili že v letih 2003, 2006 in tudi 2012, ki so bila prav tako sušna. V takšnih sušnih letih smo do žledoloma v letu 2014 hladnikijo nabirali na drugi bolj senčni lokaciji med Čavnom in

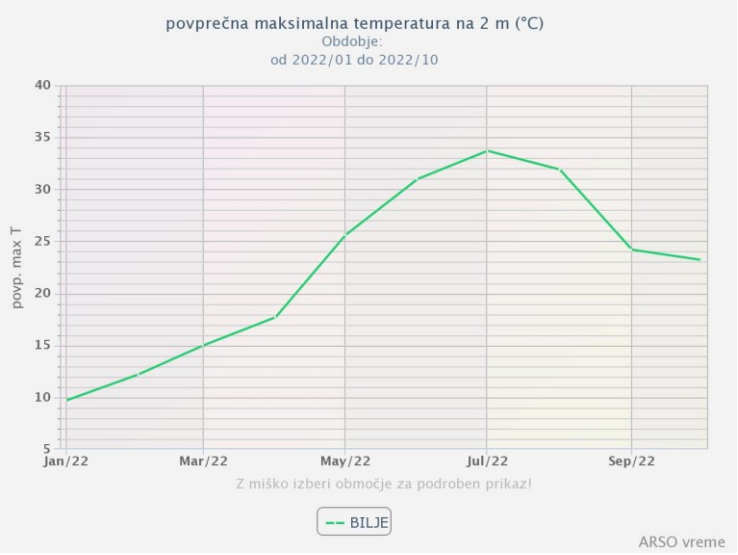
Kucljem. Res je bila ta populacija manjša a kljub temu so tam rastline v sušnih letih zaradi severnejše lege in vlažnosti rastišča vedno tvorile semena. Po žledolomu so čez to rastišče naredili gozdno vlako, rastišče zelo degradiriali zaradi česar je hladnikija od tam izginila. Druge vrste, kot so *Primula auricula*, *Saxifraga crustata*, *Valeriana saxatilis,* so se tam ponovno pojavile, medtem ko hladnikije do danes, po več kot sedmih letih, še nismo zaznali.



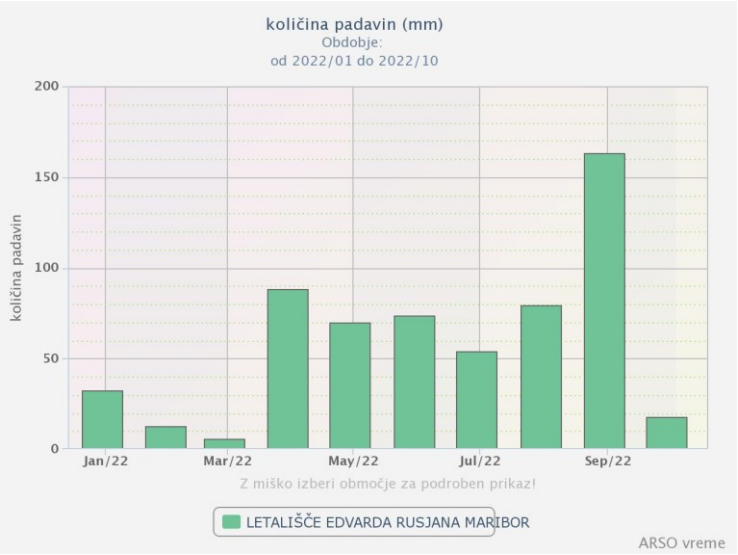
Slika / Figure 25 Average precepitation (mm) from Januar 2022 to October 2022.



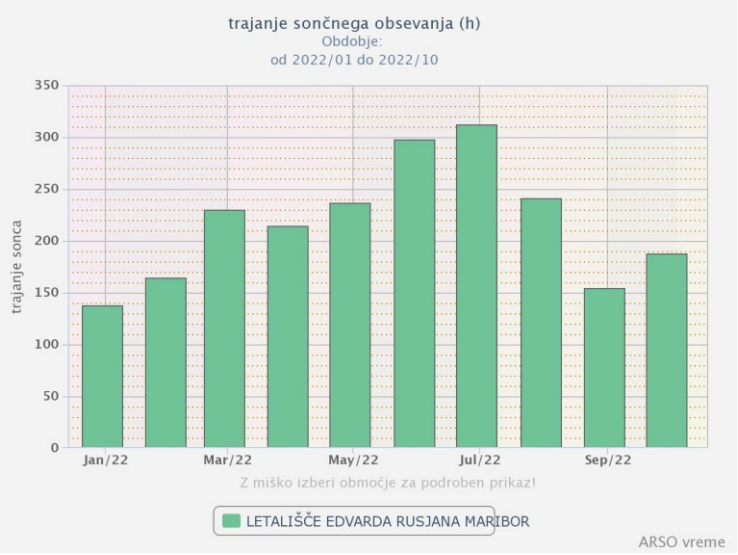
Slika / Figure 26 Duration of sun exposition from January 2022 to October 2022.



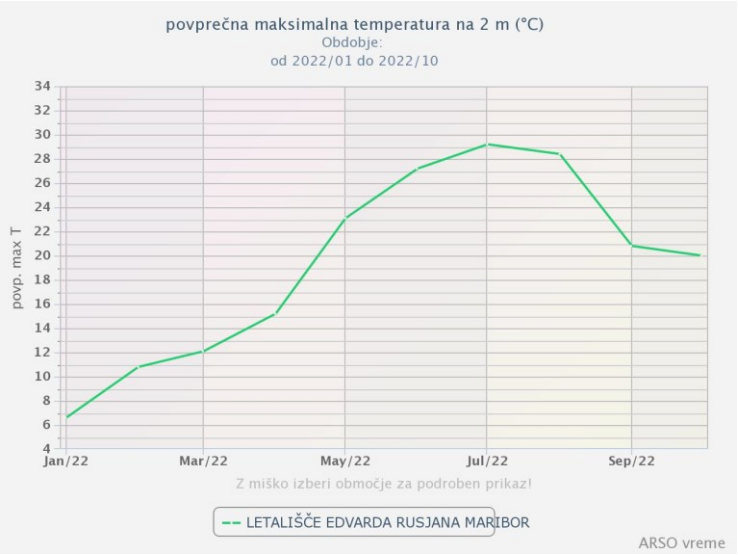
Slika / Figure 27 Average maximal temperature from January 2022 to October 2022.



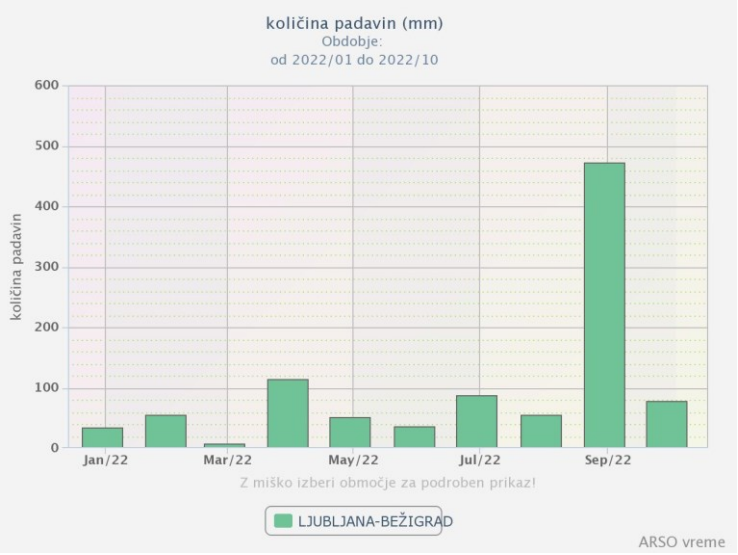
Slika / Figure 28 Average precepitation (mm) from Januar 2022 to October 2022.



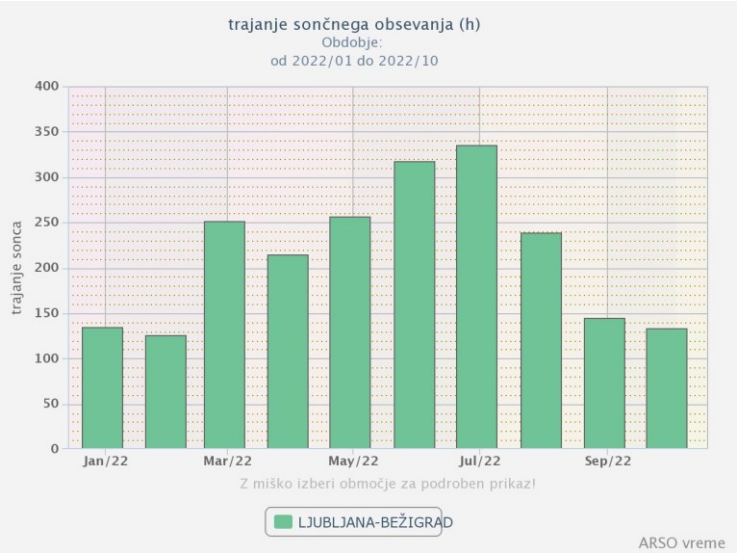
Slika / Figure 29 Duration of sun exposition from January 2022 to October 2022.



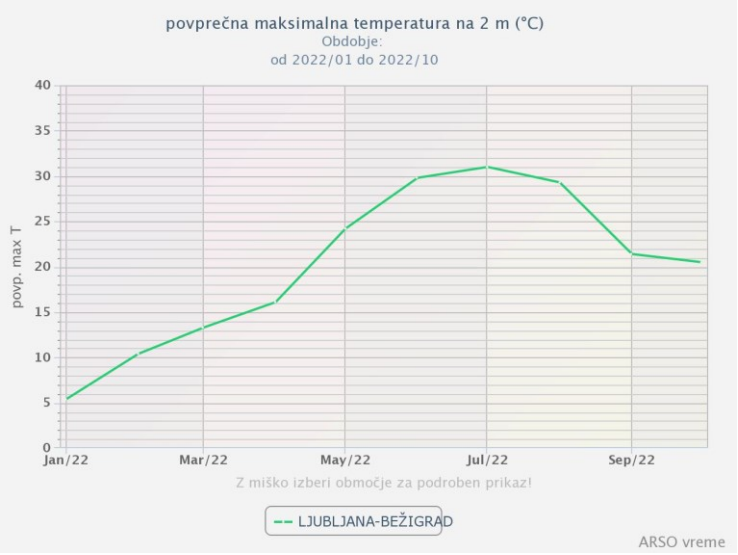
Slika / Figure 30 Average maximal temperature from January 2022 to October 2022.



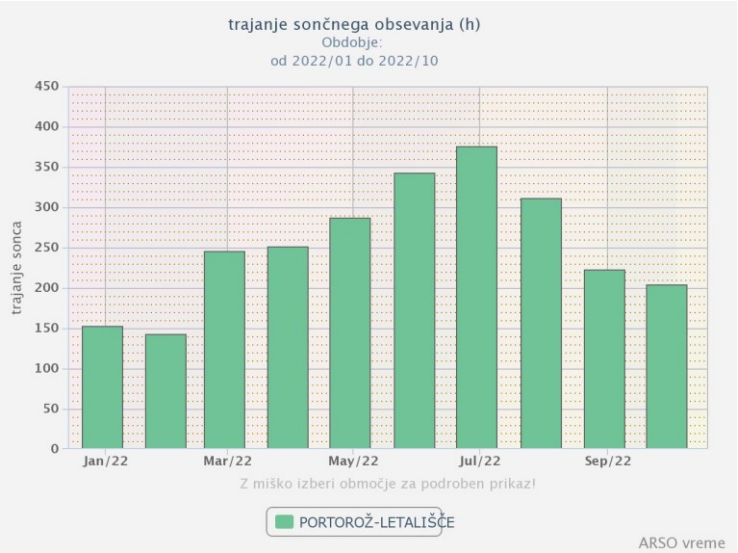
Slika / Figure 31 Average precepitation (mm) from Januar 2022 to October 2022.



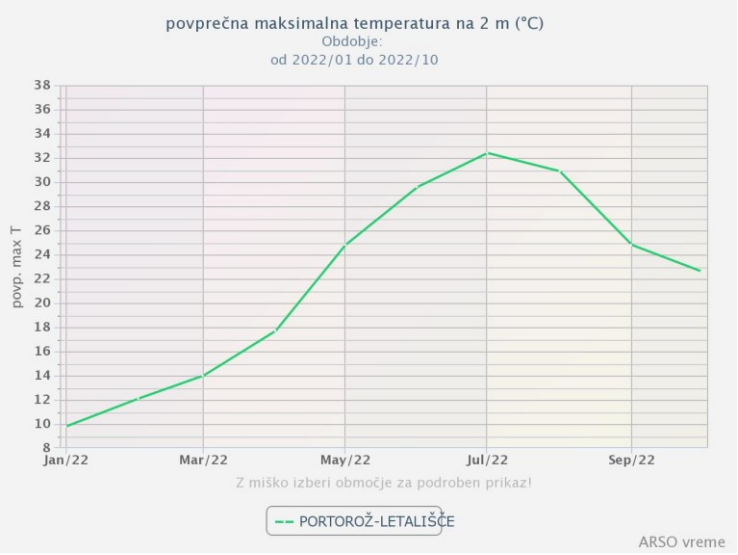
Slika / Figure 32 Duration of sun exposition from January 2022 to October 2022.



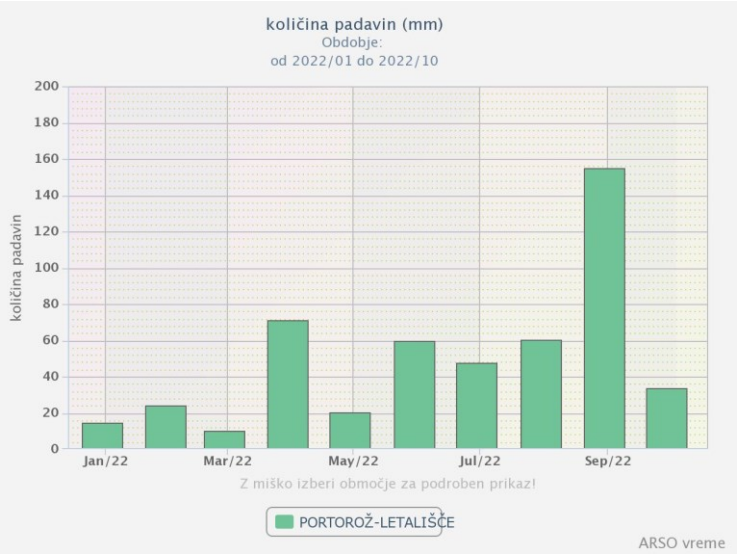
Slika / Figure 33 Average maximal temperature from January 2022 to October 2022.



Slika / Figure 34 Duration of sun exposition from January 2022 to October 2022.



Slika / Figure 35 Average maximal temperature from January 2022 to October 2022.



Slika / Figure 36 Average precepitation (mm) from Januar 2022 to October 2022.

V letošnjem letu so bili tudi plodovi preobjede *Aconitum variegatum* na Čavnu prav tako bolj ali manj prazni. Še celo velike kobulnice kot so gorski jelenovec (*Laserpitium siler*), širokolistni jelenovec (*L. latifolium*) in velestika (*Ligusticum seguieri*) so imele ponekod zelo slabo razvita semena. Na omenjeni lokaciji letos prav tako nismo nabrali plodov dišečega salamonovega pečata (*Polygonatum odoratum*), ki ga tam običajno vsako leto nabiramo. Podobno v letošnjem letu nismo našli semen navadne potonike (*Paeonia officinalis*) in ilirske perunike (*Iris pallida* subsp. *illyrica*). Suša se je zelo poznala tudi na grmovnih in drevesnih vrstah. Posebej je to izstopalo pri ruju (*Cotinus coggygria*), mehurki (*Colutea arborescens*) in malem jesenu (*Fraxinus ornus*), ki v letošnjem letu prav tako niso tvorili veliko semen.

Drug takšen primer je rumeni svišč (*Gentiana lutea*), ki že tako in tako vsako leto ne cveti obilno. Leto 2022 je bilo tisto leto z manjšim cvetenjem - pri čemer še tiste rastline, ki so cvetele, v kodeljicah niso razvile semen. Podobno se je zgodilo z redkejšo vrsto panonskim sviščem (*G. pannonica*), ki prav tako ni semenila.

Pri kraljici gora -alpski možini (*Eryngium alpinum*) pa je bilo cvetenje bistveno zgodnejše. Razvoj semen je bil slabši in številčno jih je bilo manj. V času, ko so običajno rastline šele cvetele, pa so leta 2022 že semenile, semena so že začela izpadati iz soplodij in rastline so bile v celoti videti že popolnoma suhe.

Seed collecting in the dry year 2022

Jože Bavcon, Janja Makše, Blanka Ravnjak

Seed collecting is strongly influenced by environmental conditions in the specific year. These conditions affect the plants both in the Botanic Gardens, where we help the plants with watering, and of course in nature, where the plants are on their own. Plants are an extremely good indicator of dry years, and this is particularly evident in seed production. Despite perhaps still abundant flowering, their flowers wilt very quickly and most of the plants then dry out very early.

Slika / Figure 37 *Eryngium alpinum* (Foto / Photo: J. Bavcon)

There have been quite a few such dry years in the last two decades, as we have reported several times already. Very dry and warm years were in 2003, 2006, 2012, as well as some later ones (Bavcon & Makše 2013). Droughts are observed very often when collecting seeds for *Index seminum*; sometimes they are restricted to only specific species, sometimes to entire habitat types. In some years, seed production is also affected by late frosts, which are mainly reflected on plants in the wild. Plant species that flower later are no longer adapted to frosts, usually resulting in a very noticeable decline in seed production in these species. In the last decade, there were quite a few late frosts in Slovenia, which was also reflected in seed collecting in the wild (Slovenian Environment Agency). Of course, late frosts are not characteristic of all parts of Slovenia, and because seeds are collected in different parts of Slovenia, the influence of late frosts on seed collecting is nevertheless not as pronounced than that of dry years. Dry years are more universal and generally affect the whole of Slovenia. The effects are usually most pronounced in the sub-Mediterranean region of Slovenia. Such conditions cause extremely rapid browning of leaves and a reduction in leaf mass, especially on shrub and tree species.

Compared to the drought of 2012 (Bavcon & Makše 2013) and previous ones, last year's drought was less noticeable in the sub-Mediterranean part of Slovenia on forests and even grassy areas than it was in various other regions of Slovenia. In other regions of Slovenia, the drought was observed in forests as early as the beginning of July, and then only intensified with strong browning of deciduous trees. In fact, there was no such long-lasting drought even in previous dry years, which we observed because of long-lasting flowering of early spring plants. Due to the low and dry conditions, they persisted until mid-March, which is quite

unusual in Ljubljana. There are usually snowfalls during this time, which accelerate the wilting of flowers of species such as *Galanthus nivalis*, *Crocus vernus* and *Leucojum vernum*. Rainfall can also cause faster wilting in late winter times. The dry and rather cold late winter allowed the growth of winter bulb plants, but did not accelerate the growth of grasses and other herbaceous species as much, which were actually waiting for more abundant precipitation. But even later, precipitation was not abundant.

In fact, there was almost no snow at lower altitudes (Slovenian Environment Agency) and thus the soil water storage capacity decreased with each warmer day. As temperatures increased, there were also the first instances of heat stress, as the transition from cold days to warmer ones was quite fast. And there was not enough precipitation, at least no abundant precipitation (Slovenian Environment Agency). This climate trend then continued through May and June. Repeated strong heat stress proved fatal for most plants. When most plant species flowered in June, many were already showing signs of poor growth, dry meadows were even drier, there was very little grass, and even the herbs were underdeveloped due to lack of rain. Grasslands were already too dry. Plants thrived best in deep soil, but biodiversity is usually much lower in such places. In the majority of the Dinaric mountain chain, in the pre-Alpine and Alpine zones, we still noticed a normal start of flowering in some places; however, because of the drought, extremely high temperatures and heat stress, the flowering died down very quickly. Seed development also did not occur due to the drought. Most plants that flower in summer, early summer or later did not even produce any seeds. There were practically no seeds of the Slovenian generic endemic *Hladnikia pastinacifolia*. Individual specimens did flower, but its seeds did not develop or were completely

shrivelled. This had already been observed in *H. pastinacifolia* in 2003, 2006 and 2012, which were also dry years. In such dry years, until the glaze ice disaster in 2014, we collected *H. pastinacifolia* in another, shadier location between Čaven and Kucelj. While this location was smaller, the plants there always developed seeds in dry years due to the more northern location and the humidity of the site. After the glaze ice disaster, a forest track was created over this location, causing extreme degradation; as a result, *H. pastinacifolia* disappeared from this location. Other species, such as *Primula auricula*, *Saxifraga crustata*, *Valeriana saxatilis*, have reappeared in this locations, whereas *H. pastinacifolia* has not yet been found there, even after seven years.

Similarly, the seeds of European monkshood (*Aconitum variegatum*) on Čaven were also more or less empty this year. Even large umbellifers, such as *Laserpitium siler*, *L. latifolium* and *Ligusticum seguieri*, had very poorly developed seeds in some locations. This year, we also did not collect any fruit of *Polygonatum odoratum*, which we usually collect at this location every year. Similarly, this year we found practically no seeds of common peony (*Paeonia officinalis*) and Illyrian iris (*Iris pallida* subsp. *illyrica*). The drought also had a very distinct effect on shrub and tree species. It was particularly evident on the smoke tree (*Cotinus coggygria*), bladder-senna (*Colutea arborescens*) and the manna ash (*Fraxinus ornus*), which also did not produce many seeds this year.

Another such example is the great yellow gentian (*Gentiana lutea*), which does not flower abundantly every year anyway. The year 2022 was a year with poor flowering, but even flowering plants did not develop seeds in the capsules. It was similar with

the rarer species brown gentian (*G. pannonica*), which also did not produce seeds.

In the case of the queen of the Alps or alpine eryngo (*Eryngium alpinum*), flowering occurred much earlier. Furthermore, its seeds were not as well developed and there were fewer of them. At a time when plants would normally still be flowering, in 2022 they were already developing seeds, their seeds were already starting to fall out from infructescences, and entire plants already looked completely dry.

Index seminum annis 2022 collectorum

Jože Bavcon, Janja Makše, Blanka Ravnjak, Maja Tomšič, Katja Malovrh

CONIFEROPHYTINA (Gymnospermae)

Cupressaceae

1. *Juniperus communis* L. XX-0-LJU-G-555-681
2. *Juniperus virginiana* L. XX-0-LJU-G-555-1253
3. *Thuja plicata* D. Don XX-0-LJU-G-555-2056

Pinaceae

4. *Picea abies* (L.) Karsten XX-0-LJU-G-555-996
5. *Picea omorika* (Pančić) Purkynì XX-0-LJU-G-555-2051
6. *Pinus mugo* Turra SI-0-LJU-G-555-546
7. *Tsuga canadensis* (L.) Carriere XX-0-LJU-G-555-744

Taxaceae

8. *Taxus baccata* L. SI-1-LJU-G-555-610

Taxodiaceae

9. *Cryptomeria japonica* D. Don XX-0-LJU-G-555-2041
10. *Metasequoia glyptostroboides* Hu & Cheng XX-0-LJU-G-555-511

MAGNOLIOPHYTINA (Angiospermae)

Acanthaceae

11. *Acanthus balcanicus* Heywood & I.B.K. Richardson XX-0-LJU-G-555-289

Aceraceae
12. *Acer ginnala* Maxim. XX-0-LJU-G-555-290
13. *Acer monspessulanum* L. XX-0-LJU-G-555-1223
14. *Acer obtusatum* L. XX-0-LJU-G-555-2030
15. *Acer palmatum* Thunb. XX-0-LJU-G-555-1224
16. *Acer pseudoplatanus* L. XX-0-LJU-G-555-292
17. *Acer tataricum* L. SI-1-LJU-G-844-293

Actinidiaceae
18. *Actinidia melanandra* Franch. XX-0-LJU-G-555-636

Alismataceae
19. *Alisma plantago-aquatica* L. SI-0-LJU-G-555-303

Alliaceae
20. *Allium angulosum* L. SI-1-LJU-G-555-304
21. *Allium ericetorum* Thore SI-0-LJU-G-999-305
22. *Allium fistulosum* L. XX-0-LJU-G-555-306
23. *Allium tuberosum* Roxb. XX-0-LJU-G-999-308
24. *Allium ursinum* L. SI-0-LJU-G-555-309

Amaranthaceae
25. *Froelichia gracilis* Moq. XX-0-LJU-G-555-424

Amaryllidaceae
26. *Galanthus nivalis* L. SI-1-LJU-G-555-426
27. *Leucojum vernum* L. XX-1-LJU-G-555-685

Apiaceae

28. *Astrantia carniolica* Jacq. SI-0-LJU-G-004-332
29. *Athamanta haynaldii* Borb. & Uechtr. XX-0-LJU-G-555-645
30. *Eryngium amethystinum* L. SI-0-LJU-G-000-413
31. *Hacquetia epipactis* (Scop.) DC. SI-0-LJU-G-555-448
32. *Laserpitium siler* L. SI-0-LJU-G-555-984
33. *Libanotis sibirica* (L.) C. A. Mey SI-0-LJU-G-555-492
34. *Peucedanum cervaria* (L.) Cusson ex. Lapeyr. SI-0-LJU-N-017-193
35. *Peucedanum officinale* L. XX-0-LJU-G-555-714
36. *Peucedanum schottii* Besser ex DC. SI-0-LJU-G-555-544
37. *Smyrnium perfoliatum* L. SI-0-LJU-G-555-599

Apocynaceae

* 38. *Alyxia buxifolia* R.Br. XX-0-WU-0017627
39. *Amsonia tabernaemontana* Walt. XX-0-LJU-G-555-317

Aquifoliaceae

40. *Ilex aquifolium* L. SI-1-LJU-G-555-468

Araceae

41. *Arum maculatum* L. SI-0-LJU-G-555-954

Araliaceae

42. *Eleutherococcus sieboldianus* (Mak.) Koidz. XX-0-LJU-G-555-259
43. *Hedera helix* L. XX-0-LJU-G-555-673

Aristolochiaceae

44. *Aristolochia clematitis* L. XX-0-LJU-G-555-324

Asclepiadaceae
45. *Vincetoxicum hirundinaria* Medik. SI-0-LJU-G-555-627

Asparagaceae
* 46. *Asparagus sprengeri* Regel. XX-0-LJU-G-555-643
47. *Asparagus tenuifolius* Lam. SI-0-LJU-G-555-955
48. *Ruscus aculeatus* L. SI-1-LJU-G-555-573

Asphodelaceae
49. *Anthericum ramosum* L. SI-0-LJU-G-555-323
50. *Asphodeline liburnica* (Scop.) Rchb. SI-0-LJU-G-997-261
51. *Hemerocallis lilioasphodelus* L. XX-1-LJU-G-555-2047

Asteraceae
52. *Ageratum houstonianum* Mill. XX-0-LJU-G-555-298
53. *Anthemis tinctoria* L. RS-0-LJU-G-555-322
54. *Artemisia annua* Pall. XX-0-LJU-G-555-2033
55. *Aster amellus* L. SI-0-LJU-G-002-329
56. *Bellis perennis* L. XX-0-LJU-G-555-262
57. *Buphthalmum salicifolium* L. XX-0-LJU-G-555-649
58. *Carduus nutans* L. SI-0-LJU-G-001-354
59. *Carlina vulgaris* L. subsp. *brevibracteata* (Andrae) K.Werner SI-0-LJU-G-555-652
60. *Carthamus lanatus* L. XX-0-LJU-G-555-1620
61. *Cirsium pannonicum* (L. f.) Link SI-0-LJU-G-555-962
62. *Coreopsis grandiflora* Hogg. XX-0-LJU-G-555-378
63. *Cosmos sulphureus* Cav. XX-0-LJU-G-555-383
64. *Echinops exaltatus* Schrader XX-0-LJU-G-555-408
65. *Echinops sphaerocephalus* L. XX-0-LJU-G-555-1625
66. *Eupatorium cannabinum* L. SI-0-LJU-G-555-418
67. *Inula ensifolia* L. SI-0-LJU-G-555-470
68. *Inula helenium* L. XX-0-LJU-G-555-471

69. *Inula hirta* L. SI-0-LJU-G-984-472
70. *Inula magnifica* L. XX-0-LJU-G-555-473
71. *Inula spiraeifolia* L. SI-0-LJU-G-555-474
72. *Liatris graminifolia* (Walt.) Willd. XX-0-LJU-G-555-490
73. *Liatris pycnostachya* (Alexander) Geiser ex Fernald XX-0-LJU-G-555-491
74. *Pulicaria dysenterica* (L.) Bernh. XX-0-LJU-G-555-558
75. *Serratula lycopifolia* (Vill.) A.Kern. SI-1-LJU-G-555-589
76. *Silphium integrifolium* Michx. XX-0-LJU-G-555-594
77. *Silphium perfoliatum* L. XX-0-LJU-G-555-595
78. *Silybum marianum* (L.) Gaertner XX-0-LJU-G-555-596
79. *Solidago graminifolia* (L.) Salisb. XX-0-LJU-G-555-601
80. *Solidago virgaurea* L. XX-0-LJU-G-555-1014
81. *Tagetes erecta* L. XX-0-LJU-G-555-286
82. *Tanacetum cinerariifolium* (Trev.) Schultz XX-0-LJU-G-555-2055
83. *Tanacetum corymbosum* (L.) Sch. Bip. SI-0-LJU-G-555-609
84. *Tanacetum parthenium* (L.) Schultz-Bip. XX-0-LJU-G-555-1648
85. *Tithonia tagetiflora* Desf. SI-0-LJU-G-003-743
86. *Verbesina helianthoides* Michx. XX-0-LJU-G-555-2058
87. *Xeranthemum cylindraceum* Sibth. & Smith XX-1-LJU-G-555-630
88. *Zinnia elegans* Jacq. XX-0-LJU-G-555-631

Berberidaceae

89. *Gymnospermium scipetarum* Paparisto & Qosja ex E.Mayer & Pulević XK-0-LJU-G-555-447

Betulaceae

90. *Alnus glutinosa* (L.) Gaertner XX-0-LJU-G-555-640
91. *Alnus incana* (L.) Moench SI-0-LJU-G-016-1227

Boraginaceae
92. *Anchusa officinalis* L. XX-0-LJU-G-555-260
93. *Cerinthe minor* L. SI-0-LJU-G-019-1622
94. *Echium vulgare* L. SI-0-LJU-G-001-409
95. *Pulmonaria officinalis* L. XX-0-LJU-G-555-2052

Brassicaceae
96. *Alyssoides utriculata* (L.) Medicus ME-0-LJU-G-001-314
97. *Alyssum montanum* L. SI-0-LJU-G-003-315
98. *Alyssum ovirense* Kerner SI-0-LJU-G-002-1228
99. *Alyssum petraeum* Ard. HU-0-LJU-G-010-2031
100. *Arabis glabra* L. XX-0-LJU-G-555-1618
101. *Bunias orientalis* L. SI-0-LJU-G-002-343
102. *Fibigia clypeata* (L.) Medicus HR-0-LJU-G-555-420
103. *Isatis tinctoria* L. XX-0-LJU-G-555-481
104. *Nasturtium officinale* R. Br. XX-0-LJU-G-555-1635
105. *Sisymbrium austriacum* Jacq. XX-0-LJU-G-555-1269

Buxaceae
106. *Buxus sempervirens* L. XX-0-LJU-G-555-2034
107. *Sarcococca saligna* Müll. Arg. XX-O-LJU-G-555-579

Caesalpiniaceae
108. *Gleditsia triacanthos* L. XX-0-LJU-G-555-441

Calycanthaceae
109. *Chimonanthus praecox* (L.) Link XX-0-LJU-G-555-367
110. *Sinocalycanthus chinensis* Cheng & S.Y.Chang XX-0-LJU-G-555-597

Campanulaceae

111. *Campanula justiniana* Witasek SI-0-LJU-G-555-347
112. *Campanula poscharskyana* Degen HR-0-LJU-G-555-350
113. *Campanula thyrsoides* L. SI-0-LJU-G-009-2035
114. *Campanula trachelium* L. SI-0-LJU-G-555-352
115. *Lobelia siphilitica* L. XX-0-LJU-G-555-498
116. *Platycodon grandiflorum* DC. 'Glaucum' XX-0-LJU-G-555-548
117. *Symphyandra hofmanni* Pant. XX-0-LJU-G-555-2054

Caprifoliaceae
118. *Lonicera alpigena* L. SI-0-LJU-G-555-688

Carpinaceae
119. *Carpinus betulus* L. SI-0-LJU-G-555-2036
120. *Carpinus orientalis* Mill. SI-0-LJU-G-555-357

Caryophyllaceae
121. *Agrostemma githago* L. XX-1-LJU-G-555-300
122. *Dianthus armeria* L. SI-1-LJU-G-000-395
123. *Dianthus balbisii* Ser. IT-0-LJU-G-555-2042
124. *Dianthus barbatus* L. XX-0-LJU-G-555-663
125. *Dianthus deltoides* L. XX-1-LJU-G-555-2043
126. *Dianthus giganteus* D'uru XX-0-LJU-G-555-397
127. *Dianthus graniticus* Jord. IT-0-LJU-G-555-2044
128. *Dianthus monspessulanus* L. XX-1-LJU-G-555-398
129. *Dianthus pinifolius* Sibth. & Sm. BG-0-LJU-G-093-2045
130. *Lychnis coronaria* (L.) Desr. XX-0-LJU-G-555-691
131. *Petrorhagia prolifera* (L.) P.W.Ball & Heyw. XX-0-LJU-G-555-713
132. *Petrorhagia saxifraga* (L.) Link SI-0-LJU-G-555-543
133. *Saponaria ocymoides* L. XX-0-LJU-G-555-2053
134. *Saponaria officinalis* L. XX-0-LJU-G-555-578

Celastraceae
135. *Celastrus orbiculatus* Thunb. XX-0-LJU-G-555-265
136. *Euonymus europaeus* L. SI-0-LJU-G-555-417

Cichoriaceae
137. *Crepis biennis* L. XX-0-LJU-G-555-2040
138. *Hieracium aurantiacum* L. XX-0-LJU-G-555-457
139. *Hieracium lanatum* Vill. XX-0-LJU-G-555-459
140. *Hieracium pilosella* L. SI-0-LJU-G-001-460
141. *Lapsana communis* L. XX-0-LJU-G-555-486
142. *Leontodon hispidus* L. subsp. *danubialis* (Jacq.) Simonkai SI-0-LJU-G-010-489
143. *Leontodon hispidus* L. subsp. *brumatii* (Rchb.) T.Wraber SI-0-LJU-G-555-488
144. *Tragopogon balcanicus* Velen. RS-0-LJU-G-998-615
145. *Tragopogon pratensis* L. XX-0-LJU-G-555-1018
146. *Tragopogon pterodes* Pančić RS-0-LJU-G-998-616

Cistaceae
147. *Cistus creticus* L. XX-0-LJU-G-555-963
148. *Helianthemum nummularium* (L.) Mill. XX-0-LJU-G-555-451

Convallariaceae
149. *Convallaria majalis* L. SI-1-LJU-G-555-377
150. *Danaë racemosa* (L.) Medicus XX-0-LJU-G-555-389
151. *Polygonatum latifolium* (Jacq.) Desf. XX-1-LJU-G-555-549

Convolvulaceae
152. *Ipomoea purpurea* (L.) Roh. XX-0-LJU-G-002-475

153. *Ipomoea quamoclit* L. XX-0-LJU-G-555-678

Cornaceae
154. *Cornus mas* L. SI-0-LJU-G-555-380
155. *Davidia involucrata* Baill. XX-0-LJU-G-555-662

Costaceae
* 156. *Costus dubius* (Afzel.) K.Schum. RO-0-LJU-G-009-2038

Crassulaceae
157. *Sedum maximum* Suter SI-1-LJU-G-555-587

Cucurbitaceae
158. *Bryonia dioica* Jacq. XX-0-LJU-G-555-648

Datiscaceae
159. *Datisca cannabina* L. XX-0-LJU-G-555-390

Dioscoreaceae
160. *Dioscorea balcanica* Košanin SI-0-LJU-G-555-402

Dipsacaceae
161. *Cephalaria gigantea* (Ledeb.) Bobrov XX-0-LJU-G-555-361
162. *Cephalaria leucantha* (L.) Roemer & Schultes SI-1-LJU-G-984-362
163. *Dipsacus fullonum* L. SI-0-LJU-G-555-403
164. *Dipsacus strigosus* Willd. ex Roem & Schult XX-0-LJU-G-555-404
165. *Scabiosa graminifolia* L. SI-0-LJU-G-555-582
166. *Scabiosa hladnikiana* Host. SI-0-LJU-G-009-730
167. *Scabiosa lucida* Vill. SI-0-LJU-G-555-583

168. *Succisa pratensis* Moench SI-0-LJU-G-002-607

Elaeagnaceae
169. *Elaeagnus multiflora* Thunb. XX-0-LJU-G-555-667

Fabaceae
170. *Desmodium canadense* (L.) DC. XX-0-LJU-G-555-271
171. *Dorycnium germanicum* (Gremli) Rouy. XX-0-LJU-G-555-666
172. *Laburnum alschingeri* (Vis.) K. Koch SI-1-LJU-G-555-483
173. *Laburnum anagyroides* Medik SI-0-LJU-G-555-484
174. *Lathyrus vernus* (L.) Bernh. SI-0-LJU-G-010-1254
* 175. *Leucaena leucocephala* (Lam.) de Wit xx-GZU-yy-110257
176. *Medicago pironae* Vis. SI-1-LJU-G-555-1634
177. *Medicago sativa* L. XX-0-LJU-G-555-986
178. *Ornithopus sativus* Brot. XX-0-ROST-2003-F-1644
179. *Spartium junceum* L. SI-0-LJU-G-002-603

Fagaceae
180. *Fagus sylvatica* L. SI-0-LJU-G-555-1243

Fumariaceae
181. *Corydalis cava* (L.) Schweigg. & Körte SI-0-LJU-G-555-381
182. *Corydalis solida* (L.) Clairv. SI-0-LJU-G-555-382

Gentianaceae
183. *Centaurium erythraea* Rafn XX-0-LJU-G-555-657
184. *Gentiana asclepiadea* L. SI-0-LJU-G-003-1245

Geraniaceae

185. *Erodium cicutarium* (L.) L'Hér. SI-0-LJU-G-555-971
186. *Geranium macrorrhizum* L. SI-0-LJU-G-555-433
187. *Geranium pratense* L. SI-0-LJU-G-555-435

Ginkgoaceae
188. *Ginkgo biloba* L. XX-0-LJU-G-555-439

Globulariaceae
189. *Globularia punctata* Hegetschw. SI-0-LJU-G-003-442

Hamamelidaceae
190. *Hamamelis virginiana* L. XX-0-LJU-G-555-275
191. *Liquidambar styraciflua* L. XX-0-LJU-G-555-496

Hyacinthaceae
192. *Bellevalia romana* (L.) Reichenb. SI-1-LJU-G-555-335
* 193. *Bowiea volubilis* Harv. XX-0-LJU-G-555-341
194. *Muscari comosum* (L.) Miller SI-1-LJU-G-555-519
195. *Muscari heldreichii* Boiss. XX-0-LJU-G-555-1257
196. *Muscari neglectum* Guss. ex Ten. XX-1-LJU-G-555-520
197. *Prospero elisae* Speta SI-0-LJU-G-555-1004

Hypericaceae
198. *Hypericum kalmianum* L. XX-0-LJU-G-555-463
199. *Hypericum olympicum* L. XX-0-LJU-G-555-464
200. *Hypericum perforatum* L. SI-0-LJU-G-555-676
201. *Hypericum tetrapterum* Fries SI-0-LJU-G-555-466

Iridaceae
202. *Crocus vernus* (L.) Hill SI-0-LJU-G-555-387
203. *Crocus weldenii* Hoppe IT-0-LJU-G-001-388
204. *Gladiolus illyricus* Koch SI-1-LJU-G-555-1246

205. *Iris pallida* Lam. subsp. *illyrica* (Tommasini) T.Wraber SI-0-LJU-G-555-477
206. *Iris pseudacorus* L. SI-1-LJU-G-555-478
207. *Iris sibirica* L. subsp. *erirrhiza* (Pospichal) T.Wraber SI-1-LJU-G-555-479

Juglandaceae

208. *Carya cordiformis* (Wangenh.) K.Koch XX-0-LJU-G-555-654
209. *Juglans cinerea* L. XX-0-LJU-G-555-679
210. *Juglans nigra* L. XX-0-LJU-G-555-680
211. *Pterocarya fraxinifolia* (Lam.) Spach. XX-0-LJU-G-555-557

Lamiaceae

212. *Ballota rupestris* (Biv.) Vis. XX-1-LJU-G-555-334
213. *Betonica officinalis* L. SI-0-LJU-G-555-336
214. *Betonica officinalis* L. subsp. *serotina* (Host) Hayek SI-0-LJU-G-555-337
215. *Horminum pyrenaicum* L. XX-1-LJU-G-555-675
216. *Lavandula angustifolia* Mill. SI-0-LJU-G-555-487
217. *Melissa officinalis* L. SI-0-LJU-G-555-278
218. *Micromeria dalmatica* Benth XX-0-LJU-G-000-512
219. *Origanum vulgare* L. subsp. *vulgare* SI-0-LJU-G-555-991
220. *Phlomis tuberosa* L. XX-0-LJU-G-555-545
221. *Salvia glutinosa* L. SI-0-LJU-G-555-575
222. *Salvia verticillata* L. SI-0-LJU-G-555-577
223. *Satureja montana* L. subsp. *variegata* (Host.) P.W.Ball SI-0-LJU-G-555-580
224. *Scutellaria altissima* L. SI-1-LJU-G-555-586
225. *Stachys germanica* L. XX-0-LJU-G-555-736
226. *Teucrium arduini* L. XX-0-LJU-G-555-612

227. *Teucrium chamaedrys* L. SI-0-LJU-G-555-613

Lardizabalaceae
228. *Decaisnea fargesii* Franch. XX-0-LJU-G-555-394

Liliaceae
229. *Fritillaria meleagris* L. SI-1-LJU-G-555-975
230. *Gagea lutea* (L.) Ker-Gawler SI-0-LJU-G-555-425
231. *Hosta ventricosa* (Salisb.) Stearn XX-0-LJU-G-555-461
232. *Lilium bulbiferum* L. subsp. *bulbiferum* SI-1-LJU-G-001-1631
233. *Tulipa sylvestris* L. XX-0-LJU-G-555-1272

Linaceae
234. *Linum usitatissimum* L. SI-0-LJU-G-555-276

Lythraceae
235. *Lythrum salicaria* L. SI-0-LJU-G-555-505

Magnoliaceae
236. *Magnolia kobus* DC. XX-0-LJU-G-555-277

Malvaceae
237. *Althaea armeniaca* Ten. XX-0-LJU-G-555-311
* 238. *Gossypium arboreum* L. XX-0-LJU-G-555-446
* 239. *Gossypium hirsutum* L. XX-0-LJU-G-555-445
* 240. *Hibiscus coccineus* Walter XX-0-LJU-G-555-2048
* 241. *Lagunaria patersonia* (Andrews) G.Don. xx-GZU-83-110127
* 242. *Pavonia spinifex* Cav. XX-0-LJU-G-555-541

Martyniaceae
* 243. *Ibicella lutea* (Lindl.) Van Eselt. XX-0-LJU-G-555-1250
* 244. *Proboscidea louisianica* (Mill.) Thell. XX-0-LJU-G-555-720

Meliaceae
* 245. *Melia azedarach* L. XX-O-LJU-G-555-509

Mimosaceae
* 246. *Leucaena leucocephala* (Lam.) de Wit xx-GZU-yy-110257
* 247. *Mimosa pudica* L. XX-0-LJU-G-555-513

Moraceae
248. *Maclura pomifera* (Raf.) Schneid. XX-0-LJU-G-555-692

Myrtaceae
* 249. *Psidium guajava* L. xx-GZU-yy-1102261

Nyctaginaceae
250. *Mirabilis jalapa* L. XX-0-LJU-G-555-514
251. *Oxybaphus nyctagineus* (Michx.) Sweet XX-0-LJU-G-555-515

Oleaceae
252. *Ligustrum ibota* Sieb. & Zucc. XX-0-LJU-G-555-1630

Onagraceae
253. *Circaea lutetiana* L. XX-0-LJU-G-555-369

Paeoniaceae

254. *Paeonia emodi* Wall. XX-0-LJU-G-555-2049
255. *Paeonia lactiflora* Pall. XX-0-LJU-G-555-704
256. *Paeonia officinalis* L. subsp. *officinalis* SI-1-LJU-G-555-535
257. *Paeonia romanica* Brandz. XX-0-LJU-G-555-536
258. *Paeonia veitchii* Lynch var. *beresowskii* (Kom.) Schipcz. XX-0-LJU-G-555-2050
259. *Paeonia wittmanniana* Hartw. XX-0-LJU-G-555-707

Papaveraceae
260. *Chelidonium majus* L. SI-0-LJU-G-555-366
261. *Eschscholzia californica* Cham. XX-0-LJU-G-555-416
262. *Papaver rhoeas* L. SI-0-LJU-G-555-537

Plantaginaceae
263. *Plantago lanceolata* L. SI-0-LJU-G-001-997

Plumbaginaceae
264. *Limonium latifolium* (Sm.) O.Kuntze XX-0-LJU-G-555-985

Poaceae
265. *Achnatherum calamagrostis* (L.) P.Beauv XX-0-LJU-G-555-635
266. *Calamagrostis epigejos* (L.) Roth SI-0-LJU-G-555-1236
267. *Chrysopogon gryllus* (L.) Trin. XX-0-LJU-G-555-658
268. *Festuca bosniaca* Kumm. & Sendt. XX-1-LJU-G-555-668
269. *Phragmites australis* (Cav.) Trin. ex Steud. SI-0-LJU-G-008-1639
270. *Sesleria autumnalis* F. W. Schultz SI-0-LJU-G-009-590
271. *Triticum spelta* L. XX-0-LJU-G-002-617

Primulaceae

272. *Lysimachia vulgaris* L. XX-0-LJU-G-555-504
273. *Primula denticulata* Smith. var. *cachemiriana* Hook XX-0-LJU-G-555-1001

Ranunculaceae

274. *Anemone apennina* L. XX-0-LJU-G-555-1229
275. *Anemone hupehensis* Lemoine XX-0-LJU-G-555-319
276. *Anemone hupehensis* Lemoine var. *japonica* (Thunb.) Bowles & Stearn XX-0-LJU-G-555-2032
277. *Caltha palustris* L. SI-0-LJU-G-555-346
278. *Clematis integrifolia* L. XX-0-LJU-G-555-1238
279. *Clematis recta* L. SI-0-LJU-G-555-374
280. *Consolida ajacis* (L.) Schur. XX-0-LJU-G-555-2037
281. *Eranthis hyemalis* (L.) Salisb. SI-1-LJU-G-555-411
282. *Helleborus atrorubens* Waldst. & Kit. SI-1-LJU-G-555-980
283. *Helleborus dumetorum* Waldst. & Kit. SI-1-LJU-G-555-1248
284. *Helleborus odorus* Waldst. & Kitt. XX-1-LJU-G-998-2046
285. *Nigella damascena* L. XX-0-LJU-G-555-701
286. *Pulsatilla halleri* (All.) Willd. subsp. *slavica* (G. Reuss) Zamels XX-0-LJU-G-555-560
287. *Pulsatilla montana* (Hoppe) Rchb. SI-1-LJU-G-997-561
288. *Pulsatilla nigricans* Ströck. SI-1-LJU-G-002-1006
289. *Pulsatilla vulgaris* Mill. XX-0-LJU-G-555-562
290. *Ranunculus millefoliatus* Vahl XX-0-LJU-G-555-564
291. *Thalictrum minus* L. SI-0-LJU-G-555-1017

Rosaceae

292. *Agrimonia eupatoria* L. SI-0-LJU-G-009-299
293. *Cotoneaster affinis* Lindl. XX-0-LJU-G-555-2039

294. *Cotoneaster niger* (Thunb.) Fries XX-0-LJU-G-555-1239
295. *Crataegus crus-galli* L. XX-0-LJU-G-555-269
296. *Crataegus laevigata* (Poir.) DC XX-0-LJU-G-555-1240
297. *Crataegus monogyna* Jacq. XX-0-LJU-G-555-966
298. *Filipendula ulmaria* (L.) Maxim. SI-0-LJU-G-555-421
299. *Geum coccineum* Sibth. & Sm. XX-0-LJU-G-555-437
300. *Potentilla rupestis* L. XX-0-LJU-G-555-552
301. *Pyrus pyraster* (L.) Borkh XX-0-LJU-G-555-563
302. *Rhodotypos scandens* (Thunb.) Mak. XX-0-LJU-G-555-565
303. *Rosa arvensis* Huds. SI-0-LJU-G-555-1007
304. *Rosa canina* L. SI-0-LJU-G-012-1264
305. *Rosa gallica* L. SI-0-LJU-G-555-567
306. *Rosa glauca* Pourr. SI-0-LJU-G-555-568
307. *Rosa sempervirens* L. SI-0-LJU-G-555-572
308. *Sibiraea croatica* Degen HR-0-LJU-G-555-591
309. *Stephanandra tanakae* Franch. & Sav. XX-0-LJU-G-555-605

Rutaceae
310. *Phellodendron amurense* Rupr. XX-0-LJU-G-555-280
311. *Poncirus trifoliata* (L.) Raf. XX-0-LJU-G-555-550
312. *Zanthoxylum americanum* Mill. XX-0-LJU-G-555-2059
313. *Zanthoxylum simulans* Hance XX-0-LJU-G-555-287

Saxifragaceae
314. *Darmera peltata* (Torr. ex Benth.) Voss XX-0-LJU-G-555-1644

Scrophulariaceae
315. *Digitalis laevigata* Waldst. & Kit. SI-0-LJU-G-001-968
316. *Erinus alpinus* L. XX-0-LJU-G-555-412

317. *Misopates orontium* (L.) Rafin. XX-0-LJU-G-555-516
318. *Verbascum phoeniceum* L. HR-0-LJU-G-555-2057
319. *Veronicastrum virginicum* (L.) Farw. XX-0-LJU-G-555-625

Solanaceae
320. *Datura metel* L. XX-0-LJU-G-555-391
321. *Datura metel* L. f. *inermis* XX-0-LJU-G-555-392
322. *Lycium chinense* Mill. XX-0-LJU-G-555-502
323. *Nicandra physalodes* (L.) Gaertner XX-0-LJU-G-555-525
324. *Scopolia carniolica* Jacq. SI-0-LJU-G-555-585

Staphyleaceae
325. *Staphylea pinnata* L. SI-0-LJU-G-555-604

Styracaceae
326. *Halesia carolina* L. XX-0-LJU-G-555-273

Typhaceae
327. *Typha latifolia* L. SI-0-LJU-G-555-619

Ulmaceae
328. *Celtis occidentalis* L. XX-0-LJU-G-555-358
329. *Zelkova carpinifolia* (Pall.) K. Koch XX-0-LJU-G-555-288

Urticaceae
330. *Parietaria officinalis* L. XX-0-LJU-G-555-538

Verbenaceae
331. *Callicarpa bodinieri* Levl. var. *giraldii* Rehd. XX-0-LJU-G-555-345

* 332. *Lantana camara* L. XX-0-LJU-G-555-485
333. *Vitex agnus-castus* L. XX-1-LJU-G-555-629

* Semina plantarum in caladariis cultarum.

Horti praefectus: dr. Jože Bavcon
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Semina e plantis spontaneis in loco natali annis 2022 et 2021 lecta

Jože Bavcon, Igor Dakskobler, Ljudmila Dakskobler, Janja Makše, Katja Malovrh, Blanka Ravnjak

334. *Acer pseudoplatanus* L. - Škofljica, 2022, B. R., K. M., SI-0-LJU-N-022-1894
335. *Alisma plantago-aquatica* L. - Rački ribniki, 2021, J. B., B. R., SI-0-LJU-N-021-1657
336. *Alliaria petiolata* Cav. & Grande - Božakovo, 2022, J. B., B. R., SI-0-LJU-N-022-1895
337. *Allium angulosum* L. - Petelinjsko jezero, 2021, J. B., B. R., SI-1-LJU-N-021-1659
338. *Allium senescens* L. - Sočerga, 2022, J. B., B. R., SI-0-LJU-N-022-1896
339. *Angelica sylvestris* L. - Turnovi ribniki, 2021, J. B., B. R., SI-0-LJU-N-021-1665
340. *Anthemis cotula* L. - Srednja vas, 2022, J. B., B. R., SI-0-LJU-N-022-1897
341. *Anthericum ramosum* L. - Roje, 2021, J. B., K. M., SI-0-LJU-N-021-1666
342. *Anthyllis jacquinii* Kern. - Kota 1192 m nad Avško gmajno pri Kuclju, 2022, L. & I. D., SI-0-LJU-N-022-1899
343. *Anthyllis jacquinii* Kern. - Kucelj, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1898

344. *Anthyllis vulneraria* L. - Breginjski kot, 2022, J. B., B. R., SI-0-LJU-N-022-1900
345. *Arabis sagittata* (Bertol.) DC. - Kucelj, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1901
346. *Arabis turrita* L. - Kucelj, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1902
347. *Arctium lappa* L. - Čaven-Kucelj, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1903
348. *Aster amellus* L. - Sočerga, 2022, J. B., B. R., SI-0-LJU-N-022-1904
349. *Astragalus carniolicus* Kern. - Kucelj, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1905
350. *Astrantia major* L. - Roje, 2022, J. B., B. R., SI-0-LJU-N-022-1906
351. *Atropa bella-donna* L. - Uskovnica, 2021, J. M., SI-0-LJU-N-021-1678
352. *Betonica officinalis* L. - Roje, 2021, J. B., B. R., K. M., M. T., SI-0-LJU-N-021-1679
353. *Biscutella laevigata* L. - Roje, 2022, J. B., B. R., SI-0-LJU-N-022-1907
354. *Buphthalmum salicifolium* L. - Roje, 2022, B. R., M. T., SI-0-LJU-N-022-1908
355. *Bupleurum petraeum* L. - Kal - Mala Vrata, 2022, L. & I. D., SI-0-LJU-N-022-1909
356. *Calamagrostis epigejos* (L.) Roth - Bezgovica, 2021, J. B., B. R., SI-0-LJU-N-021-1686
357. *Carpinus betulus* L. - Prapetno Brdo, 2022, L. & I. D., SI-0-LJU-N-022-1911
358. *Centaurea jacea* L. - Draga, 2022, J. B., B. R., SI-0-LJU-N-022-1912
359. *Centaurea rhenana* Boreau - Roje, 2022, B. R., M. T., SI-0-LJU-N-022-1913

360. *Centaurea scabiosa* L. - Roje, 2022, J. B., B. R., SI-0-LJU-N-022-1914
361. *Chamerion angustifolium* (Raf.) Raf. - Porezen, 2022, J. B., B. R., SI-0-LJU-N-022-1915
362. *Chrysopogon gryllus* (L.) Trin. - Brege, 2022, J. B., SI-0-LJU-N-022-1916
363. *Cirsium arvense* (L.) Scop. - Srednja vas, 2022, J. B., B. R., SI-0-LJU-N-022-1917
364. *Cirsium pannonicum* (L. f.) Link - Roje, 2022, B. R., M. T., SI-0-LJU-N-022-1918
365. *Cirsium vulgare* (Savi) Ten. - Škofljica, 2022, B. R., K. M., SI-0-LJU-N-022-1919
366. *Cirsium vulgare* (Savi) Ten. - Kucelj-Čaven, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1920
367. *Clematis alpina* (L.) Mill. - Porezen, 2022, J. B., B. R., SI-0-LJU-N-022-1921
368. *Clematis integrifolia* L. - Petelinjsko jezero, 2021, J. B., B. R., SI-0-LJU-N-021-1701
369. *Clematis recta* L. - Bezgovica, 2021, J. B., B. R., SI-0-LJU-N-021-1702
370. *Clematis vitalba* L. - Kolovrat, 2022, L. & I. D., SI-0-LJU-N-022-1923
371. *Clematis vitalba* L. - Strma reber, 2022, J. B., B. R., SI-0-LJU-N-022-1922
372. *Colchicum autumnale* L. - Roje, travnik, 2021, J. B., B. R., SI-0-LJU-N-021-1703
373. *Convallaria majalis* L. - Nanos zg. plato, 2021, J. B., B. R., SI-1-LJU-N-021-1704
374. *Coronilla emerus* L. subsp. *emeroides* Boiss. & Spruner - Dragonja, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1924
375. *Cotinus coggygria* Scop. - Kosovelje, 2022, J. B., B. R., SI-0-LJU-N-022-1925

376. *Cotinus coggygria* Scop. - Piran-Fiesa, 2022, J. K., SI-0-LJU-N-022-1926
377. *Crithmum maritimum* L. - Izola, 2022, J. B., B. R., SI-0-LJU-N-022-1927
378. *Cypripedium calceolus* L. - Ravenska kočna, 2022, B. D., SI-1-LJU-N-022-1928
379. *Daucus carota* L. - Škraplje, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1929
380. *Digitalis grandiflora* Miller - Breginjski Stol, 2022, J. B., B. R., SI-0-LJU-N-022-1930
381. *Digitalis grandiflora* Miller - Prvejk, 2022, L. & I. D., SI-0-LJU-N-022-1931
382. *Echinops ritro* L. subsp. *ruthenicus* - Čaven, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1932
383. *Echium vulgare* L. - Lesce, 2021, J. B., B. R., SI-0-LJU-N-021-1719
384. *Eryngium alpinum* L. - Porezen, 2022, J. B., B. R., SI-1-LJU-N-022-1933
385. *Eryngium amethystinum* L. - Sočerga, 2022, J. B., B. R., SI-0-LJU-N-022-1934
386. *Eryngium amethystinum* L. - Zagorje, Pivka, 2021, J. B., B. R., SI-0-LJU-N-021-1724
387. *Erysimum sylvestre* Scop. - Kucelj, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1935
388. *Eupatorium cannabinum* L. - Čaven-Kucelj, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1936
389. *Fagus sylvatica* L. - Veliki Rob, 2022, L. & I. D., SI-0-LJU-N-022-1937
390. *Ferulago campestris* (Besser) Grecescu - Nanos, 2021, J. B., B. R., SI-0-LJU-N-021-1728
391. *Filipendula vulgaris* Moench. - Roje, 2022, B. R., M. T., SI-0-LJU-N-022-1938

392. *Filipendula vulgaris* Moench. - Srednja vas, 2022, J. B., B. R., SI-0-LJU-N-022-1939
393. *Galium lucidum* All. - Srednja vas, 2022, J. B., B. R., SI-0-LJU-N-022-1940
394. *Galium purpureum* L. - Sočerga, 2022, J. B., B. R., SI-0-LJU-N-022-1941
395. *Galium verum* L. - Podgorje, 2021, J. B., B. R., SI-0-LJU-N-021-1736
396. *Gentiana asclepiadea* L. - Limes - Claustra Alpina, 2022, J. B., B. R., K. M., SI-0-LJU-N-022-1942
397. *Gentiana clusii* Perr. & Song. - Breginjski Stol, 2022, J. B., B. R., SI-1-LJU-N-022-1943
398. *Gentiana cruciata* L. - Nanos - plato, 2021, J. B., B. R., SI-0-LJU-N-021-1741
399. *Gladiolus illyricus* Koch - Planinsko polje, 2022, J. B., B. R., SI-1-LJU-N-022-1944
400. *Gladiolus illyricus* Koch - Roje, 2022, J. B., SI-1-LJU-N-022-1945
401. *Globularia cordifolia* L. - Breginjski Stol, 2022, J. B., B. R., SI-0-LJU-N-022-1946
402. *Globularia cordifolia* L. - Kucelj, 2021, J. B., B. R., SI-0-LJU-N-021-1750
403. *Globularia punctata* Hegetschw. - Roje, 2022, J. B., B. R., SI-0-LJU-N-022-1947
404. *Globularia punctata* Hegetschw. - Petelinjsko jezero, 2021, J. B., B. R., SI-0-LJU-N-021-1753
405. *Grafia golaka* (Hacq.) Rchb. - Matajur, 2021, L. & I. D., SI-0-LJU-N-021-1755
406. *Helianthemum nummularium* (L.) Mill. subsp. *grandiflorum* (Scop.) Schinz &Thell. - Breginjski Stol, 2022, J. B., B. R., SI-0-LJU-N-022-1948

407. *Helleborus multifidus* Vis. subsp. *istriacus* (Schiffner) Merxm. & Podl. - Kostel, 2022, J. B., B. R., SI-0-LJU-N-022-1950
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419. *Inula salicina* L. - Sočerga, 2021, J. B., B. R., SI-0-LJU-N-021-1767
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487. *Scorzonera villosa* Scop. - Banjšice, 2022, L. & I. D., SI-0-LJU-N-022-2013
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Collectors of the wild seeds:
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dr. Igor Dakskobler (I. D.)
Ljudmila Dakskobler (L. D.)
Janja Makše (J. M.)
Katja Malovrh (K. M.)
dr. Blanka Ravnjak (B. R.)
A few seed species are collected by:
Branko Dolinar (B. D.)
Jure Kališnik (J. K.)
Maja Tomšič (M. T.)

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The Alpine Botanical Garden Juliana

Juliana is the oldest Alpine Botanical Garden in Slovenia. It was founded in 1926 by Albert Bois de Chesne, a landowner from Trieste. His major adviser was his friend dr. Julius Kugy, a legendary mountanineer, botanist and writer, focusing on the Alps.
The garden is situated in Trenta Valley (NW Slovenia), it covers 2.572 m2 on the slope of Kukla, at an altitude of 800 m a.s.l., near the Church of St. Mary, with the Soča River flowing few tens of metres below.
Today, about **600 different plant species** prosper in the garden. It is special by its mixture of alpine and thermofillous karst species. The garden shelters **more then 100** protected, rare, endangered and endemic species. Juliana has been officially protected since 1951 and managed by The Slovenian Museum of Natural History since 1962.

The garden is opened every day from May 1 to September 30.

Semina in horto alpino Juliana Museum historiae naturalis Sloveniae anno 2022 lecta

Špela Pungaršek, Martina Tekavec, Klemen Završnik in Marija Završnik

509. *Aconitum lycoctonum* L.
510. *Adenophora liliifolia* (L.) A. DC.
511. *Agrimonia eupatoria* L.
512. *Anthericum ramosum* L.
513. *Anthyllis vulneraria* L.
514. *Aquilegia nigricans* Baumg.
515. *Arabis alpina* L.
516. *Asphodelus albus* Mill.
517. *Astragalus glycyphyllos* L.
518. *Athamanta turbith* Brot.
519. *Betonica officinalis* L.
520. *Biscutella laevigata* L.
521. *Buphthalmum salicifolium* L.
522. *Calluna vulgaris* (L.) Hull
523. *Caltha palustris* L.
524. *Carduus defloratus* L.
525. *Centaurea carniolica* Host
526. *Centaurea scabiosa* subsp. *fritschii* (Hayek) Hayek
527. *Centaurea scabiosa* subsp. *scabiosa* L.
528. *Chamaecytisus hirsutus* (L.) Link
529. *Cirsium erisithales* Scop.

530. *Cirsium oleraceum* Scop.
531. *Coronilla coronata* L.
532. *Cypripedium calceolus* L.
533. *Daphne mezereum* L.
534. *Dianthus barbatus* L.
535. *Dianthus carthusianorum* L.
536. *Digitalis grandiflora* Mill.
537. *Dryas octopetala* L.
538. *Epilobium montanum* L.
539. *Erinus alpinus* L.
540. *Eryngium alpinum* L.
541. *Euonymus latifolius* Mill.
542. *Eupatorium cannabinum* L.
543. *Filipendula ulmaria* (L.) Maxim.
544. *Fragaria vesca* L.
545. *Galium sylvaticum* L.
546. *Galium verum* L.
547. *Genista sericea* Wulfen
548. *Gentiana angustifolia* Vill.
549. *Gentiana asclepiadea* L.
550. *Geranium sanguineum* L.
551. *Geum speciosum* Albov
552. *Globularia cordifolia* L.
553. *Grafia golaka* (Hacq.) Rchb.
554. *Heliosperma alpestre* Rchb.
555. *Hemerocallis lilioasphodelus* L.
556. *Hippocrepis emerus* (L.) Lassen
557. *Hladnikia pastinacifolia* Rchb.
558. *Horminum pyrenaicum* L.
559. *Hypochaeris maculata* L.
560. *Iris sibirica* subsp. *sibirica* L.
561. *Laburnum alpinum* (Mill.) Bercht. & J.Presl

562. *Lactuca muralis* (L.) Gaertn.
563. *Laserpitium latifolium* L.
564. *Lathyrus laevigatus* subsp. *occidentalis* (Fisch. & C.A.Mey.) Breistr.
565. *Lathyrus vernus* (L.) Bernh.
566. *Leontodon incanus* subsp. *incanus* Schrank
567. *Ligusticum lucidum* Mill.
568. *Lomelosia graminifolia* (L.) Greuter & Burdet
569. *Mentha longifolia* (L.) Huds. subsp. *longifolia*
570. *Myrrhis odorata* (L.) Scop.
571. *Paeonia officinalis* L.
572. *Persicaria vivipara* (L.) Ronse Decr.
573. *Petasites albus* (L.) Gaertn.
574. *Petasites paradoxus* Baumg.
575. *Peucedanum oreoselinum* Moench
576. *Peucedanum verticillare* (L.) Koch
577. *Prenanthes purpurea* L.
578. *Primula elatior* Hill
579. *Primula veris* subsp. *veris* L.
580. *Rhaponticoides alpina* (L.) M.V.Agab. & Greuter
581. *Ruscus hypoglossum* L.
582. *Sanguisorba minor* Scop.
583. *Saponaria officinalis* L.
584. *Saxifraga hostii* Tausch
585. *Seseli gouanii* W. D. J. Koch
586. *Seseli libanotis* (L.) W. D. J. Koch
587. *Sibiraea laevigata* (L.) Maxim.
588. *Telekia speciosa* (Schreb.) Baumg.
589. *Tephroseris longifolia* subsp. *pseudocrispa* (Fiori) Greuter
590. *Thalictrum aquilegiifolium* L.
591. *Thalictrum minus* L.
592. *Tofieldia calyculata* (L.) Wahlenb.

593. *Trollius europaeus* subsp. *europaeus* L.
594. *Tussilago farfara* L.
595. *Veratrum lobelianum* Bernh.
596. *Veronica aphylla* L.
597. *Veronica longifolia* L.
598. *Vicia oroboides* Wulfen

Curator: Špela Pungaršek
Hortulani: Martina Tekavec, Klemen Završnik in Marija Završnik

Literatura / Literature

Martinčič, A. & T. Wraber, N. Jogan, A. Podobnik, B. Turk, B. Vreš, V. Ravnik, B. Frajman, S. Strgulc Krajšek, B. Trčak, T. Bačič, M. A. Fischer, K. Eler, B. Surina, 2007: Mala flora Slovenije. Ključ za določanje praprotnic in semenk. Tehniška založba Slovenije. Ljubljana. 967 pp.
Praprotnik, N., 2011: Alpski botanični vrt Juliana. Prirodoslovni muzej Slovenije. 133 pp.
http://meteo.arso.gov.si
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